

# The 6th World Conference on Photovoltaic Energy Conversion



## PROGRAM

Joint Conference of

**PVSEC-24**  
30th Anniversary

The 24th International Photovoltaic Science and Engineering Conference

**41st IEEE PVSC**

The 41st IEEE Photovoltaic Specialists Conference

**30th EU PVSEC**

The 30th European Photovoltaic Solar Energy Conference

**Kyoto International Conference Center,  
Kyoto, Japan**

**November 23-27, 2014**

**WCPEC-6 Organizing Committee**

**Co-organized by**

The Japan Society of Applied Physics  
Research Institute for Applied Science  
The European Commission  
IEEE Electron Devices Society

## **Co-sponsors**

Japan Society for the Promotion of Science, The 175th Committee on Innovative Photovoltaic Power Generation Systems

The Institute of Electrical Engineers of Japan

The Institute of Electronics, Information and Communication Engineers

The Japan Society for Aeronautical and Space Sciences

The Chemical Society of Japan

The Electrochemical Society of Japan

Japan Solar Energy Society

Kyoto Convention Bureau

## **Supporting Organizations**

Ministry of Economy, Trade and Industry

Ministry of Education, Culture, Sports, Science and Technology

Japan Science and Technology Agency

New Energy and Industrial Technology Development Organization

Photovoltaic Power Generation Technology Research Association

National Institute of Advanced Industrial Science and Technology

Japan Photovoltaic Energy Association

Japan Aerospace Exploration Agency

The Japan Electrical Manufacturers' Association

New Energy Foundation

Japan Solar System Development Association

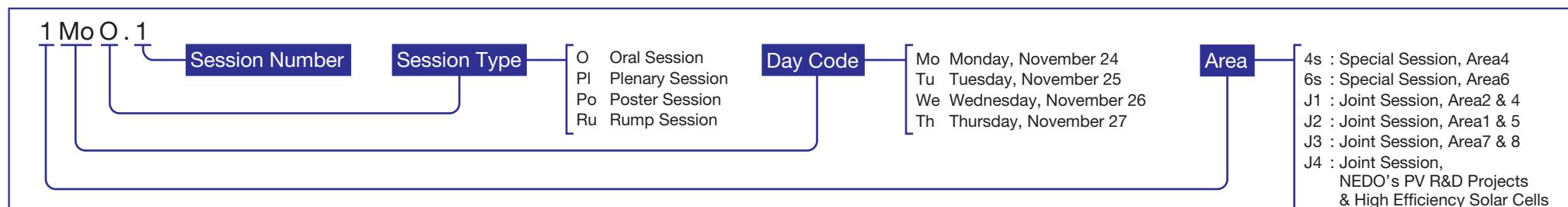
Optoelectronics Industry and Technology Development Association

We would like to express the deepest appreciation to Kyoto City.

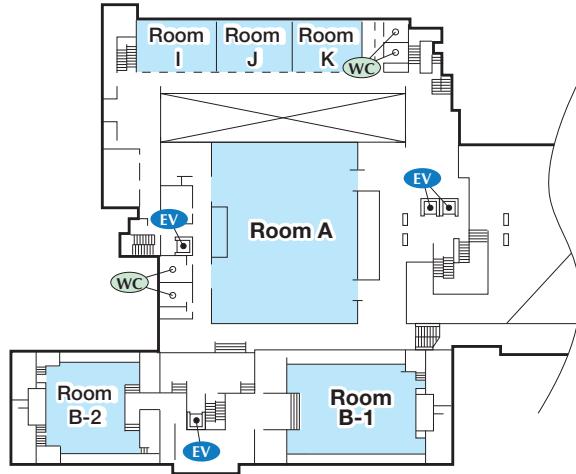
## Program Outline

Sunday, November 23											Topics / Subtopics						
9:00 13:00	Registration	Asian Nations WS (Room B-1)	Room F	Room G	Room H	Room J	Room K	1. New Concepts and New Materials for Future Technologies	4. Wafer-Based Crystalline Silicon	7. Characterization and Modules Reliability							
13:00 17:00			Tutorial	Tutorial	Tutorial	Tutorial	Tutorial	2. Thin Film Silicon Based Photovoltaics	5. Concentrator Photovoltaics, III-V and Space PV Technologies	8. Systems, BOS components and Grid Integration							
17:00 18:00								3. Thin Film Compound Semiconductor Based PV	6. Organic, Dye Sensitized and Perovskite Solar Cells	9. PV Deployment; Industry, Market and Policy							
18:00			Reception (Swan)														
Monday, November 24					Tuesday, November 25												
8:30 10:00	Opening Plenary (Annex)				Plenary Session (Room A)												
10:15 11:30	Opening Ceremony (Annex)				Room A	Room B-1	Room B-2	Room E	Annex								
13:00 14:25	Plenary Session (Room A)				3TuO.1	2TuO.5	5TuO.9	7TuO.13	1TuPo.1								IEA/PVPS Workshop
14:45 16:10	Room A	Room B-1	Room B-2	Room E	4sTuO.2	2TuO.6	5TuO.10	7TuO.14	1TuPo.2								
16:30 17:55	4sMoO.1	3MoO.3	1MoO.5	6sMoO.7	4TuO.3	1TuO.7	8TuO.11	6TuO.15		2TuPo.3	3TuPo.5			5TuPo.8	7TuPo.10		
18:30 20:00	J1MoO.2	3MoO.4	1MoO.6	6sMoO.8	4TuO.4	1TuO.8	8TuO.12	6TuO.16		2TuPo.4	3TuPo.6			5TuPo.9	7TuPo.11		
		3MoRu.9						7TuRu.17 (-20:30)									
Wednesday, November 26											Thursday, November 27						
8:30 10:00	Plenary Session (Room A)										Plenary Session (Room A)						
10:15 11:30	Room A	Room B-1	Room B-2	Room E	Room D	Annex						Room A	Room B-1	Room B-2	Room E	Room D	
13:00 14:25	J2WeO.1	9WeO.5	J3WeO.9	2WeO.13		3WePo.5	4WePo.7	6WePo.2	8WePo.8			7ThO.1	J4ThO.4		6ThO.9		
14:45 16:10	1WeO.2	9WeO.6	J3WeO.10	2WeO.14	4WeO.17	3WePo.6		6WePo.3	8WePo.9			7ThO.2	3ThO.5	J1ThO.7	6ThO.10	4sThO.12	
16:30 17:55	5WeO.3	9WeO.7	8WeO.11	3WeO.15	4WeO.18			6WePo.4		7WePo.10	7ThO.3	3ThO.6	2ThO.8	6ThO.11	4ThO.13		
19:00 21:00	5WeO.4	7WeO.8	8WeO.12	3WeO.16	4WeO.19	1WePo.1				9WePo.11							
	Banquet (Event Hall)										Closing Ceremony (16:15 - 17:00)						

## Session Code

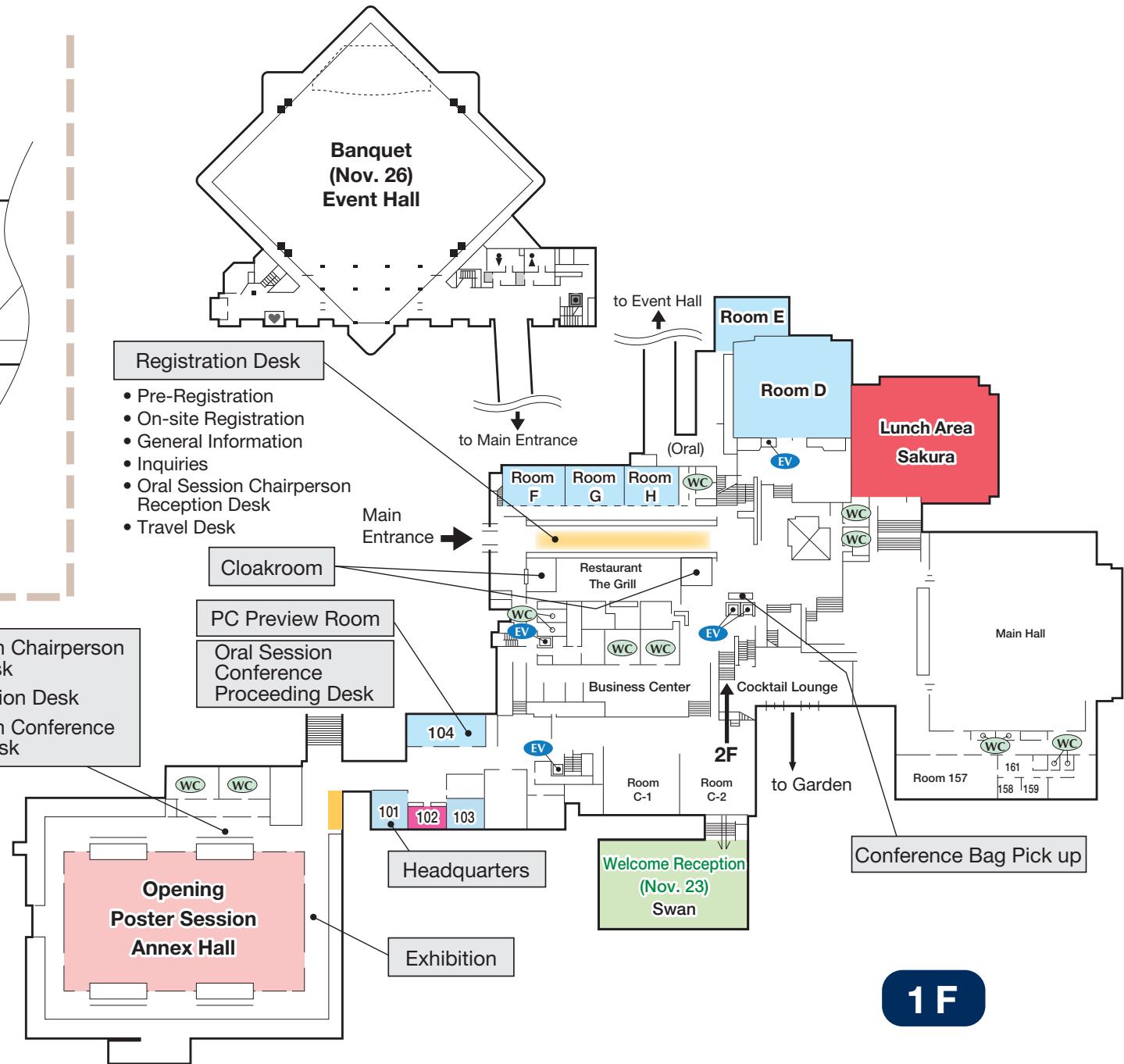


# Floor Map



2F

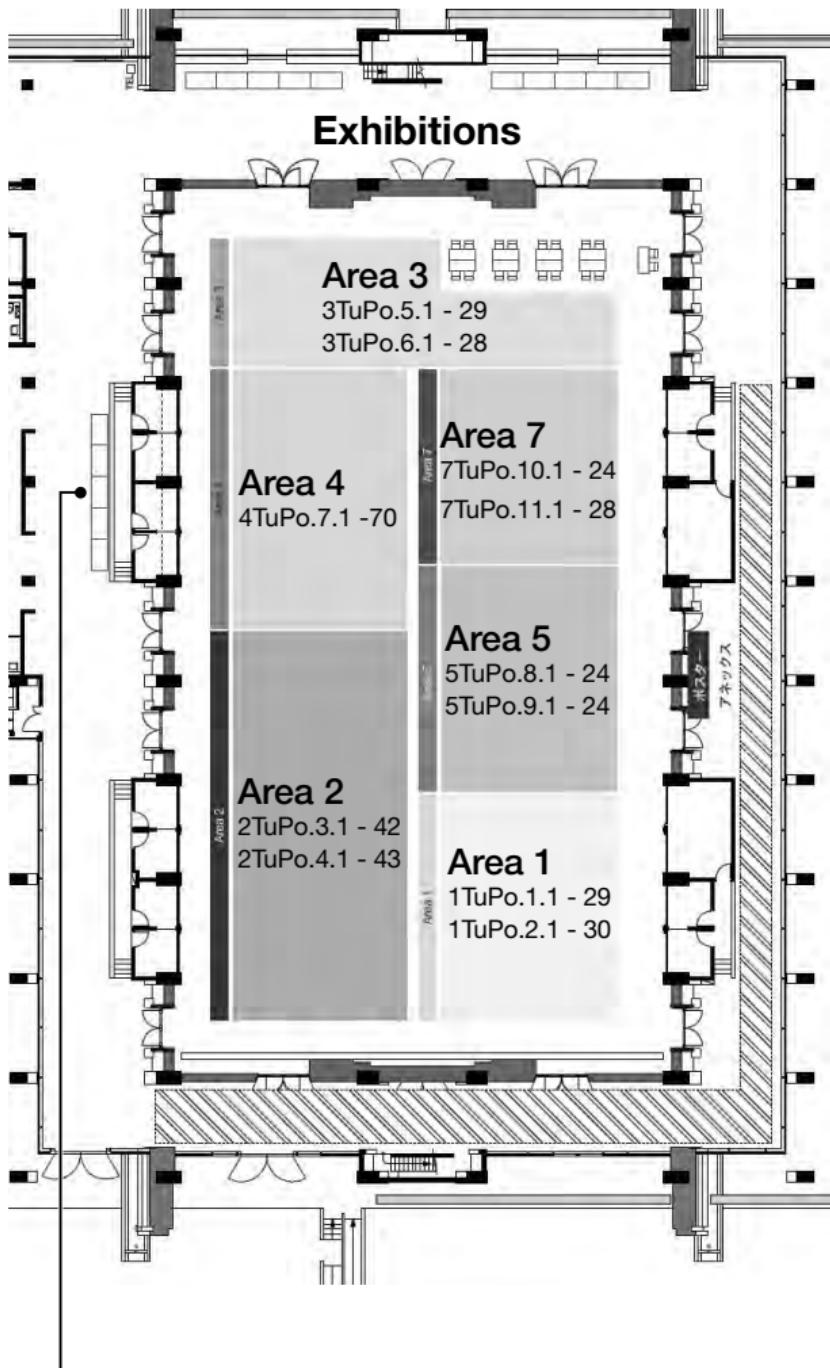
- Poster Session Chairperson Reception Desk
- Poster Reception Desk
- Poster Session Conference Proceeding Desk



# Poster Layout Map

Tuesday, November 25

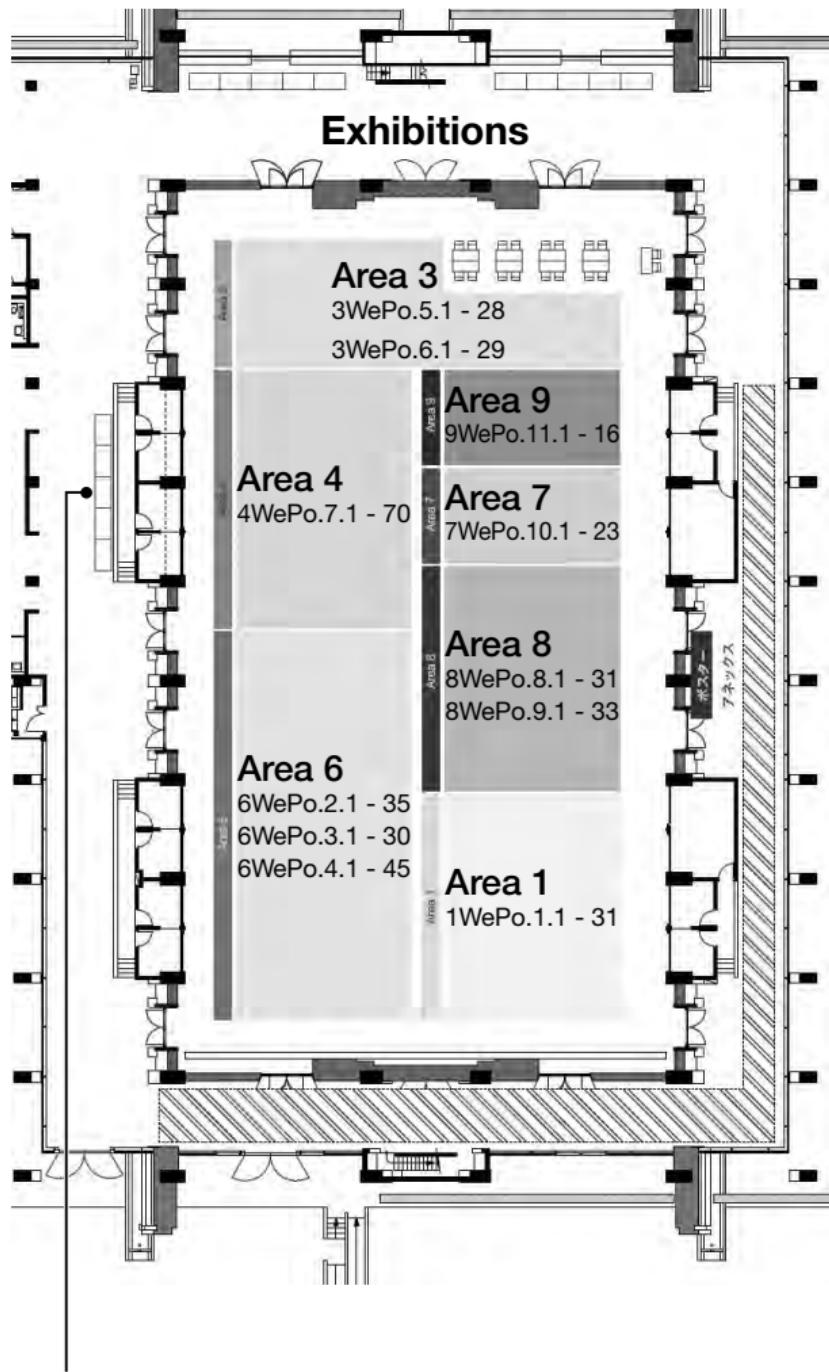
Poster Layout Map



- Poster Reception Desk
- Poster Session Chairperson Reception Desk
- Poster Session Conference Proceeding Desk

# Poster Layout Map

**Wednesday, November 26**



- Poster Reception Desk
- Poster Session Chairperson Reception Desk
- Poster Session Conference Proceeding Desk

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# Chairpersons' Message

## Message from the Conference Chair

It is our great pleasure to invite you to participate in the 6<sup>th</sup> World Conference on Photovoltaic Energy Conversion (WCPEC-6). This event will begin with opportunities for educational enhancement through a variety of tutorial topics on Sunday 23<sup>rd</sup> November, 2014. The conference proper will take place from Monday 24<sup>th</sup> to Thursday 27<sup>th</sup> November, 2014, at the Kyoto International Conference Center in Kyoto, Japan. Although previous WCPEC events have been held over 5 days, from Monday to Friday, this one is scheduled to last 4 days, from Monday to Thursday.



The conference, hosted by the WCPEC Organizing Committee, is a joint conference of the 24<sup>th</sup> Asia/Pacific PVSEC (PVSEC-24), the 41<sup>st</sup> IEEE PVSC and the 30<sup>th</sup> European PVSEC. We look forward to submissions of excellent papers, not only in the traditional areas of photovoltaics such as c-Si, thin-film materials (Si, CIGS, CdTe), III-V materials and organic materials, but also in fundamentals and new materials, modules and system development, concentrators, space applications and national programs and policies.

Japan's energy supply system is now facing a fundamental review as a result of the nuclear power plant accident following the 2011 East Japan Earthquake and Tsunami. This has led to a new recognition of the importance of photovoltaics. In Japan, there is currently a great deal of activity in photovoltaic research and development, such as the development of next-generation solar cells, and innovative solar cell development as part of the Fukushima recovery operation, beginning with PV introductory measures such as grant-aided projects for domestic solar power systems, and so-called "feed-in tariff" fixed-price power buy-back schemes. The holding of the WCPEC-6 event in November 2014 will no doubt serve as an excellent opportunity to convey the results of these various projects to the wider world.

Kyoto is in the heart of Japan and is a city with over a thousand years of history. The Kyoto International Conference Center, which will serve as the conference venue in 2014, was also the venue for the COP3 (Kyoto Protocol Climate Conference) in 1997, at which climate change and global warming were discussed. As participants, let's all take this opportunity to discuss the future of photovoltaics, which are extremely effective in reducing CO<sub>2</sub>. Late November in Kyoto is a time when the autumn colors are really beautiful. We invite you to come and enjoy the ancient city of Kyoto – a World Heritage site – while discussing the new form of energy that is photovoltaics.

**Makoto Konagai (TokyoTech, Japan)**

## Message from the EU-PVSEC Vice-Chair

As European Co-Chair of the 6th World Conference on Photovoltaic Energy Conversion (WCPEC-6) it is my honour and pleasure to invite you to participate in this joint conference of the 24<sup>th</sup> Asia/Pacific PVSEC (PVSEC-24), the 41<sup>st</sup> IEEE PVSC and the 30<sup>th</sup> European PVSEC.



When we meet in Kyoto cumulative PV capacity will most likely have exceeded 170 GW, showings that PV is on the right track to become a major electricity source. The fact that in some countries the share of PV electricity generation has reached already now up to 30% of electricity generation at certain hours not only shows the huge potential but also increases the urgency to provide cost effective solutions to integrate this PV electricity into the grid and increase its dispatchability.

The world photovoltaic community will gather on the occasion of the WCPEC-6 to meet and debate about the most recent scientific and technological progresses, industrial news, cost reductions, financial and policy issues and offer a unique opportunity for networking and knowledge exchange.

I personally look forward to meeting you in Kyoto to exchange about the latest trends and developments in photovoltaics.

A. Jäger-Waldau (EC JRC, Italy)

## Message from the IEEE Vice-Chair

Our global community of PV technologists has no more prestigious opportunity to share and publish our work than the World Conference provides us only once every three years. On behalf of the 41<sup>st</sup> IEEE PV Specialists Conference Cherry Committee, I invite and encourage you to join us in the lovely and historic city of Kyoto for the 6th WCPEC, marking the 20<sup>th</sup> year since the 1<sup>st</sup> WCPEC.



The Conference Chair has graciously accommodated the Thanksgiving holiday tradition in the United States, since the WCPEC-6 Thursday closing ceremonies in Kyoto are on Wednesday east of the International Date Line! Please join us in Japan for the world's most important PV technical conference to be held in 2014.

B.J. Stanbery (Heliovolt, USA)

# **Message from the Technical Program Committee Chairperson**

## **Message from Program Chair, WCPEC-6**

### **Message from the Technical Program Committee Chairperson**

On behalf of the Program Committee, I would like to express my sincere thanks to all the participants for their contribution to the WCPEC-6.

We have accepted nearly 1000 papers including Plenary and Invited talks for 9 different areas. More than 100 international experts in different areas devoted themselves for reviewing abstract.

Due to the limitation of the venue and time, it was tough job to formulate the program, and we have to select only 25% papers for oral presentation out of significant number of excellent papers. We are convinced that the program will be satisfactory for attendee.

The general scope of the WCPEC-6 is Terawatt Challenge beyond Grid Parity”.

The PV business has changed significantly in this decade and the electricity cost has reached grid parity in many places in the world. The cumulative installation will exceed 160 GW this year. The next target is, therefore, Terawatt scale PV in coming decades, implying that the PV plays an important role as a pillar of electricity.

We hope this conference will be fruitful for attendee to obtain new idea and to establish global network for the PV innovation.



**Michio Kondo (FREA, Japan)**

# **General Information**

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## **General Information**

## **Registration**

Registration fee for the Conference includes admission to all technical sessions, entrance to the Exhibition and Welcome Reception as well as a copy of the Program book let and Technical Digest (DVD). Please refer to page 9 for more information.

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## **Name Badge**

A name badge will be issued to all participants. It is an admission passes to all sessions, exhibition and Welcome Reception. Please wear your name badge all times during the conference for identification and security purposes.

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## **Official Language**

English is the official language of the conference and will be used for all printed materials, presentations, and discussions.

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## **Technical Programs**

WCPEC-6 2014 technical programs will consist of parallel sessions with Oral Presentations (November 24-27) and Poster Sessions (November 25-26).

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## **Poster Sessions**

The Poster Sessions will be held at Annex Hall of conference venue for 2 days (November 25-26).

All presenters are requested to set up their posters on the allotted boards prior to the session.

Poster sessions will give all conference participants the opportunity for Question and Answers.

\*Please refer to page 14 for more information.

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## **Exhibition**

The exhibition will be held in the Lobby, Annex Hall during the conference.

Date & Time:	November 24 (Mon.)	12:00-18:00
	November 25 (Tue.)	9:00-18:00
	November 26 (Wed.)	9:00-18:00

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## PC Preview Room

All speakers are requested to bring their presentation data to the PC Preview Room 30 minutes prior to the presentation.

Location: Room 104

PC Preview Room will be opened during the following hours:

Date & Time:	November 24 (Mon.)	8:00-18:00
	November 25 (Tue.)	8:00-18:00
	November 26 (Wed.)	8:00-18:00
	November 27 (Thu.)	8:00-16:00

Note: Please bring your conference proceedings and copyright form. (Please refer to page 12.)

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## Welcome Reception

Date: Sunday, November 23

Time: 18:00-20:00

Location: Banquet Hall "Swan", 1F, Kyoto International Conference Center

All participants are invited. Light meals and beverages (alcohol & soft drinks) will be served.

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## Banquet

Date: Wednesday, November 26

Time: 19:00-21:00

Location: Event Hall, 1F, Kyoto International Conference Center

Fee: 8,000.- JPY

Style: Buffet style

Registration fee does not include the banquet ticket. The ticket can be purchased at the registration desk.

Please note that banquet tickets are handled on a first come, first serve basis.

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## Coffee Breaks

As a service for participants, coffee breaks are served in front of Room A, B-1, B-2 and E during the conference.

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## Lunch Box

Please present the Lunch Box Ticket at Banquet Hall "Sakura" (1F) for those who purchased in advance.

Date	Time	Lunch Area
November 24 (Mon.)		Sakura,Room A,B-1,B-2,E
November 25 (Tue.)		Sakura,Swan, Room A,B-1,B-2,E
November 26 (Wed.)		Sakura,Swan, Room A,B-1,B-2,E,D
November 27 (Thu.)		

Lunch Area: Banquet Hall “Sakura” 1F, “Swan” 1F (November 25-27) and every Conference Room for Oral Presentation.

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## **Cloakroom**

Cloakroom is located on 1F, in front of the registration desk.

Opening Hours:

Date & Time:	November 23 (Sun.)	9:00-18:30
	November 24 (Mon.)	8:00-18:30
	November 25 (Tue.)	8:00-18:30
	November 26 (Wed.)	8:00-18:30
	November 27 (Thu.)	8:00-16:30

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## **Business Center**

Printing and photocopying services are available at the business center located at 1F in Kyoto International Conference Center.

For more details, please visit the following website: <http://www.icckyoto.or.jp/en/other/businesscenter.html>

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## **Internet Access**

Wireless internet service is available in all Lobby Area of the conference venue and in the Foyer at Annex Hall (Exhibition area).

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## **Cellular Phone**

Using cellular phones during the session is prohibited. Cellular phones must be turned off or set to silent mode during the sessions.

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## **Future Conferences**

PVSEC-25, Busan, Korea, November 15-20, 2015

The 42<sup>nd</sup> IEEE PVSC, New Orleans, USA, June 14-19, 2015

The 31<sup>st</sup> EU PVSEC, Hamburg , Germany, September 14-18, 2015

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## Registration Desk

Date & Time:	November 23 (Sun.)	9:00-18:00
	November 24 (Mon.)	8:00-18:00
	November 25 (Tue.)	8:00-18:00
	November 26 (Wed.)	8:00-18:00
	November 27 (Thu.)	8:00-16:00

Location: 1F near the main entrance.

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## Registration Fees

	Early bird From March 20 until September 30, 2014	On-Site
Regular	65,000 JPY	75,000 JPY
Student	25,000 JPY	30,000 JPY
Tutorial (Nov. 23)		5,000 JPY
Banquet (Nov. 26)		8,000 JPY

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## Cancellation Policy

To cancel your registration, a written request must be sent to the Registration Secretariat by September 30, 2014.

Registration fees are refundable as specified below. Please kindly note that all refunds will be made after the conference.

Cancellation/Refund Request Date	Refund
Must be on or before September 30, 2014	25% of registration fee per person will be deducted as a cancellation fee.
After October 1, 2014	No refund

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## Method of Payment

All payments on-site may use either Japanese yen (cash) or one of the following credit cards:

Visa, MasterCard, JCB, American Express

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## Climate

Autumn in Kyoto is comfortable, pleasant and thoroughly enjoyable. A light coat, sweater or something you can wear additionally in the cool time, should be quite adequate.

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## Money Exchange

Cash or travelers checks can be exchanged at any “Authorized Foreign Exchange Bank” (signs are displayed in English), major hotels, department stores or main post offices. In Kyoto, most major banks (including Citibank) are located near the Shijo-Karasuma intersection, two stops north of Kyoto Station on the Karasuma subway line.

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## Electricity

The voltage used throughout Japan is 100 volts AC. In Kyoto and western Japan, the frequency of electric current is 60Hz. Two-pronged outlets are used in Japan.

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## Travel Information

JTB travel desk will be opened daily during the conference. For travel and accommodation informations, please feel free to visit travel information desk.

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## Shopping

Shops in Japan are generally opened on Saturday, Sunday and national holidays as well as weekdays from 10:00-20:00.

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## Tipping

In Japan, tipping is not necessary.

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## Emergencies

In case of emergency, please contact the Registration Desk near the main entrance.

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## Insurance

The organizers cannot hold responsible for injury to Conference attendees or for damage to, or loss of their personal belongings, regardless of cause. Attendees are advised to make their own insurance arrangements.

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# **Guidelines for Oral Presentations**

## **Guidelines for Oral Presentations**

### **1. Time Allocation**

Plenary Presentations	30 minutes including discussion
Invited Presentations	20 or 25 minutes including discussion
Oral Presentations	15 minutes including discussion

### **2. PC Preview**

All speakers are requested to bring their presentation data to the PC Preview Room 30 minutes prior to the presentation.

Location: Room 104

PC Preview Room will be opened during the following hours:

Date & Time:	November 24 (Mon.)	8:00 - 18:00
	November 25 (Tue.)	8:00 - 18:00
	November 26 (Wed.)	8:00 - 18:00
	November 27 (Thu.)	8:00 - 16:00

Please bring your USB storage device or your own laptops to the PC preview room prior to the presentation. Our technical staffs will copy and save your presentation data. The copied data will be deleted after your presentation.

\* If presentation data is made by Macintosh, please bring your own laptop.

Please also do not forget to submit your conference proceedings and Copyright form at the PC preview desk.

### **3. Technical Digest**

Technical Digest will be published in DVD format after the conference. Conference proceedings should be submitted on-site during the conference at the PC preview room together with the Copyright form with consent of author and all co-authors in case of jointly authored works.

The Digest will be delivered by postal mail to the participants after the conference. If the manuscript is not available during the conference, your paper can not be published in the Technical Digest and are not eligible to receive awards.

### **4. Presentation Equipment**

#### **Preparing Presentation Data**

##### **OS and Applications**

OS	Windows 7
Applications	PowerPoint or PDF Full Screen
Version	2007 / 2010
Movies	Windows Media Player
Fonts	Windows standard fonts (Arial, Arial Black, Arial Narrow, Century, Century Gothic, Courier New, and Georgia)

\* If presentation data is made by Macintosh, you are required to bring your own laptop.

Please note that using any other font may cause letters to become unreadable.

To avoid the possible spread of computer viruses, always scan your presentation files beforehand with updated anti-virus software.

## **5. Oral Session Procedures**

For Speakers:

- 1) Please follow the Chairperson's instructions.
- 2) Please be seated in the "Next Speaker's Seat" (located in the first row of the room) at least 15 minutes prior to your presentation.
- 3) Please check the time allotted for your presentation and finish your presentation within the designated time.

Note: There will be a "Digital Time Indicator" on the podium, which will alert you the remaining time.

For Session Chairpersons:

- 1) Please complete your registration and come to the chairpersons' reception desk near the registration desk.
- 2) Please be seated at the "Next Chairperson's Seat" at least 15 minutes prior to your session.
- 3) Please ensure that the session starts and finishes on time.
- 4) Please hand in the presentation evaluation form at the Chairpersons' Reception Desk.

# Guidelines for Poster Sessions

## Guidelines for Poster Sessions

### 1. Venue and Schedule

Venue: Annex Hall

Schedule:

	Set-up Time	Q & A	Removal Time
November 25 (Tue)			
1TuPo.1.1 - 29	8:00 - 10:00	10:15 - 11:30	18:00 - 19:00
1TuPo.2.1 - 30		13:00 - 14:25	
2TuPo.3.1 - 42		14:45 - 16:10	
2TuPo.4.1 - 43		16:30 - 17:55	
3TuPo.5.1 - 29		14:45 - 16:10	
3TuPo.6.1 - 28		16:30 - 17:55	
4TuPo.7.1 - 70		10:15 - 11:30	
5TuPo.8.1 - 24		14:45 - 16:10	
5TuPo.9.1 - 24		16:30 - 17:55	
7TuPo.10.1 - 24		14:45 - 16:10	
7TuPo.11.1 - 28		16:30 - 17:55	
November 26 (Wed)			
1WePo.1.1 - 31	8:00 - 10:00	16:30 - 17:55	18:00 - 19:00
3WePo.5.1 - 28		10:15 - 11:30	
3WePo.6.1 - 29		13:00 - 14:25	
4WePo.7.1 - 70		10:15 - 11:30	
6WePo.2.1 - 35		10:15 - 11:30	
6WePo.3.1 - 30		13:00 - 14:25	
6WePo.4.1 - 45		14:45 - 16:10	
7WePo.10.1 - 23		14:45 - 16:10	
8WePo.8.1 - 31		10:15 - 11:30	
8WePo.9.1 - 33		13:00 - 14:25	
9WePo.11.1 - 16		16:30 - 17:55	

#### Notes

If you fail to put up your poster within the scheduled times, your poster will be considered to be withdrawn and the Presentation will be cancelled.

All posters left after the removal time will be disposed of.

Please submit your conference and Copyright form at the conference proceeding desk in the Lobby at Annex Hall for Technical Digest (see “Technical Digest” in p.13 for more information).

We will then give you a “Ribbon” to wear on your chests.

## **2. Poster Session Procedures**

For Poster Presenters

- 1) Poster panel size (prepared at the site) : height 2100mm × width 900mm.
- 2) Poster number (200mm × 300mm) will be placed on the top left of the panel in advance.
- 3) The size of poster board allows A0 format (841mm × 1189mm, upright format).  
Make sure that the poster meets the above space requirements. In addition, each poster must include a Title, Author’s Names and Affiliations.
- 4) Pushpins will be provided by the Registration Secretariat.  
Please use the pushpins to place your poster on the Panel.
- 5) All presenters will be given a “Ribbon” prepared by the Registration Secretariat to wear on their chests.
- 6) All presenters are required to stand by their poster panel during the session to make themselves available for discussion with participants.

For Session Chairpersons:

- 1) Please complete your registration and come to the chairperson reception desk in the Lobby at Annex Hall to show up yourself. We will give you a “Ribbon” to wear on your chests.
- 2) Please come to the assigned area in scheduled presentation time.

# **Conference Proceedings**

## **Journal Papers:**

Authors of WCPEC-6 papers are encouraged to submit their original papers presented at WCPEC-6 to (1) the Special Issues of Japanese Journal of Applied Physics (JJAP) or (2) IEEE Journal of Photovoltaics (J-PV). Please read carefully the instructions for the manuscript preparation of these two journals, then you can choose one of them. The review process for the journals is completely separate from the WCPEC-6 review process. In addition, exact copies of the Technical Digest cannot be accepted as journal papers.

- Special Issues of Japanese Journal of Applied Physics (JJAP)**

The Special Issue of Japanese Journal of Applied Physics (JJAP) accepts original papers presented at WCPEC-6 as a “regular paper” in JJAP. The standard JJAP review will be done on the submitted manuscripts. The length of the manuscript is recommended to be more than 5 published pages.

The deadline for the submission of the manuscripts is December 19th, 2014.

Online publishing on the website will be started from June 2015.

Online manuscript submission site is already available on the JJAP website.

(<http://journals.jsap.jp/jjap/special-issues/online-submission-to-jjap-special-issues>)

Instructions for preparing of manuscript and MS-word templates can be downloaded from the following website.

Instructions for preparation of manuscript

([http://journals.jsap.jp/wp-content/uploads/instruction\\_e.pdf](http://journals.jsap.jp/wp-content/uploads/instruction_e.pdf))

MS-Word Templates for preparing a manuscript (Regular Paper & Review Paper)

(<http://journals.jsap.jp/wp-content/uploads/template-RP.docx>)

When authors submit the manuscript, authors need to input the session number and to select the area number of the presentation.

Plenary speakers select “0” as area number on submission the manuscript of plenary presentation.

Guidelines for preparing a manuscript are also available on the following website.

(<http://journals.jsap.jp/jjap/special-issues/submission-guideline>)

## **IEEE Journal of Photovoltaics**

As you are likely aware, the Institute of Electrical and Electronics Engineers (IEEE) has launched the Journal of Photovoltaics (J-PV) in response to the rapid growth of research in this area.

We would like to invite you to submit your very best research findings to this new journal. This can be done at any time through the J-PV website (<http://eds.ieee.org/jpv.html>). If you are presenting a paper at the WCPEC-6, you may submit a manuscript to the J-PV that is an enhancement of your conference proceedings paper. Guidelines for preparing an enhanced manuscript are available on the J-PV website ([http://eds.ieee.org/images/files/Publications/jpv\\_info\\_for\\_authors.pdf](http://eds.ieee.org/images/files/Publications/jpv_info_for_authors.pdf)). In summary, it is required that you cite the WCPEC-6 Technical Digest article in the enhanced version, briefly explain the extent of the enhancement in the introduction, and include at least one third additional material not published in the proceedings.

We hope that the possibility to publish in a peer-reviewed, archival journal will encourage you to bring your highest quality research results to the WCPEC-6.

# Awards

## WCPEC Award

The International Advisory Committee for the WCPEC has decided to establish the WCPEC Award for advancement of photovoltaic science and technology on occasion of the 6<sup>th</sup> World Conference on photovoltaic energy conversion with co-sponsorship of the IEEE Electron Device Society, European Commission and the PVSEC Advisory Committee, Japan.

According to nominations, the recipient is selected by the WCPEC Award Committee which is organized by 21 active members selected from the three societies of IEEE PVSC, EC-PVSEC and PVSEC.

The WCPEC Award 2014 will be presented to:



### Professor Masafumi Yamaguchi

For his outstanding contributions to advancement of photovoltaic science and technology.

Dr. Yamaguchi is a Professor of Toyota Technological Institute since 1994 and Director of the Research Center of the Smart Energy Technology. His remarkable research achievements span the fields of semiconductor materials, devices and solar cells, and notably include the discovery of minority-carrier injection defect annealing in InP-related materials and solar cells, invention of double hetero structure tunnel diode for multi-junction applications, development of high efficiency III-V multi-junction including III-V/Si tandem, and concentrator solar cells.

Professor Yamaguchi is the Supervisor of the Creative Clean Energy Generation using Solar Energy of the Japan Science and Technology Agency (JST) and Project Leader of the Next Generation High Performance Photovoltaics R&D Project, New Energy and Industrial Technology Development Organization of Japan (NEDO). He is the Acting Leader of the EU-Japan Joint R&D Project on Concentrator Photovoltaics aiming at developing the world's highest efficiency concentrator solar cells, modules and systems.

He has received several awards such as Becquerel Prize from the European Commission in 2004 and William Cherry Award from the IEEE in 2008 for his outstanding contributions to the development of science and technology of photovoltaics such as high-efficiency multi-junction solar cells, space solar cells, concentrator solar cells and as one of the world leaders of the development of photovoltaics and as one of the driving forces for international co-operation, as illustrated in the PV World Conferences (WCPEC).

## PVSEC Award

The PVSEC Award will be presented for outstanding contributions to the development of photovoltaic science and technology. The recipient is selected by the PVSEC Award Committee (PVSEC National Advisory Committee) according to nominations.

The PVSEC Award 2014 will be presented to:



### **Dr. Tatsuya Takamoto**

For his outstanding contributions to photovoltaic science and technology development.

Dr. Tatsuya Takamoto has been one of the top, leading researchers in III-V compound high efficiency multi-junction solar cells in the world. He entered in the field of photovoltaic science with the development of InP space solar cells in 1987 (PVSEC-3, Tokyo). Since then, he has made many substantial contributions for high efficiency cells applied to space use and concentrator systems. His outstanding achievements of record efficiency include 30.3% efficiency dual-junction cell in 1997, 37.9% triple-junction cell and 44.4% concentrator cell in 2013. In his recent work for inverted multi-junction solar cells, not only high efficiency higher than 30% but also lightweight flexible structure have been demonstrated and realized for the first time. This technology holds massive potential for high efficiency solar cell applications.

His contribution is not only related to R&D area. He has been responsible for triple-junction solar cells at SHARP Corp. He is now working for applying the high-performance lightweight inverted triple-junction cells to space use. And also, he is working for realization of concentrator photovoltaic and terrestrial use of high efficiency III-V compound cells.

Dr. Tatsuya Takamoto is now Department General Manager of Compound Photovoltaic Cell Development Department, Energy System Solution Division, Sharp Corporation. He graduated from the University of Tsukuba in 1987 and joined Nippon Mining Corp. (now JX Holdings Inc.). He received PhD from Toyota Technological Institute in 1998. He moved to Sharp Corporation in 2001. He has won PVSEC Paper Award five times (at 9<sup>th</sup>, 11<sup>th</sup>, 13<sup>th</sup> 15<sup>th</sup> and 17<sup>th</sup> PVSEC).

## PVSEC Special Award

The Organizing Committee of the PVSEC has also decided to institute the PVSEC Special Award that will be presented to outstanding contributions for technology development and the promotion of photovoltaic solar energy conversion. The recipient is also selected by the PVSEC Award Committee (PVSEC National Advisory Committee) according to nominations.

The PVSEC Special Award 2014 will be presented to:



**Dr. Michio Kondo**

For his outstanding contribution to photovoltaic technology development and project management.

Dr. Michio Kondo is currently Deputy Director General of Fukushima Renewable Energy Institute, National Institute of Advanced Industrial Science and Technology (FREA). He received Ph.D. in material science at Osaka University in 1987. He joined University of Tokyo as a research associate in 1987 and Agency of Industrial Science and Technology in 1993. He directed Solar Photovoltaic research in AIST for 10 years and he is now deputy-director general in newly established institute, Fukushima Renewable Energy. He has conducted more than 10 national projects for photovoltaic research upon thin film solar cells and high efficiency solar cells with an efficiency higher than 40%. He has also contributed to the strategic planning of solar photovoltaics for NEDO as a committee member.

His research interest is mainly silicon thin film and related processes as well as its application to device such as TFT and solar cells including not only thin film device but also hetero junction devices with crystalline silicon and germanium.

He has published more than 200 scientific papers and 80 patents (48 filed). He received Keidanren-award for his contribution to the industrialization of thin film solar cells in collaboration with the company in 2008. He has also received the JSAP (The Japan Society of Applied Physics) Fellow Award in 2014 for his long-term activity upon basic research and its industrialization for solar cells.

## Hamakawa Award



### Professor Yoshihiro Hamakawa, a founder of the PVSEC community

This award is named in honor of Professor Yoshihiro Hamakawa, a founder of the photovoltaic community in Japan and the Asia/Pacific PV Conference (PVSEC). The Hamakawa Award is instituted in 2014 on the occasion of the 6<sup>th</sup> World PV Conference (WCPEC-6) because he is also a founder of the WCPEC and the occasion of the 30<sup>th</sup> anniversary of the PVSEC because he has served as the General Chair of the PVSEC-1 held in Kobe, Japan in 1984..

Dr. Yoshihiro Hamakawa is an Emeritus Professor of Osaka University since 1996. He has performed a number of remarkable research achievements in the field of semiconductor physics, optoelectronics, and solar photovoltaic conversion, particularly invention of the amorphous silicon multi-layer tandem solar cells and the success of valence electron control of amorphous silicon carbide films and their application to high efficiency Si thin-film solar cells.

In addition to these scientific activities, Professor Hamakawa has made many key contribution to the promotion of PV technology development. He was also an active leader in the industrial development of PV energy as an initiator of the Sunshine Project and served the Chairman of the Solar Energy Division in the New Energy Section of the Industrial Development Council, Ministry of International Trade and Industry, Japan.

For his distinguished contributions, he received numerous awards such as the William Cherry Award from the IEEE in 1994, the 1995 Purple Ribbon Prize from Japanese Emperor and WCPEC Award in 2003.

The purpose of the award is to recognize scientists and engineers who have made outstanding research and technological accomplishment, and creativity of PV energy conversion, especially outstanding contributions to developments of new concepts, new materials, new devices, ultra high efficient solar cells. The recipient is also selected by the PVSEC Award Committee (PVSEC National Advisory Committee) according to nominations.

The Hamakawa Award 2014 will be presented to:



### Professor Makoto Konagai

For his outstanding contributions to seminal studies on GaAs, concentrator, organic solar cells and Peeled Film Technology.

Makoto Konagai is Professor of Physical Electronics at Tokyo Institute of Technology. He received the B.E., M.E. and D.E. degrees in Electronic Engineering from Tokyo Institute of Technology in 1972, 1974 and 1977, respectively. Since 1977, he has been with Tokyo Institute of Technology, where he has been engaged in the development of solar cell materials and devices. In 1972, he began to investigate GaAs solar cells and proposed several novel techniques to improve the energy conversion efficiency. He demonstrated pioneering work on GaAs thin-film concentrators prepared by the Peeled Film Technology. In 1979, he began to investigate polyacetylene solar cells and amorphous Si based thin film solar cells. In 1986, he initiated CuInSe<sub>2</sub> thin film solar cells for the first time in Japan. In addition to these solar cell materials and devices, he developed ZnO transparent conducting oxides for thin film solar cell applications. He is currently working on bulk and thin-film Si Si solar cells, thin-film full-spectrum solar cells and nano-wire Si solar cells. He has authored over 400 publications in international journals and over 500 international presentations.

In addition to these scientific activities, he has made many key contributions to the promotion of photovoltaic research and development, especially in Asian countries. He organized PVSEC-9 (1996) and WCPEC-6(2014). He is currently the chairman of the Japan Society for the Promotion of Science, The 175<sup>th</sup> Committee on Innovative Photovoltaic Power Generation Systems and the chairman of International Advisory Committee, International PVSEC. He has received prestigious awards, including the PVSEC Award (1999), The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, Prizes for Science and Technology (2009), and Medal with Purple Ribbon (2013). He is now a member of Science Council of Japan.

The Hamakawa Award 2014 will also be presented to:



### **Professor Hironori Katagiri**

For his outstanding contributions to pioneering studies on new, earth abundant CuZnSn(S,Se) solar cells and materials.

Dr. Katagiri is a Professor of Nagaoka National College of Technology since 2001. He has focused on the development of  $\text{Cu}_2\text{ZnSnS}_4$  (CZTS) thin film solar cells. All of the constituents of CZTS are earth-abundant. From the viewpoint of resource strategy in the forthcoming future, CZTS is one of the most promising materials.

He demonstrated the conversion efficiency of 0.66% using CZTS thin film as an absorber at the PVSEC-9 held at Miyazaki, Japan in 1996. This is the first report of CZTS thin film solar cells. To improve the conversion efficiency, many experiments have been conducted since then. He achieved 6.77% by the end of 2008. One of the most outstanding results is concerned with the active composition. He confirmed that in order to obtain high conversion efficiency, CZTS with the off stoichiometric composition of Cu-poor and Zn-rich is preferable to the stoichiometric CZTS. He named those composition regions as the active composition.

Professor Katagiri has worked as an engineering educator in his college. All students in his laboratory are undergraduate. In the educational system of Japan, they are regarded to be the youngest researchers. Professor Katagiri says that both the development of CZTS solar cells and the education of young students are his lifework.

# **Social Program**

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## **Welcome Reception**

### **Sunday, 6:00PM-8:00PM, at room “Swan”**

Welcome Reception is held on Sunday, November 23<sup>rd</sup>, 6:00PM-8:00PM at the room “Swan” in conference venue. Any participant can attend free of charge. You can enjoy discussions with beer, wine, juice and snacks.

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## **Conference Banquet**

### **Wednesday, 7:00PM-9:00PM at “Event Hall”**

Conference Banquet will be held on Wednesday, November 26<sup>th</sup>, from 7:00PM to 9:00PM at “Event Hall” in conference venue. Participants can enjoy night at Kyoto with eating and drinking as well as dance by Kyoto ladies. Although it is on a first come, first serve basis, banquet ticket can be purchased at the “Registration Desk”.

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# Exhibition

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Du Pont Kabushiki Kaisha

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ESPEC CORP.

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JFE Techno-Research Corporation (JFE-TEC)

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Nissinbo Mechatronics Inc.

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The Japan Society of Applied Physics

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Japan Science and Technology Agency (JST)

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JAPAN ELECTRICAL SAFETY & ENVIRONMENT TECHNOLOGY LABORATORIES (JET)

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Airlight Energy

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EIKO Corporation

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EKO INSTRUMENTS CO., LTD.

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FUJIFILM Corporation

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KIKUSUI ELECTRONICS CORPORATION

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SCREEN Finetech Solutions Co., Ltd.

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Seishin Trading Co., Ltd.

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Semilab Japan KK

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Silvaco Japan Co., Ltd.

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Sinton Instruments

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TEIJIN LIMITED

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## WCPEC-6 Tutorials

November 23rd, 2014 (Sunday)

The WCPEC-6 tutorials will be held at the conference venue, " Kyoto International Conference Center ", on Sunday, November 23<sup>rd</sup>, 2014. The sites are Room F, G, H, J, K and the maximum number of each room is 48 persons.

The tutorial topics and time schedules are listed below. Please register for the tutorials using the normal conference registration process on this web site.

### **Topic A ; Crystalline Silicon Solar Cells**

Crystalline silicon solar cells hold a dominant share of the solar cell market, and this situation is expected to continue at least for a decade. This tutorial will outline the current standard technologies in mass production flow of crystalline silicon solar cells: from crystallization through sawing and cell processes to module production. In addition, leading technologies for further improvement in the efficiency and reduction of the production cost will be also reviewed.

#### (1) A-1 ; Crystalline Silicon Solar Cells - 1

(13:00 ~ 14:50, Room F, 1F)

*Instructor ; Prof. Kyotaro Nakamura,*  
Meiji University, Japan

*Synopsis ;* Crystalline silicon solar cell has been playing the central role of PV industry for a long time and the crystalline silicon solar cell technology also will continue to be dominant in solar cell production for some time in the future. This tutorial will cover all aspects of production in crystalline silicon solar cell from the present and into the future. At first, we will instruct device physics and some basic techniques of crystalline silicon solar cells, for example, Texturization, BSF (Back Surface Field) and so on. Then, the fabrication process of conventional crystalline silicon solar cells will be introduced. The fundamental fabrication process flow of conventional solar cell is as follows; (1) Sow damage removal and texturing, (2) Phosphorus diffusion and PSG removal, (3) ARC (Anti-Reflection Coating) formation, and (4) Metallization. We will explain these steps with showcasing an example of manufacturing line. On the other hand, there are also a number of advanced technologies which will dominate the next wave of large scale deployment on manufacturing lines and in field installation. So, we will also show some advanced technologies for high efficiency crystalline silicon solar cell and some important achievements in recent years in this field. Additionally, summary of the current situation and future prospect of crystalline silicon PV

industry will be presented in brief.

## (2) A-2 ; Crystalline Silicon Solar Cells - 2

(15:00 ~ 16:50, Room F, 1F)

*Instructor ; Dr. Kentaro Kutsukake*

Physics of Crystal Defects Laboratory, Institute for Materials Research, Tohoku University, Japan

*Synopsis* ; Crystalline quality of silicon wafers directly influences performance of the solar cells. This tutorial will instruct material science and technology of silicon crystals, which will cover crystal growth, wafer characterization, and fundamental science of crystal defects. As the crystal growth topics, new concept growth methods, i.e., mono-like silicon and high performance multicrystalline silicon will be introduced, in addition to standard growth methods, i.e., Czochralski method for single-crystalline silicon and casting method for multicrystalline silicon. Secondly, principle and feature, in particular detection error and limit, will be discussed for various characterization techniques, such as micro-PCD, PL imaging, FTIR, and etch pit observation, for silicon wafers and bulk ingots. Furthermore, lecture of fundamental science of crystal defects will be presented. This lecture will cover generation and propagation mechanism of dislocations and incorporation mechanism of impurities during the crystal growth process that will be a help to develop the growth technologies of silicon ingots.

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## Topic B ; Thin Film Silicon Solar Cells

In this tutorial, there will be three main topics on Si thin film PV, that is, preparations of amorphous and microcrystalline Si, fundamental physics of thin film silicon solar cells including transparent conducting oxides (TCO) and future outlook of the type of cells. In the future outlook, some recent hot topics on improvements of efficiency exceeding 10 % both in amorphous and microcrystalline Si single cells will be presented from viewpoints of growth of high quality films, device structure and optical confinement in TCO. Furthermore, fundamental physics and preparation techniques of quantum dot and nanowire solar cells will be described.

## (3) B-1 ; Fundamentals of Quantum Dot Solar Cells

(13:00 ~ 14:50, Room G, 1F)

*Instructor ; Prof. Dr. Takashi Tayagaki*

Institute for Chemical Research, Kyoto University, Japan

*Synopsis* ; This tutorial will present a survey of quantum dot solar cell technologies under development for

achieving cell efficiencies exceeding 40%. The conversion efficiencies in commercial single junction solar cells are only one-fourth the value of the theoretical limit of solar energy conversion over 85%. This suggests that the performance of solar cells could be improved 2-3 times if fundamentally different new concepts were used in their design. In addition, there would be an enormous impact on economics if the new concepts could be implemented in thin-film form, making photovoltaics one of the cheapest energy resource. Nanostructured photovoltaics, such as quantum dot solar cells, are proposed as a potential candidate to demonstrate high performance, low-cost photovoltaics. To date, while some characteristic operations, such as an enhanced photocurrent generation due to quantum dots, have been confirmed, the conversion efficiency of quantum dot solar cells has remained less than those of conventional single junction solar cells without quantum dots.

In this tutorial, new physical mechanisms for high conversion efficiency will be presented, including multi-exciton generation (impact ionization), intermediate-bands, and hot carrier solar cells. The tutorial will provide fundamental physics and preparation techniques of quantum dots. The principle in quantum dot solar cell operations will be discussed, along with a survey of quantum dot solar cell technologies. In addition, current status and prospects of quantum dot solar cells for meeting future global energy demands will be presented.

#### (4) B-2 ; Thin Film Silicon Solar Cells - 2

(15:00 ~ 16:50, Room G, 1F)

*Instructor ; TBD*

*Synopsis ; Improvement of energy conversion efficiency of solar cells is an important issue for resolving energy-supply problems in the world. One of the promising materials for realizing solar cells with higher efficiency and lower cost seems to be Si thin film. In this tutorial, outline and fundamental topics of silicon (Si) thin film solar cells are lectured and the contents will be as follows:*

- 1 Introduction of Si thin film solar cells
- 2 Characteristics of hydrogenated amorphous and microcrystalline Si films
- 3 Fundamental theory of p-i-n junction type solar cells
- 4 Preparation method of Si thin film solar cells by Plasma Enhanced Chemical Vapor Deposition (PECVD) and Hot-Wire Chemical Vapor Deposition (HWCVD)
- 5 A brief history and recent topics of the develop-

ment of Si thin film solar cells with an energy conversion efficiency of > 15 % (including tandem type Si thin film solar cells)

6 Problems and views of Si thin film solar cells to achieve an efficiency of > 20 % from viewpoints of growth of high quality films, device structure and optical confinement in transparent conducting oxides (TCO)

The details of this tutorial will be updated in the near future.

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### **Topic C ; Compound Semiconductor Solar Cells - 1**

Compound semiconductors are the critical materials for today's thin film photovoltaic technologies. In particular, chalcogenide materials such as CIGS, CZTS, etc. are highly interesting due to their uniquely high absorbance. The session C-1 will describe both fundamental properties and the recent progress in the characterization methods of the chalcogenide materials for solar cell application, and discuss the material properties to be improved to enhance device performance further. The session C-2 will present an overview of the recent progress in the development of the device fabrication technique of compound solar cells, placing special emphasis on the chalcogenide solar cells such as CIGS, CZTS, etc. Also, non-vacuum process will be presented for future low cost cells.

#### **(5)C-1 ; Compound Semiconductor Solar Cells - 1**

(13:00 ~ 14:50, Room H, 1F)

*Instructor ; Dr. Paul Pistor*

Photovoltaic Group, Institute of Physics, Martin-Luther-University, Germany

*Synopsis ; Growth and characterization of chalcogenide thin film solar cell absorbers* The C-1 will describe both fundamental properties and recent progress in the characterization methods of chalcogenide materials for solar cell applications. Chalcopyrite solar cell absorber growth techniques and their development will be briefly introduced. The fundamentals of the growth mechanisms of chalcopyrites will be reviewed and compared to other thin film absorbers including kesterite and perovskite absorbers.

Different characterization methods and fundamental material properties to be monitored will be discussed, e.g. photoluminescence. A focus will be the structural characterization of thin film growth by X-ray diffraction (XRD). The in-site detection of crystal phases during the deposition opens valuable optimization pathways, as the formation, transitions and evolutions of different phases can be monitored in real-time. Different technological approaches concerning the implementation of in-site XRD and an overview of results obtained by this powerful

technique will be presented and discussed.

## (6)C-2 ; Compound Semiconductor Solar Cells - 2

(15:00 ~ 16:50, Room H, 1F)

*Instructor* ; **Prof. Takashi Minemoto**

College of Science and Engineering, Ritsumeikan University, Japan

*Synopsis* ; Cu(In,Ga)Se<sub>2</sub> (CIGS) solar cells already achieve 21% efficiency. In this lecture, basic material properties of CIGS and fabrication methods of component layers (Mo back contact, CIGS absorber layer, buffer layer and window layers) will be reviewed. Also, operation mechanism of CIGS solar cells will be explained and physics parameters to improve short-circuit current and open-circuit voltage will be revealed. In addition, recent progresses of CIGS solar cells will be summarized. Finally, potential of other chalcogenide materials without rare metals will be discussed with some experimental data.

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## Topic D ; Organic, Dye Sensitized and Perovskite Solar Cells

Organic solar cells are a promising candidate for the next generation solar cells, which develop novel indoor and outdoor applications. The tutorial presents the recent progress and future perspectives of dye-sensitized solar cells, and overviewing of the organic-inorganic hybrid solar cells, particularly focusing on one of the fastest growing organic photovoltaic technology based on organometal halide compounds with the perovskite structure.

## (7) D-1 ; Dye Solar Technology; towards market introduction and new mesoscopic concepts

(13:00 ~ 14:50, Room J, 2F)

*Instructor* ; **Dr. Andreas Hinsch**,

Fraunhofer Institute for Solar Energy Systems ISE,  
Federal Republic Germany

*Synopsis* ; Recently first commercial dye solar cell (DSC) products based on the mesoscopic principle have successfully been launched for electronic integrated photovoltaics. The market introduction is accompanied by a strong increase in patent applications in the field during the last 4 years which is a good indication that further commercialization activities are undertaken. Materials and cell concepts have been developed to such extend that an uptake by industrial manufacturers is possible. A laboratory DSC efficiency of 13% has been shown [1]. The critical phase for a broad market acceptance is therefore reached which implies to focus on standardization related research topics like electrolumi-

nescence mapping and accelerated testing. In parallel the amount of scientific publications on DSC is growing further (larger 3500 since 2012) and the range of new or renewed more fundamental topics, like solid-state p-conductors and cobalt or organic radical based redox electrolytes, is broadening, as will be explained in the tutorial. In this sense a growing divergence between market introduction and research could be the consequence. In this tutorial an effort is undertaken to show, that such an unwanted divergence can be prevented by developing suitable reference type cell and module concepts as well as manufacturing routes which can be applied to mesoscopic based solar cells in a broader sense. As a guideline for developing future mesoscopic cell and module concepts, perovskite solar cells being a prominent example here, our recent work on up-scaling large area glass frit sealed DSC modules [2] for efficiency studies (6.6% active area efficiency) and for outdoor analyses is explained in detail. Another important point addressed in the tutorial is the issue of sustainability both affecting market introduction as well as the direction of fundamental research.

- [1] S. Mathew, A. Yella, P. Gao, R. Humphry-Baker, B.F.E. Curchod, N. Ashari-Astani, I. Tavernelli, U. Rothlisberger, Md.K. Nazeeruddin and M. Grätzel, *Dye-sensitized solar cells with 13% efficiency achieved through the molecular engineering of porphyrin sensitizers*, *Nature Chemistry* 6, 242–247 (2014), doi:10.1038/nchem.1861
- [2] A. Hinsch, W. Veurman, B. Brandt, K. Flarup-Jensen, S. Mastroianni, *Status of Dye Solar Cell Technology as a Guideline for Further Research*, *ChemPhysChem*. 15 (6) 2014, 1076-1087, <http://dx.doi.org/10.1002/cphc.201301083>

## (8) D-2 ; Perovskite Solar Cells

(15:00 ~ 16:50, Room J, 2F)

Instructor ; **Prof. Dr. Seigo Ito**

Department of Electrical Engineering and Computer Sciences, Graduate School of Engineering, University of Hyogo, Japan

*Synopsis* ; Very recently, organic-inorganic lead halide based perovskites have emerged as a new class of light absorbers, achieving exceptional progress in solar cell performance. The structure of perovskite solar cells has been close to that of dye-sensitized solar cells. These types of perovskites have favourable bandgap for photovoltaic applications and large extinction coefficients. The organic-inorganic hybrid perovskite structure has advantage over other

crystal structures as for the sensitizer, since it has high light absorption property as well as thermal stability. Discovery of its solution processability and stability combined with the earth abundance of the constituent materials has made the lead halide perovskites among the most promising solar cell materials. Perovskite semiconductor  $\text{CH}_3\text{NH}_3\text{PbX}_3$  (X: Cl, Br, or I) has been used for the solar cell exceeding an  $\eta$  value of 15% under one sun. The  $\text{CH}_3\text{NH}_3\text{PbX}_3$  perovskite can be formed by three different methods. The first method is based on in-situ formation (one-step deposition) on a nanocrystalline  $\text{TiO}_2$  surface from spin coating of the  $\text{CH}_3\text{NH}_3\text{X}$  and  $\text{PbX}_2$  mixed solution. The second method is characterized by sequential (two-steps) deposition where an initially formed  $\text{PbX}_2$  layer is immersed into a  $\text{CH}_3\text{NH}_3\text{X}$  solution, resulting in the transformation to  $\text{CH}_3\text{NH}_3\text{PbX}_3$  perovskite layer. During dipping process of the  $\text{PbI}_2$  layer into the  $\text{CH}_3\text{NH}_3\text{X}$  solution, the  $\text{CH}_3\text{NH}_3\text{X}$  molecule can transform the  $\text{PbX}_3$  crystal to  $\text{CH}_3\text{NH}_3\text{PbX}_3$  perovskite layer. The third method relies on vacuum evaporation deposition using dual source pods with  $\text{PbX}_2$  and  $\text{CH}_3\text{NH}_3\text{X}$ , which can produce very thin smooth layers on flat substrates.

These perovskite solar cells have typically employed a wide variety of organic hole conductors. Most notable as the hole-conducting materials is 2,2',7,7'-tetrakis(N,N-di-p-methoxyphenylamine) 9,9'-spirobifluorene (spiro-OMeTAD). Although high  $\eta$  value has been obtained using spiro-OMeTAD as a hole conductor in the perovskite solar cells, the relatively high cost may hamper the implementation in the future commercialization. In fact, the current commercial price of high purity spiro-OMeTAD is over ten times that of gold and platinum. While increased demand lowers this cost in some extent, it is still likely to remain expensive due to its high purity needed for photovoltaic applications. On the other hand, inorganic copper-based p-type semiconductors, such as CuSCN and Cul, are highly promising as hole conductors, because of their solution processability, wide band gap with high conductivity, and lower cost.

In this tutorial, the history, the devise principal, the variation of devise structure and the fabrication methods will be presented for the beginners of perovskite solar cells.

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## Topic E : Photovoltaic Systems

Terrestrial Photovoltaic (PV) power generation is one of the widespread countermeasures to solve environmental and energy problems and is recently becoming the mainstream of energy economy. Many countries maintain high rates of installed PV

capacity, which seems to be the trend for the foreseeable future. With this background, the technologies of efficient PV evaluation grow rapidly in importance. The problems of PID (Potential Induced Degradation) in large scale PV systems are also getting attention. Furthermore, the decline in grid power quality caused by mass PV introduction is a growing issue in our society. In this tutorial, we focus on the above topics and explain their current status and future perspective.

**(9) E-1 ; Photovoltaic System Characterization and Integration Tutorial**

(13:00 ~ 14:50, Room K, 2F)

*Instructor ; Dr. Joshua S. Stein,*

Sandia National Laboratories, Albuquerque, NM  
USA

*Synopsis ;* Photovoltaic systems are intermittent generation resources and their performance depends on the PV technology and local irradiance, weather, and environmental conditions. This tutorial will provide a technical overview of how PV technologies are characterized and how energy produced from PV systems is predicted. This will be done by covering a series of PV performance modeling steps including: irradiance translation, shading, surface reflection, spectral mismatch, IV curve models, array mismatch, inverter performance, and other performance factors. Participants will be introduced to open source tools that will allow them create detailed, physically-based PV performance models. If time allows, we will also examine power output characteristics from operating PV systems including: variability, ramp rates, and power quality and discuss how these features influence the integration of PV systems into the electrical grid.

**(10) E-2 ; Photovoltaic Systems: Landscape Design Issues**

(15:00 ~ 16:50, Room K, 2F)

*Instructor ; Dr. arch. Alessandra.Scognamiglio,*

ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development) Photovoltaic Technologies Area, Portici Research Centre, Portici (NA), Republic of Italy

*Synopsis ; ARCHITECTURE AND LANDSCAPE DESIGN ISSUES*

The target of running the places we inhabit by using only renewable energy generation technologies (net zero energy buildings, net zero energy communities) challenge us to find ways how to give them a form. Whatever the device we think to use, it has

a certain form, that will influence the way we will design it, or, at the end of the process, the shape of our living environment. Thanks to their features, photovoltaic system offer the designer the possibility of envisioning the use of photovoltaic at the architectural scale (building integrated photovoltaic), as well as at the landscape scale. Different technological and design issues are related to these uses of photovoltaic.

In the first case, photovoltaic components are used as parts of the building envelopes, and this implies a relevant importance in developing special BIPV technological elements, which could ensure the desired building performances; or in finding appropriate solutions in order to use standard components on the envelope, in an innovative way. This topic has been largely investigated in the past 20-25 years, and the tutorial will give an overview on the general topic of the building integration of photovoltaic, and on the design fundamentals.

In the second case, photovoltaic modules are arranged in the form of solar arrays, without exploiting any other function than generating energy. They can be understood as a tangible image of an increasing need of energy from renewables to significantly reduce the pollution caused by traditional energy generation systems, but anyway they generate a diffuse concern about the land use and transformation that they cause. PV and crops are kinds of opposing needs that should share the same limited resource: the land. Because of this reason in many countries local authorities prohibited the installation of PV in agricultural areas; and due to this barrier, in recent years companies working in the PV development have been experimenting with solutions for producing energy and food in the same land area. Such experiences will be presented and the issue of PV power generation will be addressed from the landscape design point of view (PV landscapes).

# Access

About 75 minutes by Airport Shuttle Train "Haruka" from Kansai International Airport to Kyoto Station.

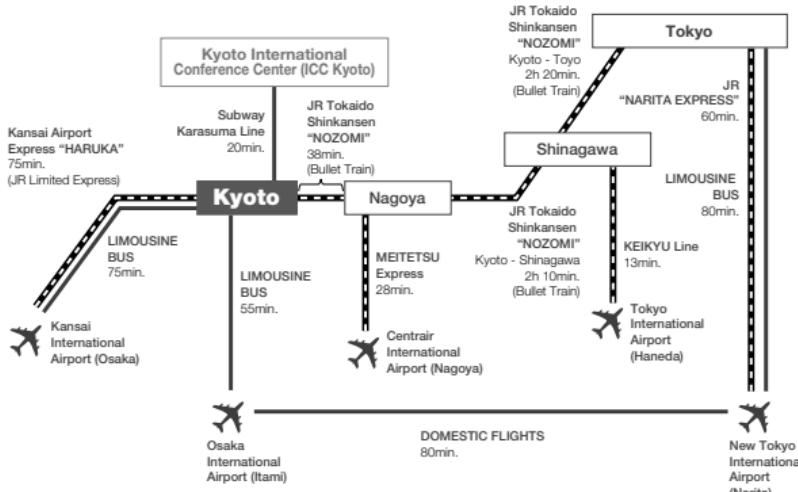
About 55 minutes by Limousine bus from Osaka (Itami) Airport to Kyoto Station.

2 hours 15 minutes by Shinkansen (Bullet Train) from Tokyo Station to Kyoto Station.

## Easy International Access

Located on the main Shinkansen (Bullet Train) Line, Kyoto is directly accessible from NARITA (Tokyo) , HANEDA (Tokyo) , Centrair (Nagoya) and KANSAI (Osaka) International Airports.

## Access Map



# Access

Access by rail	From Tokyo, Shinagawa, Nagoya	JR Tokaido Shinkansen →		Subway: Karasuma Line → (From Kyoto station, 20min.; From Karasuma station, 16min.)	ICC Kyoto Kokusai-kaikan station
	From Kyushu and Chugoku	JR Sanyo Shinkansen →	JR Kyoto station	→ (From Kyoto station, 20min.; From Karasuma station, 16min.)	
		JR Kyoto Line →			
		Hankyu Kyoto Line →	Karasuma station		
	From Osaka and Kobe	Keihan Main Line →	Sanjo station	Subway: Tozai Line & Karasuma Line → (From Sanjo station, about 20min.)	
Access by air	Kansai International Airport	JR Haruka Airport Express → (75min.)			ICC Kyoto Kokusai-kaikan station
	Osaka International Airport (Itami)	Limousine bus → (approx. 55min.)	JR Kyoto station	Subway: Karasuma Line → (20min.)	
	Centrair International Air Port (Nagoya)	Meitetsu Express + JR Tokaido Shinkansen → (approx. 80min.)			
Access by road	Meishin Express-way	Take the Kyoto South or Kyoto East exit and follow the signs to "Kyoto International Conference Center" → (40min.)			

## Approximate Flight Times to Japan

### From Asia

- Bangkok [ 5hrs ]
- Beijing [ 1.5hrs ]
- Busan [ 1hr ]
- Hong Kong [ 3hrs ]
- Kuala Lumpur [ 6hrs ]
- Manila [ 4hrs ]
- New Delhi [ 8hrs ]
- Seoul [ 1.5hrs ]
- Shanghai [ 1.5hrs ]
- Singapore [ 6hrs ]
- Taipei [ 2hrs ]

### From Oceania

- Christchurch [ 12hrs ]
- Sydney [ 10hrs ]

### From Europe

- Amsterdam [ 12hrs ]
- Frankfurt [ 10hrs ]
- London [ 11hrs ]
- Moscow [ 8hrs ]
- Paris [ 11hrs ]
- Rome [ 11hrs ]

### From Africa

- Cairo [ 11hrs ]
- Johannesburg  
(via Hong Kong) [17hrs ]

### From Canada

- Toronto [ 13hrs ]
- Vancouver [ 8hrs ]

### From USA

- Chicago [ 13hrs ]
- Los Angeles [ 11hrs ]
- New York [ 13hrs ]
- Seattle [ 11hrs ]
- Washington DC [ 13hrs ]

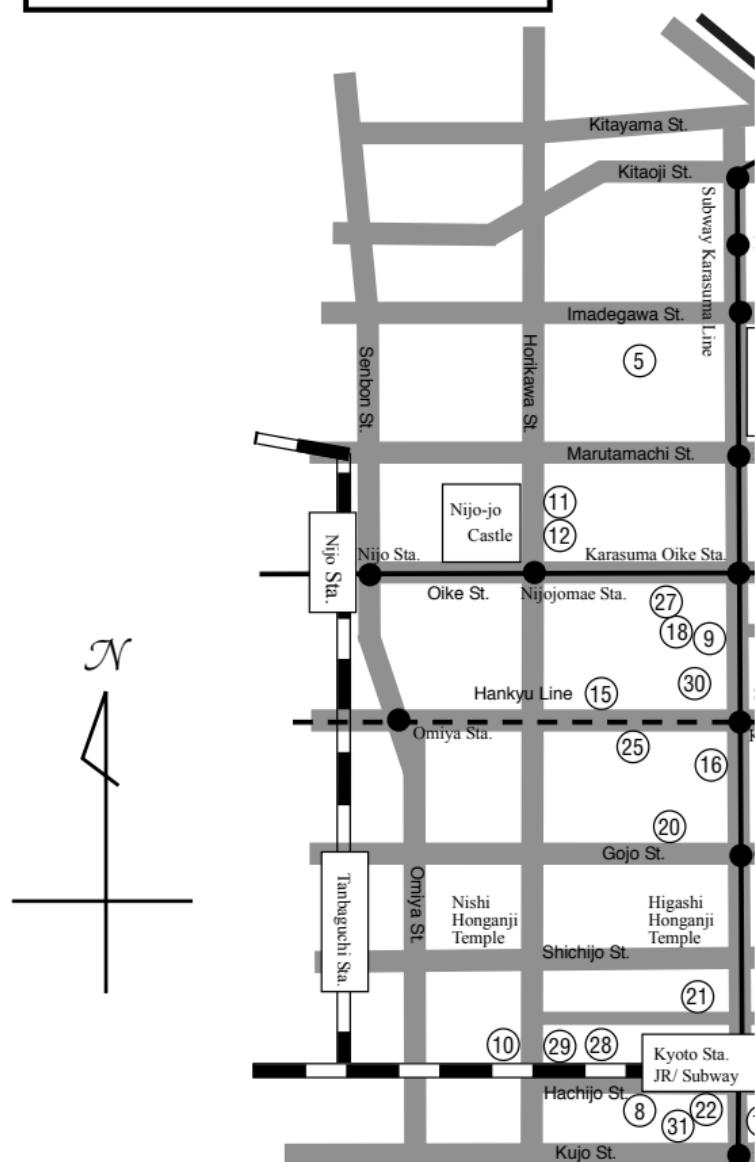
### From South America

- Sao Paulo (via LA) [ 22hrs ]

# Hotel Accomodation

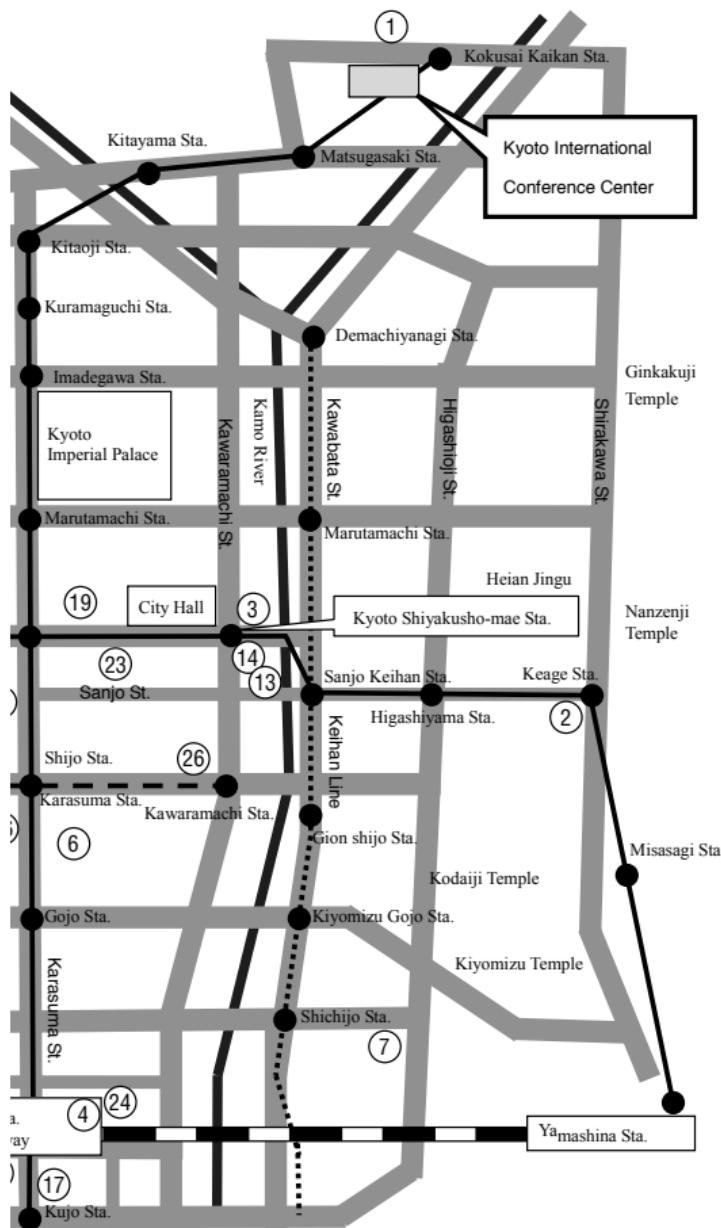
## Hotel Accomodation

### Map of Kyoto



1	Grand Prince Hotel Kyoto	9	Hotel Monterey Kyoto
2	The Westin Miyako Kyoto	10	Rihga Royal Hotel Kyoto
3	Kyoto Hotel Okura	11	Kyoto Kokusai Hotel
4	Hotel Granvia Kyoto	12	ANA Crown Plaza Hotel Kyoto
5	Kyoto Brighton Hotel	13	Royal Park Hotel the Kyoto
6	Hotel Nikko Princess Kyoto	14	Kyoto Hotel Royal & Spa
7	Hyatt Regency Kyoto	15	Hotel Mystays Kyoto Shijo
8	New Miyako Hotel	16	Karasuma Kyoto Hotel

# Hotel Accommodation



17	Daiwa Roynet Hotel .Kyoto Hachijoguchi	25	Hotel Oaks Kyoto Shijo
18	Mitsui Garden Hotel Kyoto Sanjo	26	Kyoto Central Inn
19	Hearton Hotel Kyoto	27	Kyoto Garden Hotel
20	Aranvert Hotel Kyoto	28	APA Hotel Kyoto Ekimae
21	Hotel Hokke Club Kyoto	29	APA Hotel Kyotoeki Horikawatori
22	Ibis Styles Kyoto Station	30	Viainn Kyoto Shijo Muro- machi
23	Hotel Gimmond Kyoto	31	Kyoto Daiichi Hotel
24	Kyoto Dai-ni Tower Hotel		

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## Memo

# **Program**

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## **Opening Plenary**

**Monday, November 24**

**8:30 - 10:00 Annex**

Chairpersons:

Julio Cárate (CIEMAT, Spain)

Michio Kondo (FREA, AIST, Japan)

Ryne Patrick Raffaelle (Rochester Institute of Technology, USA)

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**8:30-9:00 0MoPl.1**

### **[Plenary] The Future of PV Based on Next-Generation Fabs**

Eicke R. Weber<sup>1,2)</sup> and Ralf Preu<sup>1)</sup>

<sup>1)</sup>Fraunhofer Institute for Solar Energy Systems,

<sup>2)</sup>Institute of Physics and Faculty of Engineering,  
Albert-Ludwigs University, Germany

**9:00-9:30 0MoPl.2**

### **[Plenary] Global Renewable Energy Outlook**

Paolo Frankl

IEA

**9:30-10:00 0MoPl.3**

### **[Plenary] Introduction of Recent Japanese Science and Technology Innovation Policy**

Kazuo Kyuma

Council for Science, Technology and Innovation,  
Cabinet Office, Japan

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## **Opening Ceremony**

**Monday, November 24**

**10:15 - 11:30 Annex**

Master of Ceremony:

Mayumi Matsumoto (The University of Tokyo)

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**10:15 – 10:20**

**Greeting**

**10:20 - 10:35**

**Opening Address**

M. Konagai, Tokyo Tech  
B.J. Stanbery, Heliovolt  
A. Jäger-Waldau, EC JRC

**10:35 – 10:45**

**Guest Speeches**

Kyoto City  
M.Hashimoto (NEDO)

**10:50 – 11:30**

**Award Presentation**

**WCPEC Award**

**10:50-10:51**

Introduction: A. Luque (WCPEC Award Vice-Chair)

**10:51-10:53**

Laudatio: D. Flood (WCPEC-1 General Chair)

**10:53-10:55**

Award Presentation: S. Bailey (WCPEC-6 IACCChair,  
WCPEC-4 General Chair)

**10:55-11:03**

Memorial Lecture: M. Yamaguchi

**PVSEC Award**

**11:04-11:06**

Introduction and Laudatio: M. Yamaguchi (PVSEC  
Award Chair)

**11:06-11:08**

Award Presentation: K. Kurokawa (WCPEC-3General  
Chair)

**11:08-11:15**

Memorial Lecture: T. Takamoto

**PVSEC Special Award**

**11:15-11:17**

Introduction and Laudatio: M. Yamaguchi (PVSEC

Award Chair)

**11:17-11:19**

Award Presentation: K. Kurokawa (WCPEC-3General Chair)

**Hamakawa Award**

**11:20-11:22**

Introduction and Laudatio: M. Yamaguchi (PVSEC Award Chair)

**11:22-11:25**

Award Presentation: Y.Hamakawa (Founder,PVSEC, WCPEC)

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**Plenary**

**Monday, November 24**

**13:00 - 14:30 Room A**

Chairperson:

Wim C. Sinke (ECN Solar Energy, The Netherlands)

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**13:00-13:30 4MoPl.4**

**Area 4**

**[Plenary] Recent Technological Progress on HIT®**

Shingo Okamoto

Panasonic Corporation

**13:30-14:00 3MoPl.5**

**Area 3**

**[Plenary] Current Status and Future Prospect of CIS-based Thin-film PV Technology through the Activity of Solar Frontier K.K.**

Katsumi Kushiya

Solar Frontier K.K., Japan

**14:00-14:30 1MoPl.6**

**Area 1**

**[Plenary] Perovskite-based Hybrid Solar Cells Capable of High Voltage Outputs**

Tsutomu Miyasaka

Toin-Yokohama University

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**Monday, November 24**

**14:45 - 16:10 Room A**

**Area 4**

**4sMoO.1 Crystalline Silicon Solar Cells; Past,  
Present and Future 1**

Chairpersons:

Martin A. Green (University of New South Wales,  
Australia)

Katsuhiko Shirasawa (AIST, Japan)

---

**14:45-15:10 4sMoO.1.1**

**⟨Invited⟩ The Bell Telephone Laboratories  
Discovery 60-Years Later: *The mW-Foundation for  
Our Multi-GW Industry***

Lawrence L. Kazmerski

National Renewable Energy Laboratory

**15:10-15:30 4sMoO.1.2**

**⟨Invited⟩ The History of Hit® and Future Prospects  
of Photovoltaic Power Generation**

Yukinori Kuwano

PVTEC

**15:30-15:50 4sMoO.1.3**

**⟨Invited⟩ Crystalline Silicon Solar Cells - Towards  
the Auger-limit and beyond**

Stefan Glunz

Fraunhofer Institute for Solar Energy Systems

**15:50-16:10 4sMoO.1.4**

**⟨Invited⟩ Strategy, Development and Mass  
Production of High-Efficiency Crystalline Si PV  
Modules**

Pierre J. Verlinden, Weiwei Deng, Xueling Zhang,  
Yang Yang, Jianmei Xu, Yunhua Shu, Peng Quan,  
Jian Sheng, Shu Zhang, Jian Bao, Feilin Ping, Yingbin  
Zhang and Zhiqiang Feng

State Key Laboratory of PV Science and Technology,

Trina Solar, Changzhou, China

---

**Monday, November 24**

**16:30 - 17:50 Room A**

**J1 (Area 2 & 4)**

**J1MoO.2 Silicon Heterojunction Solar Cells**

Chairpersons:

Christophe Ballif (EPFL IMT & CSEM PV-center,  
Switzerland)

Junichi Nakamura (Sharp Corporation, Japan)

---

**16:30-16:55 J1MoO.2.1**

**⟨Invited⟩ High Efficiency Si Solar Cell by Applying  
Thin Film Si Technology**

Kenji Yamamoto

KANEKA Corporation

**16:55-17:20 J1MoO.2.2**

**⟨Invited⟩ Passivated Tunneling Contacts to N-type  
Wafer Silicon and Their Implementation into High  
Performance Solar Cells**

P. Stradins<sup>1)</sup>, S. Glunz<sup>2)</sup> and A. Rohatgi<sup>3)</sup>

<sup>1)</sup>National Renewable Energy Laboratory, USA,

<sup>2)</sup>Fraunhofer Institute for Solar Energy Systems,  
Germany, <sup>3)</sup>Georgia Institute of Technology, USA

**17:20-17:35 J1MoO.2.3**

**Carrier Transport Characteristics of Crystalline  
Silicon Solar Cells with Widegap Heterojunction  
Emitter**

T. Ogusu<sup>1)</sup>, M. Konagai<sup>1,2)</sup> and S. Miyajima<sup>1)</sup>

<sup>1)</sup>Department of Physical Electronics, Tokyo Institute  
of Technology, Japan, <sup>2)</sup>Photovoltaic Research Center  
(PVSEC), Tokyo Institute of Technology, Japan

**17:35-17:50 J1MoO.2.4**

**Increase of the Photogenerated Current in  
Amorphous/Crystalline Silicon Solar Cells**

S. Martin de Nicolas, S. De Wolf, B. Demaurex, J. Geissbühler, N. Holm, P. Löper, B. Paviet-Salomon, J. P. Seif, A. Tomasi and C. Ballif

École Polytechnique Fédérale de Lausanne (EPFL),  
Institute of Microengineering (IMT), Photovoltaics and  
thin-film electronics laboratory, Switzerland

---

**Monday, November 24**

**14:45 - 16:10 Room B-1**

**Area 3**

**3MoO.3 CIGS 1**

Chairpersons:

Shigeru Niki (RCPVT, AIST, Japan)

Kannan Ramanathan (NREL, USA)

---

**14:45-15:10      3MoO.3.1**

**⟨Invited⟩ On the Role of Alkali Metals in  
Chalcogenide Solar Cells**

P. Reinhard, M. Werner, B. Bissig, F. Pianezzi,

C. Sutter-Fella, H. Hagendorfer, S. Nishiwaki, Y.

Romanyuk, S. Buecheler, and A. N. Tiwari

Laboratory for Thin Films and Photovoltaics, Empa -  
Swiss Federal Laboratories for Materials Science and  
Technology, Switzerland

**15:10-15:25      3MoO.3.2**

**Selective Potassium and Sodium Diffusion Control  
in CuGaSe<sub>2</sub> Thin-Films Using Soda-Lime Glass  
Substrates**

S. Ishizuka<sup>1)</sup>, A. Yamada<sup>1)</sup>, P. J. Fons<sup>2)</sup>, H. Shibata<sup>1)</sup> and S. Niki<sup>1)</sup>

<sup>1)</sup>Research Center for Photovoltaic Technologies,  
National Institute of Advanced Industrial Science and  
Technology (AIST), Japan, <sup>2)</sup>Nanoelectronics Research  
Institute, National Institute of Advanced Industrial  
Science and Technology (AIST), Japan

**15:25-15:40 3MoO.3.3**

**First-principles Study on Alkali-metal Effect of Li, Na, and K in CuInSe<sub>2</sub> and CuGaSe<sub>2</sub>**

T. Maeda, A. Kawabata and T. Wada

Department of Materials Chemistry, Ryukoku University, Japan

**15:40-15:55 3MoO.3.4**

**Suppression of Recombination at a CdS/CIGS Interface by Inserting Cu(In,Ga)<sub>3</sub>Se<sub>5</sub> for Cu(In,Ga)Se<sub>2</sub> Solar Cells**

T. Nishimura<sup>1)</sup>, Y. Hirai<sup>1)</sup>, Y. Kurokawa<sup>1)</sup> and A. Yamada<sup>1, 2)</sup>

<sup>1)</sup>Department of Physical Electronics, Tokyo Institute of Technology, Japan, <sup>2)</sup>Photovoltaics Research Center (PVREC), Tokyo Institute of Technology, Japan

**15:55-16:10 3MoO.3.5**

**Surface Sulfurization of MBE-Grown Cu(In<sub>1-x</sub>Ga<sub>x</sub>)Se<sub>2</sub> Thin Films and Devices**

I. Khatri, I. Matsuyama, H. Yamaguchi and T. Nakada

Research Institute for Science and Technology, Photovoltaic Science and Technology Research Division, Tokyo University of Science, Japan

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**Monday, November 24**

**16:30 - 17:45 Room B-1**

**Area 3**

**3MoO.4 CIGS: Characterization**

Chairpersons:

Bert Stegemann (PVcomB / HTW Berlin - University of Applied Sciences, Germany)

Akira Yamada (Tokyo Institute of Technology, Japan)

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**16:30-16:45 3MoO.4.1**

**Grain Boundary Carrier Interactions in CuIn<sub>1-x</sub>Ga<sub>x</sub>Se<sub>2</sub> Photovoltaics: Unraveling Grain Boundary Recombination**

Harvey L. Guthrey IV<sup>1)</sup>, John Moseley<sup>1,2)</sup>, Miguel Contreras<sup>1)</sup>, Kannan Ramanathan<sup>1)</sup> and Mowafak Al-Jassim<sup>1)</sup>

<sup>1)</sup>National Renewable Energy Laboratory, Golden CO, United States, <sup>2)</sup>Colorado School of Mines, Golden CO, United States

**16:45-17:00 3MoO.4.2**

**Explicit Calculation of Quantum Efficiency Spectra for CuInGaSe<sub>2</sub> Solar Cells Fabricated by 3 Stage Co-Evaporation**

T. Hara<sup>1)</sup>, T. Maekawa<sup>2)</sup>, S. Minoura<sup>1)</sup>, Y. Kamikawa<sup>3)</sup>, H. Shibata<sup>3)</sup>, S. Niki<sup>3)</sup> and H. Fujiwara<sup>1)</sup>

<sup>1)</sup>Center of Innovative Photovoltaic Systems (CIPS), Gifu University, Japan, <sup>2)</sup>Research and Development Headquarters, ROHM Co., Ltd., Japan

**17:00-17:15 3MoO.4.3**

**LA-ICP-Mass Spectrometry of Impurities in Indium Feedstock Material and Their Influence on Cu(In<sub>x</sub>,Ga<sub>(1-x)</sub>)Se<sub>2</sub> PV-Device Performance**

V. Hinrichs, V. Handke, L. Chikhaoui and M. Ch. Lux-Steiner

Institut für Heterogene Materialsysteme, Helmholtz-Zentrum Berlin für Materialien und Energie, Germany

**17:15-17:30 3MoO.4.4**

**Picosecond and Nanosecond Laser Structuring of CIGSe Solar Cells**

B. Stegemann<sup>1)</sup>, M. Schüle<sup>1)</sup>, C. Schultz<sup>1)</sup>, K. Stelmaszczyk<sup>1,2)</sup>, M. Weizman<sup>1)</sup>, C. Wolf<sup>2)</sup>, C. A. Kaufmann<sup>2)</sup>, B. Rau<sup>2)</sup>, R. Schlatmann<sup>1,2)</sup>, V. Quaschning<sup>1)</sup> and F. Fink<sup>1)</sup>

<sup>1)</sup>PVcomB / HTW Berlin - University of Applied Sciences, Germany, <sup>2)</sup>PVcomB / Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Germany

**17:30-17:45 3MoO.4.5**

**Cu<sub>2</sub>ZnSnSe<sub>4</sub>-Cu(In,Ga)Se<sub>2</sub> Alloys for Solar Cells**

Stefan Hartnauer, Leonard Wägele, Enrico Jarzembowksi, Wolfgang Fränzel, Paul Pistor, Roland Scheer

Institute of Physics, Martin-Luther-University, Germany

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**Monday, November 24**

**18:30-20:00 Room B-1**

**Area 3**

**3MoRu.9 High-efficiency CIGS Solar Cells**

Chairperson:

Shogo Ishizuka (AIST, Japan)

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**18:30-18:55      3MoRu.9.1**

**[Invited] Progress in the CIGS PV Technology**

S. Niki<sup>1)</sup>, S. Ishizuka<sup>1)</sup>, Y. Kamikawa<sup>1)</sup>, J. Nishinaga<sup>1)</sup>, H. Tampo<sup>1)</sup>, K. Matsubara<sup>1)</sup>, H. Shibata<sup>1)</sup>, A. Yamada<sup>1)</sup>, K. Hara<sup>2)</sup>, A. Masuda<sup>2)</sup>, N. Terada<sup>3)</sup>, T. Sakurai<sup>4)</sup> and K. Akimoto<sup>4)</sup>

<sup>1)</sup>Research Center for Photovoltaic Technologies, AIST, Tsukuba, Ibaraki, Japan, <sup>2)</sup>Research Center for Photovoltaic Technologies, AIST, Tosu, Saga, Japan, <sup>3)</sup>Kagoshima University, Japan, <sup>4)</sup>Tsukuba University, Japan

**18:55-19:20      3MoRu.9.2**

**[Invited] Status of CIGS Research at NREL**

K. Ramanathan, L. Mansfield, R. Garris, S. Glynn, B. Egaas and M.A Contreras

National Renewable Energy Laboratory, USA

**19:20-20:00      Discussion**

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**Monday, November 24**

**14:45 - 16:05 Room B-2**

**Area 1**

**1MoO.5 Hot Carrier Solar Cells**

Chairpersons:

Jean-François Guillemoles (NextPV, Joint CNRS and RCAST Laboratory, France/Japan)  
Yasuhiko Takeda (Toyota Central Research and Development Laboratories, Inc., Japan)

**14:45-15:10 1MoO.5.1**

**⟨Invited⟩ Hot Carrier Solar Cells: Mechanisms and Materials**

S.K. Shrestha, G. Conibeer, S. Huang, S. Chung, N. Gupta, Y. Liao, Y. Feng, H. Xia, S. Smyth, X. Wen

School of Photovoltaic and Renewable Energy Engineering, UNSW Australia, Australia

**15:10-15:30 1MoO.5.2**

**⟨Extended Oral⟩ The Development of a Hot Carrier Photovoltaic Cell**

J. A. R Dimmock<sup>1,2)</sup>, M. Kauer<sup>1)</sup>, K. Smith<sup>1)</sup>, P. Stavrinou<sup>2)</sup> and N. J. Ekins-Daukes<sup>2)</sup>

<sup>1)</sup>Sharp Laboratories of Europe Ltd, UK, <sup>2)</sup>Imperial College London, UK

**15:30-15:50 1MoO.5.3**

**⟨Extended Oral⟩ Practical Concept of an All-Optical Hot Carrier Solar Cell**

D. König, Y. Yao and J. Yang

Australian Centre of Advanced Photovoltaics (ACAP), University of New South Wales, Australia

**15:50-16:05 1MoO.5.4**

**Improvement in Solar Cell Efficiency via Addition of Flexible Luminescent Down-shifting Phosphor PDMS Film as a Spectral Converter**

Hau-Vei Han<sup>1)</sup>, Wen-Yi Lin<sup>1)</sup>, Tien-Lin Shen<sup>1)</sup>, Kuo-Ju Chen<sup>1)</sup>, Chien-Chung Lin<sup>2)</sup>, Yu-Lin Tsai<sup>1)</sup>, Hao-Chung Kuo<sup>1)</sup> and Peichen Yu<sup>1)</sup>

<sup>1)</sup>Department of Photonics and Institute of Electro-Optical Engineering, National Chiao Tung University, Taiwan, <sup>2)</sup>Institute of Photonic System, National Chiao

Tung University, Taiwan

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**Monday, November 24**

**16:30 - 17:55 Room B-2**

**Area 1**

**1MoO.6 Silicon Nanowires and Advanced Concepts**

Chairpersons:

Dirk König (University of New South Wales, Australia)

Koji Matsubara (AIST, Japan)

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**16:30-16:55 1MoO.6.1**

**⟨Invited⟩ Radial Heterojunction c-Si Nanowire Solar Cells with 11.8% Conversion Efficiency**

O. Isabella, A. Ingenito, F. T. Si, R. Vismara and M. Zeman

Delft University of Technology, PVMD, The Netherlands

**16:55-17:10 1MoO.6.2**

**The Photovoltaic Properties of Aggregate Axial-Junction Silicon Nanowire Solar Cells**

D. Kanematsu<sup>1,2)</sup>, S. Yata<sup>1)</sup>, A. Terakawa<sup>1)</sup>, M. Tanaka<sup>1)</sup> and M. Konagai<sup>2)</sup>

<sup>1)</sup>Panasonic Corporation, Japan, <sup>2)</sup>Tokyo Institute of Technology, Japan

**17:10-17:25 1MoO.6.3**

**Photovoltaic Conversion in Solar Cells with Radial Junctions on Silicon Nanowires**

A. Fejfar<sup>1)</sup>, M. Hyvl<sup>1)</sup>, A. Vetushka<sup>1)</sup>, M. Ledinsky<sup>1)</sup>, J. Kocka<sup>1)</sup>, A. Marek<sup>2)</sup>, J. Vyskocil<sup>2)</sup>, P. Klapetek<sup>3)</sup> and J. Valenta<sup>4)</sup>, S. Misra<sup>5)</sup>, L. Yu<sup>5)</sup>, M. Foldyna<sup>5)</sup> and P. Roca i Cabarrocas<sup>5)</sup>

<sup>1)</sup>Institute of Physics, Academy of Sciences of the Czech Republic, Physics, Academy of Sciences of the Czech Republic, Czech Republic, <sup>2)</sup>HVM plasma s.r.o., Czech Republic, <sup>3)</sup>Czech Metrology Institute, Czech Republic, <sup>4)</sup>Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic, <sup>5)</sup>Department of Materials Science and Engineering, National Taiwan University, Taiwan

17:25-17:40      1MoO.6.4LN

**Charge Carrier Dynamics in Quantum Dot Intermediate Band Solar Cells from Non-equilibrium Quantum Statistical Mechanics**

U. Aeberhard

IEK-5 Photovoltaik, Germany

17:40-17:55      1MoO.6.5LN

**Approaches for Silicon Solar Cells to Approach 50%**

C.B. Honsberg, S.G. Bowden and S.M. Goodnick

Arizona State University, School of Electrical, Computer and Energy Engineering, USA

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**Monday, November 24**

**14:45 - 16:00 Room E**

**Area 6**

**6sMoO.7 Hybrid Solar Cells 1**

Chairpersons:

Giles Eperon (University of Oxford, UK)

Shuzi Hayase (Kyushu Institute of Technology, Japan)

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14:45-15:10      6sMoO.7.1

**⟨Invited⟩ Organohalide Lead Perovskites for Photovoltaic Applications**

Mohammad Khaja Nazeeruddin

Laboratory of Photonics and Interfaces (LPI), Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland

15:10-15:35      6sMoO.7.2

**⟨Invited⟩ High Efficiency Perovskite Solar Cells by Material and Interfacial Engineering**

Nam-Gyu Park

School of Chemical Engineering, Department of Energy Science, Sungkyunkwan University, Korea

**15:35-16:00 6sMoO.7.3**

**⟨Invited⟩ Introduction to the In-situ Solar Cell Concept as Applied for Ultra-low-cost Perovskite Solar Cells**

Andreas Hinsch, H. Brandt, W. Veurman, S. Mastroianni

Fraunhofer Institute for Solar Energy Systems ISE, Germany

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**Monday, November 24**

**16:30 - 17:45 Room E**

**Area 6**

**6sMoO.8 Hybrid Solar Cells 2**

Chairpersons:

Masahiro Hiramoto (Institute for Molecular Science, Japan)

Nam-Gyu Park (Sungkyunkwan University (SKKU), Korea)

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**16:30-16:55 6sMoO.8.1**

**⟨Invited⟩ Efficiency and Stability Challenges in Organic Solar Cells**

James R Durrant

Centre for Plastic Electronics, Department of Chemistry, Imperial College London, and Specific IKC, Materials Science Centre, University of Swansea, U.K.

**16:55-17:20 6sMoO.8.2**

**⟨Invited⟩ High Efficiency Printable Polymer Solar Cells Introducing Novel Functional Materials**

Kwanghee Lee

Heeger Center for Advance Materials & Research Institute of Solar and Sustainable Energies, Gwangju Institute of Science and Technology(GIST), South Korea

17:20-17:45      6sMoO.8.3

**⟨Invited⟩ Organic Semiconductors and Interlayers  
for Printed Solar Cells**

Antonio Facchetti

Polyera Corporation / Northwestern University, USA

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**Plenary**  
**Tuesday, November 25**  
**8:30 - 10:00 Room A**

Chairpersons:

Akira Terakawa (Panasonic Corporation, Japan)

Greg M. Wilson (NREL, USA)

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**8:30-9:00      1TuPl.1      Area 1**  
**[Plenary] Photonic Design Approaches for High Efficiency**

Harry A. Atwater<sup>1,2)</sup>, Dennis M. Callahan<sup>1)</sup>, Sunita Darbe<sup>1)</sup>, Carissa N. Eisler<sup>1)</sup>, Cristofer Flowers<sup>1)</sup>, Katherine Fountaine<sup>2)</sup>, Emily D. Kosten<sup>1)</sup>, John Lloyd<sup>1)</sup> and Emily Warmann<sup>1)</sup>

<sup>1)</sup>Thomas J. Watson Laboratories of Applied Physics, California Institute of Technology, USA, <sup>2)</sup>Joint Center for Artificial Photosynthesis, California Institute of Technology, USA

**9:00-9:30      3TuPl.2      Area 3**  
**[Plenary] Towards Energy Security through Mega Solar**

Raffi Garabedian

First Solar

**9:30-10:00      2TuPl.3      Area 2**  
**[Plenary] New Opportunities for Thin Film Silicon Technology**

Christophe Ballif

EPFL

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**Tuesday, November 25**  
**10:15 - 11:45 Room A**  
**3TuO.1 CZTS & CTS**

**Area 3**

Chairpersons:

Hironori Katagiri (Nagaoka National College of

Technology, Japan)  
Hajime Shibata (AIST, Japan)

10:15-10:30 3TuO.1.1

### The Role of Potential Fluctuations in Voltage Limitations for CZTSSe Solar Cells

C. J. Hages<sup>1)</sup>, W.-C. Yang<sup>1)</sup>, N. J. Carter<sup>1)</sup>, E. A. Stach<sup>2)</sup>, T. Unold<sup>3)</sup> and R. Agrawal<sup>1)</sup>

<sup>1)</sup>Purdue University, USA, <sup>2)</sup>Brookhaven National Lab, USA, <sup>3)</sup>Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Germany

10:30-10:45 3TuO.1.2

### Fabrication of Cu<sub>2</sub>ZnSnS<sub>4</sub> Thin Film Solar Cells Using Spray Pyrolysis Method

T. H. Nguyen, W. Septina, S. Ikeda, T. Harada and M. Matsumura

Research Center of Solar Energy Chemistry, Osaka University, Japan

10:45-11:00 3TuO.1.3

### Modulation of Energy Band Diagram Around the Grain Boundaries in High Efficiency Cu<sub>2</sub>Sn<sub>1-x</sub>Ge<sub>x</sub>S<sub>3</sub> (CTGS) Solar Cells

M. Umehara<sup>1)</sup>, Y. Takeda<sup>1)</sup>, K. Ohishi<sup>1)</sup>, T. Motohiro<sup>1)</sup>, T. Sakai<sup>2)</sup> and R. Maekawa<sup>2)</sup>

<sup>1)</sup>Toyota Central Research & Development Labs., Inc., Japan, <sup>2)</sup>Toyota Motor Corporation, Japan

11:00-11:15 3TuO.1.4

### Fabrication of Cu<sub>2</sub>SnS<sub>3</sub> Thin Film Solar Cells with Power Conversion Efficiency of Over 4%

Ayaka Kanai<sup>1)</sup>, Kotoba Toyonaga<sup>1)</sup>, Kotaro Chino<sup>1)</sup>, Hironori Katagiri<sup>1)</sup> and Hideaki Araki<sup>1,2)</sup>

<sup>1)</sup>Nagaoka National College of Technology, Japan,

<sup>2)</sup>Japan Science and Technology Agency, PRESTO, Japan

**11:15-11:30 3TuO.1.5**

**On the Optimization of Cu<sub>2</sub>ZnSnSe<sub>4</sub>/CdS Heterojunction for High Efficiency and Sustainable Solar Cells**

Y. Sánchez<sup>1)</sup>, M. Neuschitzer<sup>1)</sup>, S. López-Marino<sup>1)</sup>, M. Placidi<sup>1)</sup>, H. Xie<sup>1)</sup>, V. Izquierdo-Roca<sup>1)</sup>, A. Pérez-Rodríguez<sup>1,2)</sup> and E. Saucedo<sup>1)</sup>

<sup>1)</sup>Catalonia Institute for Energy Research (IREC),

<sup>2)</sup>IN<sup>2</sup>UB, Departament d'Electrònica, Universitat de Barcelona

**11:30-11:45 3TuO.1.6LN**

**The Investigation of Ge Substitution Effects in Cu<sub>2</sub>ZnSnSe<sub>4</sub> Thin Film Solar Cells**

S. Kim, K. M. Kim, H. Tampo, H. Shibata and S. Niki

National Institute of Advanced Industrial Science and Technology (AIST), Research Center for Photovoltaics Technologies, Japan

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**Tuesday, November 25**

**13:00 - 14:25 Room A**

**Area 4**

**4sTuO.2 Crystalline Silicon Solar Cells: Past, Present and Future 2**

Chairpersons:

Tatsuo Saga (Osaka University, Japan)

Paul Stradins (NREL, USA)

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**13:00-13:25 4sTuO.2.1**

**⟨Invited⟩ High Efficiency Crystalline Silicon Solar Cells: The Path to 25% Efficiency**

Martin A. Green

Australian Centre for Advanced Photovoltaics, School of Photovoltaic and Renewable Energy Engineering, University of New South Wales

13:25-13:45 4sTuO.2.2

**⟨Invited⟩ Development and Production of High Performance Silicon Cells for PV Panels and LCPV systems**

D. Rose, D. Smith, and P. Cousins

SunPower Corporation, USA

13:45-14:05 4sTuO.2.3

**⟨Invited⟩ Silicon Photovoltaics: Cat with Nine Lives**

Wim C. Sinke

ECN Solar Energy, The Netherlands

14:05-14:25 4sTuO.2.4

**⟨Invited⟩ 20.0% Average Efficiency n-type Bifacial Solar Cells by Using Industrial Mass-production Technology**

Wei-Chih Hsu, Chie-Sheng Liu, Yu-Hong Huang, Ming-Yi Hsu, Yuan-Chih Lee, Wei-Ming Chen

Neo Solar Power Corporation (NSP), Taiwan

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**Tuesday, November 25**

**14:45 - 16:00 Room A**

**Area 4**

**4TuO.3 c-Si PV: Simulation**

Chairpersons:

Shinsuke Miyajima (Tokyo Institute of Technology, Japan)

Bernd Steinhauser (Fraunhofer ISE, Germany)

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14:45-15:00 4TuO.3.1

**Input Parameters for the Simulation of Silicon Solar Cells in 2014**

A. Fell<sup>1)</sup>, K. R. McIntosh<sup>2)</sup>, P. P. Altermatt<sup>3),4)</sup>, K. C. Fong<sup>1)</sup>, G. J. M. Janssen<sup>5)</sup>, I. G. Romijn<sup>5)</sup>, M. Hermle<sup>6)</sup>, H. Steinkemper<sup>6)</sup>, R. Stangl<sup>7)</sup>, S. Bowden<sup>8)</sup> and A. Ho-Baillie<sup>9)</sup>

<sup>1)</sup>The Australian National University, Australia, <sup>2)</sup>PV Lighthouse, Australia, <sup>3)</sup>Leibniz University of Hanover, Germany, <sup>4)</sup>Institute for Solar Energy Research, Germany, <sup>5)</sup>Energy Research Centre of the Netherlands, <sup>6)</sup>Fraunhofer Institute for Solar Energy, Germany, <sup>7)</sup>Solar Energy Research Institute of Singapore, <sup>8)</sup>Arizona State University, USA, <sup>9)</sup>University of New South Wales, Australia

15:00-15:15 4TuO.3.2

**Mercury: Modelling of IBC Cells with Front Floating Emitter**

A. R. Burgers, I. Cesar, A. A. Mewe, N. Guillemin and D. Dekker

ECN Solar Energy, The Netherlands

15:15-15:30 4TuO.3.3

**Influence of TCO/a-Si:H Contact Formation on Silicon Heterojunction Solar Cell Performance**

L. Korte, R. Rößler, S. Kämpfer, C. Pettenkofer and B. Rech

Helmholtz-Zentrum Berlin, Institute Silicon Photovoltaics, Germany

15:30-15:45 4TuO.3.4

**Efficiency Potential of Rear Heterojunction Stripe Contacts Applied in Hybrid Silicon Wafer Solar Cells**

Zixuan Qiu<sup>1,2)</sup>, Jessica Wang<sup>1)</sup>, Armin Aberle<sup>1,2)</sup> and Rolf Stangl<sup>1)</sup>

<sup>1)</sup>Solar Energy Research Institute of Singapore (SERIS), National University of Singapore (NUS), Singapore,

<sup>2)</sup>NUS Graduate School for Integrative Sciences and Engineering, National University of Singapore, Singapore

15:45-16:00 4TuO.3.5

**Simulation of Interdigitated Back-Contact Silicon Heterojunction Solar Cells with Quantum Transport Model**

T. Kamioka<sup>1)</sup>, Y. Hayashi<sup>1)</sup>, K. Nakamura<sup>2)</sup> and Y. Ohshita<sup>1)</sup>

<sup>1)</sup>Toyota Technol. Inst., Japan, <sup>2)</sup>Meiji Univ., Japan

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**Tuesday, November 25**

**16:30 - 17:55 Room A**

**Area 4**

**4TuO.4 c-Si PV: Cell 1**

Chairpersons:

Emanuele Cornagliotti (imec, Belgium)

Yuichi Sakai (Mitsubishi Electric Corporation, Japan)

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**16:30-16:55 4TuO.4.1**

**⟨Invited⟩ Development of Heterojunction Back Contact Si Solar Cells**

Junichi Nakamura<sup>1)</sup>, Naoki Asano<sup>1)</sup>, Takeshi Hieda<sup>1)</sup>, Chikao Okamoto<sup>1)</sup>, Tetsuya Ohnishi<sup>1)</sup>, Masamichi Kobayashi<sup>1)</sup>, Hiroyuki Tadokoro<sup>1)</sup>, Rihito Saganuma<sup>1)</sup>, Yuta Matsumoto<sup>1)</sup>, Hiroyuki Katayama<sup>1)</sup>, Kenichi Higashi<sup>2)</sup>, Takeshi Kamikawa<sup>2)</sup>, Kenji Kimoto<sup>2)</sup>, Masatomi Harada<sup>2)</sup>, Toshihiko Sakai<sup>1)</sup>, Hiroaki Shigeta<sup>2)</sup>, Tokuaki Kuniyoshi<sup>2)</sup>, Kazuya Tsujino<sup>2)</sup>, Liumin Zou<sup>2)</sup>, Naoki Koide<sup>2)</sup> and Kyotaro Nakamura<sup>3)</sup>

<sup>1)</sup>Energy System Solutions Division, SHARP Corporation, Japan, <sup>2)</sup>Coporate Research & Development Division, SHARP Corporation, Japan,  
<sup>3)</sup>Meiji University, Japan

**16:55-17:10 4TuO.4.2**

**Development of High Efficiency Interdigitated Back Contact Silicon Solar Cells and Modules with Industrial Processing Technologies**

XueLing Zhang, Yang Yang, Wei Liu, KangPing Zhang, Yan Chen, ZhongLan Li, GuanChao Xu, HaiJun Jiao, Shu Zhang, ZhiQiang Feng and Pierre Verlinden

State Key Laboratory of PV Science and Technology, Changzhou Trina Solar Energy Co., Ltd., China

**17:10-17:25 4TuO.4.3**

**High Efficiency Multicrystalline Silicon Solar Cells**

T. Arima, T. Honma, S. Sugawara and Y. Matsubara

Kyocera Corporation, Japan

**17:25-17:40 4TuO.4.4**

**Towards High Efficiency n-type UMG Solar Cells**

F. E. Rougieux<sup>1)</sup>, C Samundsett<sup>1)</sup>, M. Forster<sup>2)</sup>, R. Einhaus<sup>2)</sup> and D. Macdonald<sup>1)</sup>

<sup>1)</sup>Research School of Engineering, The Australian National University, <sup>2)</sup>Apollon Solar

**17:40-17:55 4TuO.4.5**

**Optimized Cell Interconnection for PERC Modules Exceeding 300 W**

J. Müller<sup>1)</sup>, D. Hinken<sup>1)</sup>, S. Blankemeyer<sup>1)</sup>, R. Witteck<sup>1)</sup>, K. Bothe<sup>1)</sup>, M. Köntges<sup>1)</sup> and R. Brendel<sup>[1,2]</sup>

<sup>1)</sup>Institute for Solar Energy Research Hamelin (ISFH), Germany, <sup>2)</sup>Institute of Solid-State Physics, University of Hanover, Germany

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**Tuesday, November 25**

**10:15 - 11:25 Room B-1**

**Area 2**

**2TuO.5 Industrial Technologies**

Chairpersons:

Onno Gabriel (PVcomB / Helmholtz-Zentrum Berlin, Germany)

Takashi Suezaki (Kaneka Corporation, Japan)

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**10:15-10:40 2TuO.5.1**

**⟨Invited⟩ Current Status and Future Prospect for Thin Film Si Based Solar Cell Technology in Hanergy**

X. Xu, J. Zhang, X. Ru, A. Hu, and Y. Li

Hanergy Solar Group Chengdu R&D Center, China

10:40-10:55 2TuO.5.2

**(Invited) Progress in Thin-film Silicon Tandem (MICROMORPH™) Photovoltaic Conversion Efficiencies for Large Area Modules**

J. Cashmore<sup>1)</sup>, M. Apolloni<sup>1)</sup>, A. Braga<sup>1)</sup>, O. Caglar<sup>1)</sup>, V. Cervetto<sup>1)</sup>, Y. Fenner<sup>1)</sup>, S. G oldbach-Aschemann<sup>1)</sup>, C. Goury<sup>1)</sup>, J. Hötzl<sup>1)</sup>, M. Klindworth<sup>1)</sup>, M. Kupich<sup>1)</sup>, G.-F. Leu<sup>1)</sup>, M.-H. Lindic<sup>1)</sup>, P. Losio<sup>1)</sup>, B. Mereu<sup>1)</sup>, X.-V. Nguyen<sup>1)</sup>, I. Psimouli<sup>1)</sup>, S. Ristau<sup>1)</sup>, T. Roschek<sup>1)</sup>, A. Salabas<sup>1)</sup>, E. L. Salabas<sup>1)</sup>, I. Sinicco<sup>1)</sup>, S. Benagli<sup>2)</sup>, L Fesquet<sup>2)</sup>, J Steinhauser<sup>2)</sup>, J. Meier<sup>2)</sup>, J. Lin<sup>3)</sup> and D Matsunaga<sup>3)</sup>

<sup>1)</sup>TEL Solar AG., Switzerland, <sup>2)</sup>TEL Solar-Lab SA., Switzerland, <sup>3)</sup>Tokyo Electron Ltd., Japan

10:55-11:10 2TuO.5.3

**PECVD Technologies for G5-size Thin Film Silicon Solar Cells**

S. Nakao<sup>1)</sup>, T. Masuda<sup>1)</sup>, K. Tagashira<sup>1)</sup>, T. Yamane<sup>1)</sup>, E. Otsubo<sup>1)</sup>, H. Sai<sup>2)</sup>, T. Matsui<sup>2)</sup>, I. Yoshida<sup>3)</sup> and Y. Takeuchi<sup>1)</sup>

<sup>1)</sup>Mitsubishi Heavy Industries (MHI), Ltd., Japan,

<sup>2)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan, <sup>3)</sup>Photovoltaic Power Generation Technology Research Association (PVTEC), Japan

11:10-11:25 2TuO.5.4

**Development of a Separated-function Type Textured ZnO Substrate for Improving Conversion Efficiency of Thin-film Si Solar Cells**

H. Katayama<sup>1)</sup>, H. Sai<sup>2)</sup>, T. Koida<sup>2)</sup>, K. Maejima<sup>3)</sup>, I. Yoshida<sup>3)</sup>, S. Yata<sup>1)</sup> and A. Terakawa<sup>1)</sup>

<sup>1)</sup>Panasonic Corporation, Japan, <sup>2)</sup>National Institute of Advanced Industrial Science and Technology, Japan, <sup>3)</sup>Photovoltaic Power Generation Technology Research Association, Japan

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**Tuesday, November 25****13:00 - 14:25 Room B-1****Area 2****2TuO.6 High-efficiency Devices****Chairpersons:**

Takashi Itoh (Gifu University, Japan)

Miro Zeman (Delft University of Technology, The Netherlands)

**13:00-13:25 2TuO.6.1****⟨Invited⟩ Light-management Strategies for Thin-film Silicon Multijunction Solar Cells**

B. Niesen<sup>1)</sup>, J.-W. Schüttauf<sup>1)</sup>, E. Moulin<sup>1)</sup>, S. Hänni<sup>1)</sup>, M. Boccard<sup>1)</sup>, E. Feuser<sup>1)</sup>, X. Niquille, M. Stuckelberger<sup>1)</sup>, N. Blondiaux<sup>2)</sup>, R. Pugin<sup>2)</sup>, E. Scolan<sup>2)</sup>, F. Meillaud<sup>1)</sup>, F.-J. Haug<sup>1)</sup>, and C. Ballif<sup>1,2)</sup>

<sup>1)</sup>Ecole Polytechnique Fédérale de Lausanne (EPFL), Institute of Microengineering (IMT), Photovoltaics and Thin Film Electronics Laboratory, Switzerland, <sup>2)</sup>Centre Suisse d'Electronique et de Microtechnique (CSEM) SA, Switzerland

**13:25-13:40 2TuO.6.2****High-efficiency Amorphous Silicon Solar Cells Realized by Reduced Light-induced Degradation and Improved Device Design**

T. Matsui<sup>1)</sup>, A. Bidiville<sup>1)</sup>, H. Sai<sup>1)</sup>, T. Suezaki<sup>2,3)</sup>, M. Matsumoto<sup>2,4)</sup>, K. Saito<sup>2,5)</sup>, I. Yoshida<sup>2)</sup> and M. Kondo<sup>1)</sup>

<sup>1)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan, <sup>2)</sup>Photovoltaic Power Generation Technology Research Association (PVTEC), Japan, <sup>3)</sup>Kaneka Corporation, Japan, <sup>4)</sup>Panasonic Corporation, Japan, <sup>5)</sup>Fukushima University, Japan

**13:40-13:55 2TuO.6.3****High-V<sub>oc</sub> Top-cells for Multi-junction Thin-film Silicon Photovoltaic Devices**

E. V. Johnson<sup>1)</sup>, F. Ventosinos<sup>1)</sup>, S. Park<sup>1)</sup>, D. Y. Kim<sup>2)</sup>, R. A. C. M. M van Swaaij<sup>2)</sup> and P. Roca i Cabarrocas<sup>1)</sup>

<sup>1)</sup>LPICM, CNRS, Ecole Polytechnique, France, <sup>2)</sup>PVMD, Netherlands

**13:55-14:10 2TuO.6.4**

### **High $V_{oc}$ Silicon-based Thin-film Quadruple-junction Solar Cells**

F. T. Si<sup>1)</sup>, D. Y. Kim<sup>1)</sup>, R. Santbergen<sup>1)</sup>, H. Tan<sup>1)</sup>, R. A. C. M. M. van Swaaij<sup>1)</sup>, A. Bidiville<sup>2)</sup>, T. Matsui<sup>2)</sup>, A. H. M. Smets<sup>1)</sup>, O. Isabella<sup>1)</sup> and M. Zeman<sup>1)</sup>

<sup>1)</sup>Photovoltaic Materials and Devices Laboratory, Delft University of Technology, the Netherlands, <sup>2)</sup>Research Center for Photovoltaic Technologies, National Institute of Advanced Industrial Science and Technology, Japan

**14:10-14:25 2TuO.6.5**

### **Multi Junction Solar Modules Based On a-Si:H and C-si:h with High Stable Efficiency**

S. Kirner<sup>1)</sup>, S. Neubert<sup>1)</sup>, C. Schultz<sup>2)</sup>, O. Gabriel<sup>1)</sup>, B. Stannowski<sup>1)</sup>, B. Rech<sup>1)</sup> and R. Schlatmann<sup>1,2)</sup>

<sup>1)</sup>Helmholtz-Zentrum Berlin, Germany, <sup>2)</sup>Hochschule für Wirtschaft und Technik, Germany

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**Tuesday, November 25**

**14:45 - 16:15 Room B-1**

**Area 1**

### **1TuO.7 Intermediate Band Solar Cells**

Chairpersons:

Seth Hubbard (Rochester Institute of Technology, USA)  
Yoshitaka Okada (The University of Tokyo, Japan)

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**14:45-15:10 1TuO.7.1**

### **⟨Invited⟩ Novel Semiconductor Materials for Photovoltaics and Photoelectrochemical Cells**

Wladek Walukiewicz

Materials Sciences Division Lawrence Berkeley National Laboratory, USA

15:10-15:25 1TuO.7.2

### **Recent Progress in Cr:ZnS Based Intermediate Band Solar Cells**

M. Nematollahi, X. Yang, L. M. S. Aas, P. Kusterle, Z. Ghadyani, M. Kildemo, U. Gibson and T. W. Reenaas

Department of Physics, Norwegian University of Science and Technology, Norway

15:25-15:40 1TuO.7.3

### **ZnTeO-based Intermediate Band Solar Cells Using MBE-grown *n*-type ZnS Layers**

Tooru Tanaka<sup>1,2)</sup>, Shin Haraguchi<sup>1)</sup>, Kosuke Mizoguchi<sup>1)</sup>, Toshiki Terasawa<sup>1)</sup>, Katsuhiko Saito<sup>1)</sup>, Qixin Guo<sup>1)</sup>, Mitsuhiro Nishio<sup>1)</sup>, Kin M. Yu<sup>3)</sup> and Wladek Walukiewicz<sup>3)</sup>

<sup>1)</sup>Department of Electrical and Electronic Engineering, Saga University, Japan, <sup>2)</sup>PRESTO, Japan Science and Technology Agency (JST), Japan, <sup>3)</sup>Materials Sciences Division, Lawrence Berkeley National Laboratory, U.S.A.

15:40-15:55 1TuO.7.4

### **Molecular Beam Epitaxy Growth of Intermediate Band Materials Based on GaAs:N $\delta$ -Doped Superlattices**

T. Suzuki<sup>1)</sup>, K. Osada<sup>1)</sup>, S. Yagi<sup>1)</sup>, S. Naito<sup>2)</sup>, Y. Hijikata<sup>1)</sup>, Y. Okada<sup>2)</sup> and H. Yaguchi<sup>1)</sup>

<sup>1)</sup>Graduate School of Science and Engineering, Saitama University, Japan, <sup>2)</sup>Research Center for Advanced Science and Technology (RCAST), The University of Tokyo, Japan

15:55-16:15 1TuO.7.5

### ***<Invited>* Study of InAs Quantum Dots in a AlAsSb Matrix for Intermediate Band Solar Cell Application**

Seth M. Hubbard<sup>1)</sup>, Zachary S. Bittner<sup>1)</sup>, Ramesh B. Laghumavarapu<sup>2)</sup>, Staffan Hellstroem<sup>1)</sup>, Diana Huffaker<sup>2)</sup> and Paul Simmonds<sup>2)</sup>

<sup>1)</sup>Rochester Institute of Technology, United States,

<sup>2)</sup>University of California at Los Angeles, United States

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**Tuesday, November 25**

**16:30 - 17:55 Room B-1**

**Area 1**

**1TuO.8 Light Management Concepts and Emerging Technology**

Chairpersons:

Masakazu Sugiyama (The University of Tokyo, Japan)  
Wladek Walukiewicz (Lawrence Berkeley National Laboratory, USA)

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**16:30-16:55 1TuO.8.1**

**⟨Invited⟩ Hexagonal Metal Grating Structure for Broadband Enhancement of Near-infrared Absorption in Silicon Solar Cells**

Qi Xu<sup>1,2)</sup>, Craig Johnson<sup>1)</sup>, Claire Disney<sup>1)</sup>, Martin Green<sup>1)</sup> and Supriya Pillai<sup>1)</sup>

<sup>1)</sup>Australian Centre for Advanced Photovoltaics, The University of New South Wales, Australia, <sup>2)</sup>Department of Electronic Engineering, Tsinghua University, China

**16:55-17:10 1TuO.8.2**

**Photovoltaic/Photoelectrochemical Devices Based on Thin Film Silicon Alloys for Effective Hydrogen Evolution**

L. Han<sup>1)</sup>, I. A. Digdaya<sup>2)</sup>, W. A. Smith<sup>2)</sup>, B. Dam<sup>2)</sup>, M. Zeman<sup>1)</sup> and A. H. M. Smets<sup>1)</sup>

<sup>1)</sup>Photovoltaic Materials and Devices (PVMD) Laboratory, Delft University of Technology, the Netherlands, <sup>2)</sup>Materials for Energy Conversion and Storage (MECS) Laboratory, Delft University of Technology, the Netherlands

**17:10-17:25 1TuO.8.3**

**Solar-pumped Lasers for Photovoltaic Solar Energy Conversion**

S. Mizuno<sup>1)</sup>, K. Hasegawa<sup>1)</sup>, T. Ichikawa<sup>1)</sup>, H. Ito<sup>1)</sup>, T.

Motohiro<sup>2)</sup>, T. Suzuki<sup>3)</sup> and T. Ohishi<sup>3)</sup>

<sup>1)</sup>Toyota Central Research and Development Laboratories, Inc., Japan, <sup>2)</sup>Nagoya University, Japan, <sup>3)</sup>Toyota Technological Institute, Japan

**17:25-17:40 1TuO.8.4**

**Enhancement of Light Absorption in Ge/Si Quantum Dot Solar Cells by Surface Photonic Nanostructures**

T. Tayagaki<sup>1)</sup>, Y. Kishimoto<sup>1)</sup>, Y. Hoshi<sup>2)</sup> and N. Usami<sup>2)</sup>

<sup>1)</sup>Kyoto University, Japan, <sup>2)</sup>Nagoya University, Japan

**17:40-17:55 1TuO.8.5**

**Effect of Large Bi-Exciton Binding Energy in CdSe/CdTe QD MEG Solar Cells**

S. Tomić<sup>1)</sup>, J. Miloszewski<sup>1)</sup> and D. Binks<sup>2)</sup>

<sup>1)</sup>University of Salford, UK, <sup>2)</sup>University of Manchester, UK

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**Tuesday, November 25**

**10:15 - 11:35 Room B-2**

**Area 5**

**5TuO.9 Space Solar Cells**

Chairpersons:

Ned Ekins-Daukes (Imperial College London, UK)

Mitsuru Imaizumi (JAXA, Japan)

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**10:15-10:40 5TuO.9.1**

**⟨Invited⟩ Development of Inverted Metamorphic Triple-Junction Solar Cell for Space Use**

T. Sumita<sup>1)</sup>, T. Nakamura<sup>1)</sup>, M. Imaizumi<sup>1)</sup>, S. -i. Sato<sup>2)</sup>, H. Abe<sup>2)</sup> and T. Ohshima<sup>2)</sup>

<sup>1)</sup>Japan Aerospace Exploration Agency (JAXA), Japan,

<sup>2)</sup>Japan Atomic Energy Agency (JAEA), Japan

10:40-10:55 5TuO.9.2

### Flexible, High Specific Power Triple-Junction Solar Cell Sheets and Applications

H. Miyamoto, R. Chan, C. Stender, A. Hains, C. Youtsey, V. Elarde, J. Adams, R. Tatavarti, M. Osowski and N. Pan

MicroLink Devices, Inc., USA

10:55-11:10 5TuO.9.3

### Reliability Tests of the New Type Solar Sheet For Space

Hiroshi Yamaguchi<sup>1)</sup>, Ryo Ijichi<sup>1)</sup>, Yoshiyuki Suzuki<sup>1)</sup>, Sachiyo Ooka<sup>1)</sup>, Keiji Shimada<sup>1)</sup>, Naoki Takahashi<sup>1)</sup>, Hidetoshi Washio<sup>1)</sup>, Kazuyo Nakamura<sup>1)</sup>, Tatsuya Takamoto<sup>1)</sup>, Mitsuru Imaizumi<sup>2)</sup>, Taishi Sumita<sup>2)</sup>, Kazunori Shimazaki<sup>2)</sup> and Tetsuya Nakamura<sup>2)</sup>

<sup>1)</sup>SHARP Corporation, Japan, <sup>2)</sup>Japan Aerospace Exploration Agency(JAXA), Japan

11:10-11:35 5TuO.9.4

### **(Invited) Solar Power for Future NASA Missions**

Sheila Bailey<sup>1)</sup>, Michael Piszcior<sup>1)</sup> and Charles Taylor<sup>2)</sup>

<sup>1)</sup>NASA Glenn Research Center, U.S.A., <sup>2)</sup>Langley Research Center, U.S.A.

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**Tuesday, November 25**

**13:00 - 14:30 Room B-2**

**Area 5**

### **5TuO.10 Multijunction Cells**

Chairpersons:

Andreas W. Bett (Fraunhofer ISE, Germany)

Nobuaki Kojima (Toyota Technological Institute, Japan)

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13:00-13:15 5TuO.10.1

### Investigation of InGaP/(In)AlGaAs/GaAs Triple Junction Top Cells for Smart Stacked Multijunction Solar Cells Grown Using Molecular Beam Epitaxy

**T. Sugaya<sup>1)</sup>, T. Mochizuki<sup>2)</sup>, K. Makita<sup>1)</sup>, R. Oshima<sup>1)</sup>, K. Matsubara<sup>1)</sup>, Y. Okano<sup>2)</sup> and S. Niki<sup>1)</sup>**

<sup>1)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan, <sup>2)</sup>Tokyo City University, Japan

**13:15-13:30 5TuO.10.2**

**Potential for Reaching 50% Power Conversion Efficiency Using Quantum Heterostructures**

**T. Thomas<sup>1)</sup>, M. Führer<sup>1)</sup>, D. Alonso Alvarez<sup>1)</sup>, N. J. Ekins-Daukes<sup>1)</sup>, D. Lackner<sup>2)</sup>, P. Kailuweit<sup>2)</sup>, S. P. Philipps<sup>2)</sup>, A. W. Bett<sup>2)</sup>, M. Sugiyama<sup>3)</sup> and Y. Okada<sup>3)</sup>**

<sup>1)</sup>Department of Physics, Imperial College London, U.K., <sup>2)</sup>Fraunhofer ISE, Germany, <sup>3)</sup>Research Center for Advanced Science and Technology, University of Tokyo, Japan

**13:30-13:45 5TuO.10.3**

**Progress on High-efficiency Inverted Compound Semiconductor Solar-cells**

**R. Onitsuka, T. Agui, K. Nakaido, T. Inoue, K. Sasaki, H. Juso and T. Takamoto**

New Business Development Center, Energy Systems Solution Division, SHARP Corporation, Japan

**13:45-14:00 5TuO.10.4**

**Monolithically Integrated Multi-Junction Cells built by Multiple Separate Growths in Different Epitaxy Reactors**

**D. Lackner<sup>1)</sup>, S. P. Philipps<sup>1)</sup>, F. Dimroth<sup>1)</sup>, H. Sodabanlu<sup>2)</sup>, K. Watanabe<sup>2)</sup>, N. Miyashita<sup>2)</sup>, M. Sugiyama<sup>2)</sup>, Y. Okada<sup>2)</sup> and A. W. Bett<sup>1)</sup>**

<sup>1)</sup>Fraunhofer Institute for Solar Energy System ISE, Germany, <sup>2)</sup>University of Tokyo, Research Center for Advanced Science and Technology, Japan

**14:00-14:15 5TuO.10.5**

**Improved Carrier Collection in Thick GaInNAsSb Solar Cells**

N. Miyashita, N. Ahsan and Y. Okada

Research Center for Advanced Science and Technology (RCAST), The University of Tokyo, Japan

14:15-14:30      5TuO.10.6

**Accurate Current-voltage Characteristics Measurement of CPV Cells with a High Intensity Pulsed Solar Simulator**

T. Ueda and Y. Hishikawa

Research Center for Photovoltaic Technologies (RCPVT), National Institute of Advanced Industrial Science and Technology (AIST), Japan

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**Tuesday, November 25**

**14:45 - 16:10 Room B-2**

**Area 8**

**8TuO.11 Outdoor Performance**

Chairpersons:

Ryoichi Hara (Hokkaido University, Japan)

Steve Ransome (SRCL, UK)

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14:45-15:10      8TuO.11.1

**⟨Invited⟩ Regional Test Centers: Validation of PV Technologies in Different Climates**

Joshua S. Stein

Sandia National Laboratories, USA

15:10-15:25      8TuO.11.2

**Performance Analysis for BIPV in High-rise, High-density Cities: a Case Study in Singapore**

C. Zomer<sup>1)</sup>, A. M. Nobre<sup>1,2)</sup>, T. Reindl<sup>2)</sup> and R. Rüther<sup>1)</sup>

<sup>1)</sup>Universidade Federal de Santa Catarina (UFSC), Brazil, <sup>2)</sup>Solar Energy Research Institute of Singapore (SERIS), National University of Singapore (NUS), Singapore

**15:25-15:40 8TuO.11.3**

**"Counting the Sun" - a Dutch Public Awareness Campaign on PV Performance**

W. G. J. H. M. van Sark<sup>1,2)</sup>, S. 't Hart<sup>1,3)</sup>, M. M. de Jong<sup>1)</sup>, P. de Rijk<sup>1)</sup>, P. Moraitis<sup>2)</sup>, B. B. Kausika<sup>2)</sup> and H. van der Velde<sup>2)</sup>

<sup>1)</sup>Stichting Monitoring Zonnestroom, the Netherlands,

<sup>2)</sup>Utrecht University, Copernicus Institute, the

Netherlands, <sup>3)</sup>Holland Solar, the Netherlands

**15:40-15:55 8TuO.11.4**

**Soiling Impact on the Energy Production of PV Pilot System Implemented in the Emirate of Abu Dhabi**

E. Al Hammadi, S. Al-Yalyali and A. Al-Sabounchi

National Energy and Water Research Center (NEWRC),  
Abu Dhabi Water and Electricity Authority (ADWEA),  
UAE

**15:55-16:10 8TuO.11.5**

**Prototype Robotic Crawler for On-site Inspection of Crystalline Silicon Photovoltaic Modules**

N. Yamada<sup>1)</sup>, M. Yoshida<sup>2)</sup>, T. Machida<sup>1)</sup>, S. Kawamoto<sup>1)</sup>, K. Tada<sup>1)</sup>, H. Saitoh<sup>1)</sup>, K. Yamamoto, K. Okamoto<sup>1)</sup>, T. Kimura<sup>1)</sup>, M. Iwahashi<sup>2)</sup>, T. Tadaumi<sup>3)</sup> and K. Kato<sup>4)</sup>

<sup>1)</sup>Department of Mechanical Engineering, Nagaoka University of Technology, Japan, <sup>2)</sup>Department of Electrical Engineering, Nagaoka University of Technology, Japan, <sup>3)</sup>Robotics Engineering Department, ATOX Co., Ltd., Japan, <sup>4)</sup>Research Center for Photovoltaic Technologies (RCPVT), National Institute of Advanced Industrial Science and Technology(AIST), Japan

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**Tuesday, November 25**

**16:30 - 17:55 Room B-2**

**Area 8**

**8TuO.12 Design and Operation**

Chairpersons:

Roger H. French (SDLE Center, CWRU, USA)

Noboru Yamada (Nagaoka University of Technology, Japan)

**16:30-16:55 8TuO.12.1**

**⟨Invited⟩ Performance and Failure Analysis of over 5,000 PV Modules after 10-year Operation - Lessons Learned from AIST "Mega-Solartown" -**

T. Takashima, K. Ikeda and K. Kato

National Institute of Advanced Industrial Science and Technology(AIST), Japan

**16:55-17:10 8TuO.12.2**

**PV Module Deterioration After 15 - Year Field Operation in Thailand**

B. Wiengmoon<sup>1,2)</sup>, K. Kirtikara<sup>1)</sup>, C. Jivacate<sup>1)</sup>, T. Chenvidhya<sup>1)</sup>, R. Songprakorp<sup>1)</sup> and D. Chenvidhya<sup>1)</sup>

<sup>1)</sup>CES Solar Cells Testing Center (CSSC), Pilot Plant Development and Training Institute (PDTI), King Mongkut's University of Technology Thonburi (KMUTT), Thailand, <sup>2)</sup>Department of Physics, Faculty of Science, Naresuan University, Thailand

**17:10-17:25 8TuO.12.3**

**Field Experience from Bifacial PV in Snow Region**

K. Sugibuchi<sup>1)</sup>, S. Yamauchi<sup>1)</sup>, S. Goda<sup>1)</sup>, K. Hosokawa<sup>2)</sup> and N. Ishikawa<sup>1)</sup>

<sup>1)</sup>PVG Solutions Inc., Japan, <sup>2)</sup>Hokkaido University of Science, Japan

**17:25-17:40 8TuO.12.4**

**Reduction of Installation Cost by Plastic & Metal Hybrid Fixation Parts without Bolts & Nuts**

Y. Shitanoki<sup>1)</sup> and M. Yonezawa<sup>2)</sup>

<sup>1)</sup>New Business Development Japan, DuPont Kabushiki Kaisha, Japan, <sup>2)</sup>DuPont Performance Polymer, DuPont Kabushiki Kaisha, Japan

**17:40-17:55 8TuO.12.5**

## **Photovoltaic Greenhouses: A Feasible Solution for Islands? Design, Operation, Monitoring and Lessons Learned from a Real Case Study**

**A. Scognamiglio<sup>1)</sup>, F. Garde<sup>2)</sup>, T. Ratsimba<sup>2)</sup>, A. Monnier<sup>3)</sup> and E. Scotto<sup>3)</sup>**

<sup>1)</sup>ENEA, Italian National Agency for New Technologies, Energy and Sustainable Economic Development, Italy, <sup>2)</sup>ESIROI, Université de La Réunion, France, <sup>3)</sup>Akuoenergy, France

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**Tuesday, November 25**

**18:30 - 20:30 Room B-2**

**Area 7**

## **7TuRu.17 Rump Session upon PV Quality Assurance**

Chairpersons:

Sarah Kurtz (NREL, USA)

Masaaki Yamamichi (AIST, Japan)

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**18:30-18:40 7TuRu.17.1**

### **A Holistic View of PV Cell and Module Reliability**

Homer Antoniadis, Andreas Meisel and William J.Gambogi

DuPont, KK

**18:40-18:50 7TuRu.17.2**

### **Bending Load Testing to Evaluate the Interconnector Breakdown in c-Si PV Modules**

Soh Suzuki, Tadanori Tanahashi, Takuya Doi, and Atsushi Masuda

PVTEC, AIST, ESPEC Corp.

**18:50-19:00 7TuRu.17.3**

### **PV Module Reliability in Terms of an Encapsulant Manufacturer and an Investor**

Tsuyoshi Shioda

Mitsui Chemicals, Inc.

19:00-19:10 7TuRu.17.4

**The Big Hammer Approach – Is This Really Useful?**

Bengt Jaeckel

UL, Germany

19:10-19:40 Break and Poster Presentation

19:40-20:30 Free Discussion

This session is sponsored by Dupont KK, ESPEC Corp., Kaneka Corp., Mitsubishi Electric Corp., Mitsui Chemicals Inc., Toray Industries Inc., UL Japan, VDE Global Services Japan.

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**Tuesday, November 25**

**10:15 - 11:40 Room E**

**Area 7**

**7TuO.13 PV Module Characterization 1**

Chairpersons:

Yoshihito Eguchi (MITSUI CHEMICALS, INC., Japan)  
Hung-Sen Wu (Industrial Technology Research Institute, Taiwan)

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10:15-10:40 7TuO.13.1

**⟨Invited⟩ Characterization from Manufacturers Point of View**

Kazufumi Tanaka

Kyocera, Japan

10:40-10:55 7TuO.13.2

**Photovoltaic Lifetime and Degradation Science: a Data Science Approach**

Y. Xu, N. R. Wheeler, Y. Hu, M. A. Hossain, A. Gok, V. Y. R. Gunapati, Y. Hou, P. Zhao, H. M. Lemire, L. S. Bruckman, T. J. Peshek, G.-Q. Zhang, J. Sun and

R. H. French

Solar Durability and Lifetime Extension Center Case  
Western Reserve University, USA

**10:55-11:10 7TuO.13.3**

**Intensity Modulation Transfer Function  
Spectroscopy of Solar Cell**

A. Namin<sup>1)</sup>, J. Thongpron<sup>1)</sup>, D. Chenvidhya<sup>2)</sup>, C. Jivacate<sup>2)</sup>, K. Wattanavichean<sup>2)</sup> and K. Kirtikara<sup>2)</sup>

<sup>1)</sup>Rajamangala University of Technology Lanna,  
Thailand, <sup>2)</sup>King Mongkut's University of Technology  
Thonburi, Thailand

**11:10-11:25 7TuO.13.4**

**Development of Performance Estimation Method  
for Thin Film Silicon HYBRID Modules Under the  
Long Term Outdoor Exposure**

N. Kadota, Y. Minami, T. Sasaki, T. Sawada and A. Nakajima

Solar Energy Division, Kaneka Corporation, JAPAN

**11:25-11:40 7TuO.13.5**

**Development of the High-Efficiency Bifacial  
Photovoltaic Module and the Simulation Method  
for Its Power Generation**

T. Nakamura, S. Fukumochi, Y. Maruyama, S. Tsujii,  
K. Yamada, T. Nishida, H. Yukawa, T. Yoshihara,  
T. Nakajima, T. Yoshida, M. Shima, T. Haga and S. Okamoto

Solar Business Unit, Eco Solutions Company,  
Panasonic Corporation, Japan

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**Tuesday, November 25**

**13:00 - 14:25 Room E**

**Area 7**

**7TuO.14 PV Module Components**

Chairpersons:

Bengt Jaeckel (UL, Germany)

Haruhiko Nakaniwa (DuPont K.K., Japan)

13:00-13:25 7TuO.14.1

**(Invited) Degradation Phenomena of Crystalline Silicon Photovoltaic Modules**

Atsushi Masuda

National Institute of Advanced Industrial Science and Technology, Japan

13:25-13:40 7TuO.14.2

**PV Module Durability and Backsheet Performance**

W. Gambogi<sup>1)</sup>, Y. Heta<sup>2)</sup>, J. Kopchick<sup>1)</sup>, T. Felder<sup>1)</sup>, S. MacMaster<sup>1)</sup>, A. Bradley<sup>1)</sup>, B. Hamzavytehrany<sup>1)</sup>, B.-L. Yu<sup>1)</sup>, K. Stika<sup>1)</sup>, T. J. Trout<sup>1)</sup>, L. Garreau-Iles<sup>3)</sup>, O. Fu<sup>4)</sup> and H. Hu<sup>4)</sup>

<sup>1)</sup>DuPont, USA, <sup>2)</sup>DuPont K.K., Japan, <sup>3)</sup>Du Pont de Nemours Intl. S.A., Switzerland, <sup>4)</sup>DuPont (China) R&D and Management Co., Ltd., China

13:40-13:55 7TuO.14.3

**Properties of Encapsulation Materials and Their Relevance for Quality Control and Recent Field Failures**

J. Berghold<sup>1)</sup>, S. Koch<sup>1)</sup>, T. Shioda<sup>2)</sup> and P. Grunow<sup>2)</sup>

<sup>1)</sup>PI Photovoltaik-Institut Berlin, Germany, <sup>2)</sup>Mitsui Chemicals, Inc., Japan

13:55-14:10 7TuO.14.4

**Solder Joint Failure Modes in Crystalline Si PV Modules Operated in the Tsukuba, Japan for 10 Years -Ag and Cu Leaching**

Uichi Itoh<sup>1)</sup>, Tetsuro Nishimura<sup>2)</sup>, Takuro Fukami<sup>2)</sup>, Kenji Takamura<sup>2)</sup>, Akira Kita<sup>2)</sup>, Ryosuke Miyabayashi<sup>3)</sup> and Hideo Ohkuma<sup>4)</sup>

<sup>1)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan, <sup>2)</sup>Nihon Superior Co. LTD., Japan, <sup>3)</sup>NPC Incorporated, Japan, <sup>4)</sup>HTO Inc., Japan

**14:10-14:25 7TuO.14.5**

**Development of a Nanostructured pH Sensor for Detecting Acetic Acid in Photovoltaic Modules**

T. Asaka<sup>1)</sup>, T. Itayama<sup>1)</sup>, H. Nagasaki<sup>1)</sup>, K. Iwami<sup>1)</sup>, C. Yamamoto<sup>2)</sup>, Y. Hara<sup>2)</sup>, A. Masuda<sup>2)</sup> and N. Umeda<sup>1)</sup>

<sup>1)</sup>Tokyo Univ. of Agri. & Tech., Japan, <sup>2)</sup>AIST, Japan

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**Tuesday, November 25**

**14:45 - 16:15 Room E**

**Area 6**

**6TuO.15 Dye Sensitized and Organic Photovoltaic Cells**

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Chairpersons:

Mohammad Khaja Nazeeruddin ( EPF Lausanne(EPFL), Switzerland)

Atsushi Wakamiya (Institute for Chemical Research, Kyoto University, Japan)

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**14:45-15:00 6TuO.15.1**

**Optimization of Electrolyte Solution for Highly Efficient Black-Dye-Based Dye-Sensitized Solar Cells**

R. Shimizu, Y. Tawaraya, H. Ozawa and H. Arakawa

Tokyo University of Science, Japan

**15:00-15:15 6TuO.15.2**

**The I<sub>3</sub><sup>-</sup> Ion Transport in the Electrolyte Solution of Dye-sensitized Solar Cells**

M. Yanagida<sup>1,2)</sup> and L. Han<sup>1)</sup>

<sup>1)</sup>Photovoltaic Materials Research Unit, <sup>2)</sup>National Institute of Materials Science (NIMS), Global Research Center for Environment and Energy based on Nanomaterials Science (GREEN), Japan

15:15-15:30 6TuO.15.3

### Fabrications of Flexible Dye-Sensitized Solar Cells Using Ultrasonic Spray Coating Technology: Synthesis of Organic Dyes for Flexible Dye-Sensitized Solar Cells

Hyun-Gyu Han<sup>1)</sup>, Jeong Su Kim<sup>1)</sup>, Hyun Oh Shin<sup>1)</sup>, Hasitha C. Weerasinghe<sup>2,3)</sup>, Eung Lee<sup>1)</sup>, Yi-Bing Cheng<sup>4)</sup>, David J. Johnes<sup>2)</sup>, Andrew B. Holmes<sup>2,3)</sup> and Tae-Hyuk Kwon<sup>1)</sup>

<sup>1)</sup>Department of Chemistry, School of Natural Sciences, Ulsan National Institute of Science and Technology(UNIST), Republic of Korea, <sup>2)</sup>School of Chemistry, Bio<sup>2)</sup>Institute, University of Melbourne, Australia , <sup>3)</sup>Commonwealth Scientific and Industrial Research Organisation (CSIRO) Materials Science and Engineering, Australia, <sup>4)</sup>Department of Materials Engineering, Monash University, Australia

15:30-15:45 6TuO.15.4

### Co-evaporant Induced Crystallization for Realization of Crystalline Ideal Structure of Organic Photovoltaic Cells

T. Kaji<sup>1,2)</sup>, M. Katayama<sup>1,2)</sup>, S. Nakao<sup>1)</sup> and M. Hiramoto<sup>1)</sup>

<sup>1)</sup>Institute for Molecular Science, National Institutes of Natural Sciences, Japan, <sup>2)</sup>JST-ALCA, Japan

15:45-16:00 6TuO.15.5

### Crystal Structure Control for Organic Solar Cells

Tetsuhiko Miyadera<sup>1,2)</sup>, Zhiping Wang<sup>1)</sup>, Takeshi Sugita<sup>1)</sup>, Yuji Yoshida<sup>1)</sup> and Masayuki Chikamatsu<sup>1)</sup>

<sup>1)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan, <sup>2)</sup>Japan Science and Technology Agency (JST), Japan

16:00-16:15 6TuO.15.6

### Organic-silicon Heterojunctions: a Promising New Concept for High-efficiency Solar Cells

J. Schmidt<sup>1,2)</sup> and D. Zielke<sup>1)</sup>

<sup>1)</sup>Institute for Solar Energy Research Hamelin (ISFH), Germany, <sup>2)</sup>Institute of Solid-State Physics, Leibniz Universität Hannover, Germany

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**Tuesday, November 25**

**16:30 - 18:00 Room E**

**Area 6**

**6TuO.16 Organic Photovoltaic Cells**

Chairpersons:

Tetsuhiko Miyadera (AIST, Japan)  
Jan Schmidt (Institute for Solar Energy Research Hamelin (ISFH), Germany)

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**16:30-16:45 6TuO.16.1**

**Naphthobisthiadiazole Semiconducting Polymers for High-Efficiency Solar Cells**

I. Osaka<sup>1,2)</sup>, T. Kakara<sup>3)</sup>, K. Kawashima<sup>1,3)</sup> and K. Takimiya<sup>1,3)</sup>

<sup>1)</sup>Center for Emergent Matter Science, RIKEN, Japan,

<sup>2)</sup>Precursory Research for Embryonic Science and Technology (PRESTO), JST, Japan, <sup>3)</sup>Department of Applied Chemistry, Graduate School of Engineering, Hiroshima University, Japan

**16:45-17:00 6TuO.16.2**

**Efficiency Enhancement of Bulk-heterojunction Organic Solar Cells by Using Sensitizer**

Ashraf Uddin, Rui Lin and Matthew Wright

School of Photovoltaic and Renewable Energy Engineering, University of New South Wales, Australia

**17:00-17:15 6TuO.16.3**

**Development of Highly Efficient Polymer Blend Solar Cells Composed of Donor and Acceptor Polymers**

H. Benten<sup>1)</sup>, D. Mori<sup>1)</sup>, I. Okada<sup>1)</sup>, H. Ohkita<sup>1,2)</sup> and S. Ito<sup>1)</sup>

<sup>1)</sup>Department of Polymer Chemistry, Graduate School

of Engineering, Kyoto University, Japan, <sup>2)</sup>Japan Science and Technology Agency, PRESTO, Japan

17:15-17:30 6TuO.16.4

**Time-Resolved Photoluminescence and Light-Induced Electron Spin Resonance Studies of Photo-Induced Charge Transfer in new Polyazomethines:Fullerene for Organic Solar Cells**

S. Grankowska<sup>1)</sup>, A. Iwan<sup>2)</sup>, K. Parafiniuk<sup>2)</sup>, A. Wolos<sup>1)</sup>, K. P. Korona<sup>1)</sup> and M. Kaminska<sup>1)</sup>

<sup>1)</sup>Institute of Experimental Physics, University of Warsaw, Poland, <sup>2)</sup>Division of Electrotechnology and Materials Science, Electrotechnical Institute, Poland

17:30-17:45 6TuO.16.5

**Solution-processable Colloidal Quantum Dot-based Bulk-heterojunction Solar Cells Utilizing ZnO Nanowire Arrays**

Takaya Kubo, Haibin Wang, Yoshitaka Sanehira, Jotaro Nakazaki and Hiroshi Segawa

Research Center for Advanced Science and Technology, The University of Tokyo, Japan

17:45-18:00 6TuO.16.6

**Module Composition for Reliability Test of OPV**

H. Morita<sup>1,2)</sup>, M. Miyashita<sup>2)</sup> and A. Masuda<sup>3)</sup>

<sup>1)</sup>Photovoltaic Power Generation Technology Research Association (PVTEC), Japan, <sup>2)</sup>Toray Industries, Inc., Japan, <sup>3)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan

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## **Plenary**

**Wednesday, November 26**

**8:30 - 10:00 Room A**

Chairpersons:

Sheila Bailey (NASA Glenn Research Center, USA)

Kazuhiko Ogimoto (The University of Tokyo, Japan)

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**8:30-9:00**

**5WePl.1**

**Area 5**

**[Plenary] Advancements in High Efficiency  
Multijunction Solar Cells for Low-Cost Power  
Generation**

Nasser H. Karam

Boeing Spectrolab Inc.

**9:00-9:30**

**9WePl.2**

**Area 9**

**[Plenary] Photovoltaics Becoming Mainstream:  
Opportunities and Challenges for Technology,  
Markets and Policy from a Global Perspective**

Stefan Nowak

Chairman, IEA PVPS

**9:30-10:00**

**8WePl.3**

**Area 8**

**[Plenary] Renewable Energy Integration to Power  
Systems - National Projects in Japan -**

S. Ashidate

Tokyo Electric Power Co. Inc., Japan

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**Wednesday, November 26**

**10:15 - 11:30 Room A**

**J2 (Area 1 & 5)**

**J2WeO.1 Next Generation Concentrator  
Photovoltaic (NGCPV)**

Chairpersons:

Ned Ekins-Daukes (Imperial College London, UK)

Kensuke Nishioka (University of Miyazaki, Japan)

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10:15-10:40 J2WeO.1.1

**⟨Plenary⟩ Recent Developments in CPV Technology**

Andreas W. Bett, Frank Dimroth, Peter Fuss-Kailuweit, Stefan Heckelmann, Vera Klinger, David Lackner, Markus Niemeyer, Simon P. Philipps, Gerald Siefer, Maike Wiesenfarth

Fraunhofer Institute for Solar Energy Systems ISE,  
Germany

10:40-11:05 J2WeO.1.2

**⟨Invited⟩ Spectrum and Light Absorption in Nanostructured Photovoltaics**

Antonio Luque<sup>1,2)</sup> and A. Martí<sup>1)</sup>

<sup>1)</sup>Technical University of Madrid (UPM), Spain, <sup>2)</sup>Ioffe Physical-Technical Institute, Russia

11:05-11:30 J2WeO.1.3

**⟨Invited⟩ Outline and Activities of Europe-Japan Collaborative Research on Concentrator Photovoltaics**

Masafumi Yamaguchi<sup>1)</sup> and Antonio Luque<sup>2)</sup>

<sup>1)</sup>Toyota Technological Institute, Japan, <sup>2)</sup>University Polytechnic of Madrid, Spain

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**Wednesday, November 26**

**13:00 - 14:20 Room A**

**Area 1**

**1WeO.2 QD and QW Solar Cells**

Chairpersons:

Sungjee Kim (POSTECH, Korea)

Shuhei Yagi (Saitama University, Japan)

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**13:00-13:20 1WeO.2.1**

**⟨Extended Oral⟩ Suppression of Thermal Carrier Escape and Efficient Photo-carrier Generation by Two-step Photon Absorption in Intermediate-band Solar Cells Using a Dot-in-well Structure**

S. Asahi, H. Teranishi, N. Kasamatsu, T. Kada, T. Kaizu and T. Kita

Department of Electrical and Electronic Engineering,  
Faculty of Engineering, Kobe University, Japan

13:20-13:35 1WeO.2.2

**Strong Absorption Exaltation in Ultrathin QDs and MQWs for Tandem and Intermediate Band Solar Cells**

B. Behaghel<sup>1,2,4)</sup>, P. Rale<sup>2)</sup>, Y. Shoji<sup>3)</sup>, R. Tamaki<sup>3)</sup>, N. Vandamme<sup>1)</sup>, L. Lombez<sup>2)</sup>, C. Dupuis<sup>1)</sup>, A. Cattoni<sup>1)</sup>, K. Watanabe<sup>3)</sup>, H. Sodabanlu<sup>3)</sup>, M. Sugiyama<sup>3)</sup>, Y. Okada<sup>3)</sup>, S. Collin<sup>1)</sup> and J-F. Guillemoles<sup>2,4)</sup>

<sup>1)</sup>Laboratory for Photonics and Nanostructures - (LPN-CNRS), France, <sup>2)</sup>Institute of Research and Development on Photovoltaic Energy - (IRDEP-CNRS), France, <sup>3)</sup>Research Center for Advanced Science and Technology - The University of Tokyo, Japan, <sup>4)</sup>NextPV - The University of Tokyo and CNRS, Japan

13:35-13:50 1WeO.2.3

**Thin-film InGaAs/GaAsP MQWs Solar Cell with Dielectric Micro-Hole Array Structure for Light Trapping Effect**

K. Watanabe<sup>1)</sup>, T. Inoue<sup>2)</sup>, H. Sodabanlu<sup>1)</sup>, Y. Wang<sup>1)</sup>, M. Sugiyama<sup>2)</sup> and Y. Nakano<sup>1,2)</sup>

<sup>1)</sup>Research Center for Advanced Science and Technology, the University of Tokyo, Japan,

<sup>2)</sup>Department of Electrical Engineering & Information System, School of Engineering, the University of Tokyo, Japan

13:50-14:05 1WeO.2.4

**Layer-by-layer Assemblies of Semiconductor Quantum Dots and Surface Modification for Nanostructured Photovoltaic Devices**

Sukyung Choi, Ho Jin and Sungjee Kim

Department of Chemistry, Pohang University of Science and Technology, South Korea

14:05-14:20 1WeO.2.5

## Photofilling Effect on Optical Transitions in InGaAs/GaAs Quantum Dot Solar Cells

R. Tamaki, Y. Shoji, Y. Okada and K. Miyano

Research Center for Advanced Science and Technology (RCAST), The University of Tokyo, Japan

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**Wednesday, November 26**

**14:45 - 16:15 Room A**

**Area 5**

## 5WeO.3 Quantum Effect

Chairpersons:

Andreas W. Bett (Fraunhofer ISE, Germany)

Masakazu Sugiyama (The University of Tokyo, Japan)

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14:45-15:00 5WeO.3.1

### Strongly-carrier-density-dependent Luminescent Coupling in Multi-junction Tandem Solar Cells Revealed via Absolute-electroluminescence-efficiency Measurements

Shaoqiang Chen<sup>1)</sup>, Lin Zhu<sup>1)</sup>, Masahiro Yoshita<sup>1)</sup>, Toshimitsu Mochizuki<sup>1)</sup>, Changsu Kim<sup>1)</sup>, Hidefumi Akiyama<sup>1)</sup>, Tetsuya Nakamura<sup>2)</sup>, Mitsuru Imaizumi<sup>2)</sup> and Yoshihiko Kanemitsu<sup>3)</sup>

<sup>1)</sup>Institute for Solid State Physics, University of Tokyo, and JST-CREST, Japan, <sup>2)</sup>Japan Aerospace Exploration Agency (JAXA), Japan, <sup>3)</sup>Institute for Chemical Research, Kyoto University, and JST-CREST, Japan

15:00-15:15 5WeO.3.2

### InAs/GaAs Quantum Dot Solar Cell with 26.8% Efficiency Achieved Through Current Constraint Engineering

Tomoh Sogabe, Yasushi Shoji, Chao-Yu Hung, Daniel J. Farrell and Yoshitaka Okada

Research Center for Advanced Science and Technology (RCAST), The University of Tokyo, JAPAN

15:15-15:30 5WeO.3.3

**Open-circuit Voltage Behavior in Multiple Quantum Well Solar Cells with Different Barrier Thickness Illuminated Under High Concentrated Sunlight**

W. Yanwachirakul<sup>1)</sup>, K. Toprasertpong<sup>1)</sup>, H. Fujii<sup>1)</sup>, K. Watanabe<sup>2)</sup>, M. Sugiyama<sup>1)</sup> and Y. Nakano<sup>1)</sup>

<sup>1)</sup>Graduate School of Engineering, The University of Tokyo, Japan, <sup>2)</sup>Research Center for Advanced Science and Technology (RCAST), Japan

15:30-15:45 5WeO.3.4

**Carriers Recombination Study of InGaP/InGaAsP Multiple-Quantum-Well Top Cell for High Efficiency Multi-Junction Solar Cells**

K. -H. Lee<sup>1,2)</sup>, K. W. J. Barnham<sup>2)</sup>, J. S. Roberts<sup>3)</sup> and N. J. Ekins-Daukes<sup>2)</sup>

<sup>1)</sup>Toyota Technological Institute, Japan, <sup>2)</sup>Blackett Laboratory, Imperial College London, United Kingdom,  
<sup>3)</sup>National Center for III-V Technologies, UK

15:45-16:00 5WeO.3.5

**Efficiency Improvement of InGaAs/GaAsP Multiple Quantum Well Solar Cells on Mis-oriented GaAs Substrates by Pulse Injection MOVPE**

H. Sodabanlu<sup>1)</sup>, Y. Wang<sup>1)</sup>, K. Watanabe<sup>1)</sup>, M. Sugiyama<sup>2)</sup> and Y. Nakano<sup>1)</sup>

<sup>1)</sup>Research Center for Advanced Science and Technology, the University of Tokyo, Japan,

<sup>2)</sup>Department of Electrical Engineering & Information System, School of Engineering, the University of Tokyo, Japan

16:00-16:15 5WeO.3.6

**Photo-charging Effects in High Efficiency Multi-quantum Wells and Wires Solar Cells**

D. Alonso-Álvarez<sup>1)</sup>, M. Fuhrer<sup>1)</sup>, T. Thomas<sup>1)</sup>, N. P. Hylton<sup>1)</sup>, D. Lackner<sup>2)</sup>, S. P. Philipps<sup>2)</sup>, A. W. Bett<sup>2)</sup>, M. Sugiyama<sup>3)</sup> and N. J. Ekins-Daukes<sup>1)</sup>

<sup>1)</sup>Department of Physics, Imperial College London, United Kingdom, <sup>2)</sup>Fraunhofer Institute for Solar Energy Systems ISE, Germany, <sup>3)</sup>Department of Electrical Engineering and Information Systems, the University of Tokyo, Japan

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**Wednesday, November 26****16:30 - 18:00 Room A****Area 5****5WeO.4 CPV**

Chairpersons:

Kenji Araki (Daido Steel, Japan)

Kensuke Nishioka (University of Miyazaki, Japan)

**16:30-16:45      5WeO.4.1****Development of the New DFK CPV Module by NGCPV Japan-EU Collaboration**

H. Nagai<sup>1)</sup>, K. Araki<sup>1)</sup>, K. Hobo<sup>1)</sup>, P. Zamora<sup>2)</sup>, P. Benitez<sup>2)</sup>, J. C. Miñano<sup>2)</sup>, K. Nishioka<sup>3)</sup>, Y. Ota<sup>3)</sup>, I. Luque-Herdia<sup>4)</sup>, J. Hashimoto<sup>5)</sup>, T. Ueda<sup>5)</sup>, Y. Hishikawa<sup>5)</sup>, R. Herrero<sup>6)</sup>, S. Askins<sup>6)</sup>, Ignacio Antón<sup>6)</sup>, R. Núñez<sup>6)</sup>, G. Sala<sup>6)</sup>, G. Niemeyer<sup>7)</sup>, G. Siefer<sup>7)</sup> and A. W. Bett<sup>7)</sup>

<sup>1)</sup>Daido Steel, Japan, <sup>2)</sup>Universidad Politécnica de Madrid, Campus de Montegancedo, Spain, <sup>3)</sup>University of Miyazaki, Japan, <sup>4)</sup>BSQ Solar, Spain, <sup>5)</sup>AIST, Japan, <sup>6)</sup>Instituto de Energía Solar-Universidad Politécnica de Madrid, Spain, <sup>7)</sup>Fraunhofer Institute for Solar Energy Systems, ISE, Germany

**16:45-17:00      5WeO.4.2****Investigations on FLATCON® Modules Using IMM-Solar Cells**

M. Steiner<sup>1)</sup>, G. Siefer<sup>1)</sup>, A. W. Bett<sup>1)</sup>, K. Sasaki<sup>2)</sup>, H. Juso<sup>2)</sup> and T. Takamoto<sup>2)</sup>

<sup>1)</sup>Fraunhofer Institute for Solar Energy Systems ISE, Germany, <sup>2)</sup>Sharp Cooperation, Japan

17:00-17:15      5WeO.4.3

### **Energetic Performances of the 50kW CPV Plant Realized within NGCPV Project**

C. Cancro<sup>1)</sup>, S. Ferlito<sup>1)</sup>, G. Graditi<sup>1)</sup>, R. Nunez<sup>2)</sup>, I. Antón<sup>2)</sup>, G. Sala<sup>2)</sup>, M. Castro<sup>2)</sup> and K. Araki<sup>3)</sup>

<sup>1)</sup>ENEA -Italian national Agency for new technologies, Energy and Sustainable Economic Development - Research Center of Portici, Italy, <sup>2)</sup>Instituto de Energ-Solar - Universidad Politécnica de Madrid, Spain, <sup>3)</sup>Daido Steel Co., Japan

17:15-17:30      5WeO.4.4

### **High Efficiency Spectrum Splitting Prototype Submodule Using Commercial CPV Cells**

Mark J Keevers<sup>1)</sup>, Cho Fai Jonathan Lau<sup>1)</sup>, Ian Thomas<sup>2)</sup>, John B Lasich<sup>2)</sup>, Richard R King<sup>3)</sup> and Martin A Green<sup>1)</sup>

<sup>1)</sup>School of Photovoltaic and Renewable Energy Engineering, UNSW, Australia, <sup>2)</sup>RayGen Resources Pty Ltd, Australia, <sup>3)</sup>Spectrolab Inc, USA

17:30-17:45      5WeO.4.5

### **Analysis of Thermo-mechanical Stress Effects on CPV Receiver Under High Intensity Light Cycles**

V. Perez, I. Antón, R. Herrero, E. Nogueira, R. Núñez, C. del Cañizo and G. Sala

Instituto de Energía Solar-UPM, E.T.S.I. Telecomunicación, Spain

17:45-18:00      5WeO.4.6

### **InGaP/GaAs/Si Hybrid Triple-Junction Cells by Surface Activated Bonding of Invertedly-Grown III-V Heterostructures to Si-Based Bottom Cells**

Naoteru Shigekawa<sup>1)</sup>, Li Chai<sup>1)</sup>, Masashi Morimoto<sup>1)</sup>, Jianbo Liang<sup>1)</sup>, Ryusuke Onitsuka<sup>2)</sup>, Takaaki Agui<sup>2)</sup>, Hiroyuki Juso<sup>2)</sup> and Tatsuya Takamoto<sup>2)</sup>

<sup>1)</sup>Graduate School of Engineering, Osaka City University, Japan, <sup>2)</sup>Sharp Corporation, Japan

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**Wednesday, November 26****10:15 - 11:30 Room B-1****Area 9****9WeO.5 Environmental & Economic Aspects of PV****Chairpersons:**

Keiichi Komoto (Mizuho Information &amp; Research Institute, Inc., Japan)

Keiichiro Sakurai (AIST, Japan)

**10:15-10:30 9WeO.5.1****Environmental Benefits of a Megasolar CdTe PV Project in Japan**

P. Sinha<sup>1)</sup>, M. J. de Wild-Scholten<sup>2)</sup>, Y. Matsuno<sup>3)</sup>, K. Brutsaert<sup>4)</sup> and I. Soga<sup>4)</sup>

<sup>1)</sup>First Solar, USA, <sup>2)</sup>SmartGreenScans, The Netherlands, <sup>3)</sup>The University of Tokyo, Japan, <sup>4)</sup>First Solar, Japan

**10:30-10:45 9WeO.5.2****Development of the PV Recycling System for Various Kinds of PV Modules**

M. Noda<sup>1)</sup>, K. Kushiya<sup>2)</sup>, H. Saito<sup>3)</sup>, K. Komoto<sup>4)</sup> and T. Matsumoto<sup>5)</sup>

<sup>1)</sup>Kitakyushu Foundation for the Advancement of Industry, Science and Technology, Japan, <sup>2)</sup>Showa Shell Sekiyu K.K., Japan, <sup>3)</sup>Shinryo Corporation, Japan, <sup>4)</sup>Mizuho Information & Research Institute, Inc., Japan, <sup>5)</sup>The University of Kitakyushu, Japan

**10:45-11:00 9WeO.5.3****Economics of Residential PV Systems in Europe**

Arnulf Jäger-Waldau, Sandor Szabo and Thomas Huld

European Commission, Institute for Energy and Transport, Renewable Energy, Italy

**11:00-11:15 9WeO.5.4****International Technology Roadmap for Photovoltaics: Challenging Perspectives**

A. Metz<sup>1)</sup>, M. Fischer<sup>2)</sup> and S. Raithel<sup>3)</sup>

<sup>1)</sup>h.a.l.m. elektronik GmbH, Germany, <sup>2)</sup>Hanwha Q CELLS GmbH, Germany, <sup>3)</sup>SEMI Europe, Germany

**11:15-11:30 9WeO.5.5**

**Assessment of Photovoltaic Learning Curves and Model Parameterization of Module Efficiency Trend for Industrial Crystalline Silicon and Thin Film Technologies**

Yifeng Chen, Zhiqiang Feng and Pierre Verlinden

State Key Laboratory of PV Science and Technology,  
Trina Solar, China

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**Wednesday, November 26**

**13:00 - 14:35 Room B-1**

**Area 9**

**9WeO.6 National Program & R&D**

Chairpersons:

John Benner (Stanford University, USA)

Izumi Kaizuka (RTS Corporation, Japan)

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**13:00-13:25 9WeO.6.1**

**⟨Invited⟩ The Long Term Vision for Solar in the United States**

Robert Margolis

National Renewable Energy Laboratory, USA

**13:25-13:50 9WeO.6.2**

**⟨Invited⟩ Trends in Photovoltaic Applications - the Latest Survey Results on PV Markets and Policies from the IEA PVPS Programme**

Ir. Gaëtan Masson<sup>1)</sup>, Pius Hüsser<sup>2)</sup>, Vicente Salas<sup>3)</sup>,  
Robert Margolis and Izumi Kaizuka<sup>4)</sup>

<sup>1)</sup>IEA PVPS, Belgium, <sup>2)</sup>Nova Energie, Switzerland,

<sup>3)</sup>Universidad Carlos III de Madrid, Spain,

<sup>4)</sup>National Renewable Energy Laboratory, USA, <sup>5)</sup>RTS Corporation, Japan

13:50-14:05 9WeO.6.3

## **Assessment of China's Domestic Solar Policy Development in the Context of the 13<sup>th</sup> Five-Year-Plan (2016-2020) and Its Impact on the Domestic Market Demand**

Frank Haugwitz

Asia Europe Clean Energy (Solar) Advisory Co. Ltd,  
Hong Kong

14:05-14:20 9WeO.6.4

## **Thailand PV Power Plants and Roof-Tops Status in 2014**

T. Chenvidhya, K. Kirtikara and D. Chenvidhya

CES Solar Cells Testing Center, Pilot Plant  
Development and Training Institute, King Mongkut's  
University of Technology Thonburi, Thailand

14:20-14:35 9WeO.6.5

## **Optimising PV Research Infrastructures in Europe: Lessons Learned from the SOPHIA Project**

P. Malbranche<sup>1)</sup>, J. Merten<sup>1)</sup>, B. Assoa<sup>1)</sup>, E. Gerritsen<sup>1)</sup>,  
F. Bergeron<sup>1)</sup>, M. Albaric<sup>1)</sup>, R. Varache<sup>1)</sup>, S. Cros<sup>1)</sup>,  
G. Siefer<sup>2)</sup>, M. Koehl<sup>2)</sup>, M. Schubert<sup>2)</sup>, W. Warta<sup>2)</sup>, S.  
Misara<sup>2)</sup>, W. Sprenger<sup>2)</sup>, A. Pozza<sup>3)</sup>, N. Taylor<sup>3)</sup>, T.  
Sample<sup>3)</sup>, F. Paletta<sup>4)</sup>, I. J. Bennett<sup>5)</sup>, J. Kroon<sup>5)</sup>, J. Zhu<sup>6)</sup>,  
R. Gottschalg<sup>6)</sup>, S. Zamini<sup>7)</sup>, K. Berger<sup>7)</sup>, P. Pugliatti<sup>8)</sup>,  
A. Di Stefano<sup>8)</sup>, F. Aleo<sup>8)</sup>, F. Roca<sup>9)</sup>, G. Graditi<sup>9)</sup>, M.  
Pellegrino<sup>9)</sup>, O. Zubillaga<sup>10)</sup>, P. Cano<sup>10)</sup>, I. Gordon<sup>11)</sup>,  
S. Gevorgyan<sup>12)</sup>, I. Lauermann<sup>13)</sup>, V. Hinrichs<sup>13)</sup>, M.  
Schmid<sup>13)</sup>, J. Huepkes<sup>14)</sup>, Y. Augarten<sup>14)</sup>, I. Anton<sup>15)</sup>, S.  
Rousu<sup>16)</sup>, J. Hast<sup>16)</sup>, T. Pettersen, M. Juel<sup>17)</sup>, P. Basso<sup>18)</sup>,  
G. Arrowsmith<sup>19)</sup>, V. Valente<sup>19)</sup> and D. Craciun<sup>20)</sup>

<sup>1)</sup>CEA INES, France, <sup>2)</sup>Fraunhofer ISE & IWES, Germany,

<sup>3)</sup>JRC, Italy, <sup>4)</sup>RSE, Italy, <sup>5)</sup>ECN, Netherlands, <sup>6)</sup>CREST,  
UK, <sup>7)</sup>Austrian Institute of Technology, Austria,

<sup>8)</sup>ENEL, Italy, <sup>9)</sup>ENEA, Italy, <sup>10)</sup>Tecnalia, Spain, <sup>11)</sup>IMEC,  
Belgium, <sup>12)</sup>DTU, Denmark, <sup>13)</sup>HZB, Germany, <sup>14)</sup>FZ  
Jülich, Germany, <sup>15)</sup>UPM, Spain, <sup>16)</sup>VTT, Finland,  
<sup>17)</sup>Sintef, Norway, <sup>18)</sup>EPIA, Belgium, <sup>19)</sup>EUREC, Belgium,

<sup>20)</sup>Derlab, Germany

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**Wednesday, November 26**

**14:45 - 16:20 Room B-1**

**Area 9**

**9WeO.7 PV in Energy System**

Chairpersons:

Stefan Nowak (Chairman, IEA PVPS, Switzerland)

Hiroyuki Yamada (NEDO, Japan)

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**14:45-15:10 9WeO.7.1**

**⟨Invited⟩ Conceptual Considerations on Renewable Energy Mix to Moderate Next Generation Power Grids**

K. Kurokawa

Tokyo Institute of Technology, Japan

**15:10-15:35 9WeO.7.2**

**⟨Invited⟩ Impacts of the Feed-in Tariff Program on the PV Market in Japan**

Hiroshi Matsukawa, Takashi Ohigashi, Haruki Yamaya, Izumi Kaizuka and Osamu Ikki

RTS Corporation, Japan

**15:35-15:50 9WeO.7.3**

**North-East Asian Super Grid: Renewable Energy Mix and Economics**

Christian Breyer<sup>1)</sup>, Dmitrii Bogdanov<sup>1)</sup>, Keiichi Komoto<sup>2)</sup>, Tomoki Ehara<sup>3)</sup>, Jinsoo Song<sup>4)</sup> and Namjil Enebish<sup>5)</sup>

<sup>1)</sup>Lappeenranta University of Technology, Finland, <sup>2)</sup>

Mizuho Information & Research Institute, Japan, <sup>3)</sup>

E-konzal, Japan, <sup>4)</sup>Korea Institute of Energy Research, Korea, <sup>5)</sup>National University of Mongolia, Mongolia

**15:50-16:05 9WeO.7.4**

**Energy Transition from Nuclear to Solar: The Case of Switzerland**

A. V. Shah<sup>1)</sup>, Jan Remund<sup>2)</sup> and Nicolas Wyrsch<sup>1)</sup>

<sup>1)</sup>PV Lab, IMT, EPFL, Switzerland, <sup>2)</sup>Meteotest,  
Switzerland

**16:05-16:20 9WeO.7.5**

**Remote Markets 2.0 - The Next Wave of PV  
Expansion - An Update**

W. B. Rever, III<sup>1)</sup> and P. J. Mints<sup>2)</sup>

<sup>1)</sup>WB Rever Associates, USA, <sup>2)</sup>SPV Market Research,  
USA

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**Wednesday, November 26**

**16:30 - 17:55 Room B-1**

**Area 7**

**7WeO.8 PV Module Characterization 2**

Chairpersons:

Yoshihiro Hishikawa (AIST, Japan)

Gerald Siefer (Fraunhofer ISE, Germany)

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**16:30-16:55 7WeO.8.1**

**(Invited) Optical Characterization of PV Modules**

Ulrike Jahn, Werner Herrmann, Lorenz Rimmelspacher

TÜV Rheinland Energie und Umwelt GmbH, Germany

**16:55-17:10 7WeO.8.2**

**Towards Modelling Realistic Ageing Rates of  
Amorphous Silicon Devices in Operational  
Environments**

J. Zhu, M. Bliss, T. R. Betts and R. Gottschalg

Centre for Renewable Energy Systems Technology  
(CREST), Loughborough University, UK

**17:10-17:25 7WeO.8.3**

**SmartWire Solar Cell Interconnection Technology**

M. Despeisse<sup>1)</sup>, A. Faes<sup>1)</sup>, J. Levrat<sup>1)</sup>, J. Escarré<sup>1)</sup>, J.  
Champliaud<sup>1)</sup>, V. Chapuis<sup>1)</sup>, N. Badel<sup>1)</sup>, T. Söderström<sup>2)</sup>,  
Y. Yao<sup>2)</sup>, J. Ufheil<sup>3)</sup>, P. Papet<sup>4)</sup>, G. Cattaneo<sup>5)</sup>, J. Cattin<sup>5)</sup>,

Y. Baumgartner<sup>5)</sup>, A. Hessler-Wyser<sup>5)</sup> and C. Ballif<sup>1,5)</sup>

<sup>1)</sup>CSEM SA, PV-center, Switzerland, <sup>2)</sup>Meyer Burger AG, Switzerland, <sup>3)</sup>Somont, Germany, <sup>4)</sup>Roth&Rau Research AG, Switzerland, <sup>5)</sup>Ecole Polytechnique Fédérale de Lausanne (EPFL), Institute of Microengineering (IMT), Photovoltaics and thin film electronics laboratory (PV-Lab), Switzerland

**17:25-17:40 7WeO.8.4**

**Day Light Electroluminescence Imaging of Photovoltaic Modules by Image Difference Technique**

R. Dubey<sup>1,2)</sup>, S. Chattopadhyay<sup>1,3)</sup>, J. J John<sup>1,2)</sup>, V. Kuthanazhi<sup>1,2)</sup>, A. Kottantharayil<sup>1,2)</sup>, B. M. Arora<sup>1,2)</sup>, C. S. Solanki<sup>1,3)</sup>, K. L. Narasimhan<sup>1,2)</sup> and J. Vasi<sup>1,2)</sup>

<sup>1)</sup>National Centre for Photovoltaic Research and Education, Indian Institute of Technology Bombay, India, <sup>2)</sup>Department of Electrical Engineering, Indian Institute of Technology Bombay, India, <sup>3)</sup>Department of Energy Science and Engineering, Indian Institute of Technology Bombay, India

**17:40-17:55 7WeO.8.5**

**Quality Assurance Procedure and Calibration Results for Standard IV Curve Measurement**

M. Seapan, D. Chenvidhya, C. Iimsakul, Y. Sangponsanont and K. Kirtikara

CES Solar Cells Testing Center (CSSC), Pilot Plant Development and Training Institute, King Mongkut's University of Technology Thonburi, Thailand

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**Wednesday, November 26**

**10:15 - 11:30 Room B-2**

**J3 (Area 7 & 8)**

**J3WeO.9 Energy Rating**

Chairpersons:

Yoshihiro Hishikawa (AIST, Japan)

Michael Koehl (Fraunhofer ISE, Germany)

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10:15-10:30 J3WeO.9.1

### Influence of Solar Spectrum on the Energy Production of Various Photovoltaic Technologies

T. Ishii<sup>1,2)</sup>, A. Masuda<sup>2)</sup> and Y. Hishikawa<sup>2)</sup>

<sup>1)</sup>Central Research Institute of Electric Power Industry (CRIEPI), Japan, <sup>2)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan

10:30-10:45 J3WeO.9.2

### Uncertainty in Energy Yield Estimation Based on c-Si Module Round-Robin Results

B. Mihaylov<sup>1)</sup>, J. W. Bowers<sup>1)</sup>, T. R. Betts<sup>1)</sup>, R. Gottschalg<sup>1)</sup>, T. Krametz<sup>2)</sup>, R. Leidl<sup>2)</sup>, K. A. Berger<sup>2)</sup>, S. Zamini<sup>2)</sup>, N. Dekker<sup>3)</sup>, G. Graditi<sup>4)</sup>, F. Roca<sup>4)</sup>, M. Pellegrino<sup>4)</sup>, G. Flaminio<sup>4)</sup>, P. M. Pugliatti<sup>5)</sup>, A. Di Stefano<sup>5)</sup>, F. Aleo<sup>5)</sup>, G. Gigliucci<sup>5)</sup>, W. Ferrara<sup>5)</sup>, G. Razongles<sup>6)</sup>, J. Merten<sup>6)</sup>, A. Pozza<sup>7)</sup>, A. A. Santamaría Lancia<sup>7)</sup>, S. Hoffmann<sup>8)</sup>, M. Koehl<sup>8)</sup>, A. Gerber<sup>9)</sup>, J. Noll<sup>9)</sup>, F. Paletta<sup>10)</sup>, G. Friesen<sup>11)</sup> and S. Dittmann<sup>11)</sup>

<sup>1)</sup>CREST, Loughborough University, UK, <sup>2)</sup>AIT GmbH, Austrian Institute of Technology, AT, <sup>3)</sup>ECN, Petten, NL,

<sup>4)</sup>ENEA, IT, <sup>5)</sup>ENEL Engineering and Research SpA, IT, <sup>6)</sup>INES, National solar energy institute, FR, <sup>7)</sup>JRC-ESTI Renewable Energy unit, European Solar Test Installation, IT, <sup>8)</sup>Fraunhofer ISE, DE,

<sup>9)</sup>Forschungszentrum Juelich GmbH, DE, <sup>10)</sup>RSE IT,

<sup>11)</sup>SUPSI, CH

10:45-11:00 J3WeO.9.3

### Worldwide Energy Yield Sensitivity vs. PV Technology Coefficients Derived from the TEL/SRCL Loss Factors Model

Steve Ransome<sup>1)</sup> and Juergen Sutterlueti<sup>2)</sup>

<sup>1)</sup>SRCL, London, UK, <sup>2)</sup>TEL Solar, Switzerland

11:00-11:15 J3WeO.9.4

### Photovoltaic System Model Calibration Using Monitored System Data

Clifford W. Hansen<sup>1)</sup>, Katherine A. Klise<sup>1)</sup>, Joshua S.

Stein<sup>1)</sup>, Yuzuru Ueda<sup>2)</sup> and Keiichiro Hakuta<sup>3)</sup>

<sup>1)</sup>Sandia National Laboratories, United States, <sup>2)</sup>Tokyo Institute of Technology, Japan, <sup>3)</sup>NTT Facilities, Inc., Japan

**11:15-11:30 J3WeO.9.5**

**Monitoring and Meteorological Analysis of PV Performance**

E. Takeuchi, K. Shibayama, H. Kamoi and T. Hasegawa  
EKO Instruments Co., LTD., Japan

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**Wednesday, November 26**

**13:00 - 14:35 Room B-2**

**J3 (Area 7 & 8)**

**J3WeO.10 PV Module Qualification Test & PID**

Chairpersons:

Takuya Doi (AIST, Japan)

Manit Seapan (King Mongkut's University of Technology Thonburi (KMUTT), Thailand)

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**13:00-13:25 J3WeO.10.1**

**⟨Invited⟩ Extended Tests for Commercial PV Modules and Solar Cells**

Hung-Sen Wu, Yu-Hsien Lee and Min-An Tsai

Photovoltaic Metrology laboratory, Center for Measurement Standards, Industrial Technology Research Institute, Taiwan

**13:25-13:50 J3WeO.10.2**

**⟨Invited⟩ Testing Procedures for High Reliability of Photovoltaic Modules**

K. Masuda<sup>1)</sup>, H. Kato<sup>1)</sup>, Y. Uchida<sup>1)</sup>, T. Obayashi<sup>1)</sup>, E. Yamada<sup>1)</sup>, S. Kawai<sup>2)</sup>, Y. Fukumoto<sup>2)</sup>, F. Tamai<sup>2)</sup>, T. Doi<sup>3)</sup>, A. Masuda<sup>3)</sup> and M. Kondo<sup>3)</sup>

<sup>1)</sup>Japan Electrical Safety & Environment Technology Laboratories, Japan, <sup>2)</sup>Industrial Technology Center of Saga, Japan, <sup>3)</sup>National Institute of Advanced Industrial

Science and Technology, Japan

13:50-14:05 J3WeO.10.3

### PV Module Soldering Reliability Investigation from Field and Experiment Result

Maoyi Chang, C. H. Hsueh, Chienyu Chen, Eva Yen, Maoyi Chang, Richard Lai, Changru Shiu, Haomin Chen, Polly YU, Kyle Wang and Kerry Ho

AU Optronics Corporation, Taiwan

14:05-14:20 J3WeO.10.4

### Acceleration of Potential-Induced Degradation (PID) by Salt-Mist Preconditioning in c-Si Photovoltaic Modules

Soh Suzuki<sup>1)</sup>, Naoki Nishiyama<sup>2)</sup>, Seiji Yoshino<sup>3)</sup>, Takumi Ujiro<sup>2)</sup>, Shin Watanabe<sup>3)</sup>, Takuya Doi<sup>4)</sup>, Atsushi Masuda<sup>4)</sup> and Tadanori Tanahashi<sup>1)</sup>

<sup>1)</sup>ESPEC CORP., Japan, <sup>2)</sup>JFE Techno-Research Corp., Japan, <sup>3)</sup>NPC Inc., Japan, <sup>4)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan

14:20-14:35 J3WeO.10.5

### Potential Induced Degradation (PID) of P-type Crystalline Solar Cells and Modules

J. Bagdahn<sup>1,2)</sup>, O. Breitenstein<sup>3)</sup>, A. Graff<sup>4)</sup>, Ch. Hagendorf<sup>1)</sup>, A. Hänel<sup>3)</sup>, D. Lausch<sup>1,2)</sup> and V. Naumann<sup>1)</sup>

<sup>1)</sup>Fraunhofer Center for Silicon Photovoltaics, Germany,

<sup>2)</sup>Anhalt University of Applied Science, Germany, <sup>3)</sup>Max-Planck-Institute for Microstructural Physics, Germany,

<sup>4)</sup>Fraunhofer Institute for Mechanics of Materials, Germany

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**Wednesday, November 26**

**14:45 - 16:10 Room B-2**

**Area 8**

**8WeO.11 Forecast of Power Generation**

Chairpersons:

Joao G.S. Fonseca Jr. (AIST, Japan)  
Takashi Oozeki (AIST, Japan)

**14:45-15:10 8WeO.11.1**

**⟨Invited⟩ Progress of PV Forecast Technology in Japan**

K. Ogimoto<sup>1)</sup>, Y. Miwa<sup>2)</sup>, K. Takitani<sup>3)</sup>, A. Usami<sup>4)</sup>, T. Kaishima<sup>5)</sup>, T. Deguchi<sup>6)</sup>, M. Marta<sup>7)</sup>, M. Tsurugai<sup>8)</sup>, T. Oozeki<sup>9)</sup>, T. Kobayashi<sup>10)</sup> and Y. Yamada<sup>11)</sup>

<sup>1)</sup>The University of Tokyo, Japan, <sup>2)</sup>Chubu Electric Power Co., Japan, <sup>3)</sup>Japan Weather Association, Japan, <sup>4)</sup>Central Research Institute of Electric Power Industry, Japan, <sup>5)</sup>ITOCHU Techno-Solutions, Japan, <sup>6)</sup>Solar Frontier, Japan, <sup>7)</sup>Mitsubishi Electric Co., Japan, <sup>8)</sup>Hitachi, Ltd., Japan, <sup>9)</sup>National Institute of Advanced Industrial Science and Technology, Japan, <sup>10)</sup>Gifu University, Japan, <sup>11)</sup>Meteorological Research Institute, Japan

**15:10-15:25 8WeO.11.2**

**A Meteorological Sensing Network for Improved Short-term Solar Irradiance Forecasting for Photovoltaic Applications in Singapore**

A. M. Nobre<sup>1,2)</sup>, D. Yang<sup>1)</sup>, C. A. Severiano Jr<sup>3)</sup>, H. Du<sup>1)</sup>, M. Kubis<sup>1)</sup>, F. R. Martins<sup>4)</sup>, R. Rüther<sup>2)</sup> and T. Reindl<sup>1)</sup>

<sup>1)</sup>Solar Energy Research Institute of Singapore (SERIS), National University of Singapore (NUS), Singapore, <sup>2)</sup>Universidade Federal de Santa Catarina (UFSC), Brazil, <sup>3)</sup>Universidade Federal de Minas Gerais (UFMG), Brazil, <sup>4)</sup>Universidade Federal de São Paulo (UNIFESP), Brazil

**15:25-15:40 8WeO.11.3**

**Comparison of Forecasts of Global Horizontal Irradiance Obtained from Numerical Weather Prediction Models with Different Horizontal Resolutions**

H. Ohtake<sup>1)</sup>, J. G. S. Fonseca Jr<sup>1)</sup>, T. Takashima<sup>1)</sup>, T. Oozeki<sup>1)</sup> and Y. Yamada<sup>2)</sup>

<sup>1)</sup>National Institute of Advanced Industrial Science

and Technology, Japan, <sup>2)</sup>Meteorological Research Institute, Japan Meteorological Agency, Japan

**15:40-15:55 8WeO.11.4**

### **Development of Solar Radiation Estimation and Forecasting Method for Solar Power Generation**

N. Yoshida, K. Takitani, N. Maeyama and R. Kodama  
Japan Weather Association, Japan

**15:55-16:10 8WeO.11.5**

### **Demonstration and Validation of An Energy Yield Prediction Model Suitable for Non-steady State Non-uniform Conditions**

D. Anagnostos<sup>1)</sup>, H. Goverde<sup>2,3)</sup>, B. Herteleer<sup>2,3)</sup>, F. Catthoor<sup>2)</sup>, D. Soudris<sup>1)</sup>, J. Driesen<sup>3)</sup> and J. Poortmans<sup>2,3)</sup>

<sup>1)</sup>Department of computer science, National Technical University of Athens, Greece, <sup>2)</sup>IMEC vzw, Belgium, <sup>3)</sup>ESAT/ELECTA, KU Leuven, Belgium

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**Wednesday, November 26**

**16:30 - 17:45 Room B-2**

**Area 8**

### **8WeO.12 Grid Integration**

Chairpersons:

Hiroyuki Hatta (Central Research Institute of Electric Power Industry, Japan)

Robert Hoeller (University of Applied Sciences Upper Austria, Austria)

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**16:30-16:45 8WeO.12.1**

### **Comparison among Various Pumped Storage Systems for Large Amount of PV**

N. Shabrina<sup>1)</sup>, S. Wakao<sup>1)</sup> and O. Nagura<sup>2)</sup>

<sup>1)</sup>Waseda University, Japan, <sup>2)</sup>Hitachi Mitsubishi Hydro Corporation, Japan

**16:45-17:00 8WeO.12.2**

**Estimation of Power Output of Photovoltaic Systems in the Distribution Network**

P. Attaviriyupap, T. Hirata, Y. Kojima and M. Marmiroli

Mitsubishi Electric Corporation., Japan

**17:00-17:15 8WeO.12.3**

**Pricing Method of Reactive Power for Distribution System with a Large Number of Pv Systems -Consideration of the Area Difference in Profit-**

S. Ishida, A. Takahashi, J. Imai and S. Funabiki

Okayama University, Japan

**17:15-17:30 8WeO.12.4**

**Utilization Method of Surplus Power of Photovoltaic Generation System by Using Heat Pump Water Heater and Battery Energy Storage System. - Improvement for Re-planning and Real Time Control of Heat Pump Water Heater and Electric Vehicle -**

Eitaro Omine, Masahiro Asari and Hiromu Kobayashi

Central Research Institute of Electric Power Industry, Japan

**17:30-17:45 8WeO.12.5**

**Transformerless Inverters - Challenges and Experience with High Efficient Topologies**

Ch. Gehrke<sup>1)</sup>, A. Gerdemann<sup>1)</sup>, J. Laschinski<sup>1)</sup>, M. Kawakami<sup>2)</sup> and M. Armstrong<sup>3)</sup>

<sup>1)</sup>SMA Solar Technology AG, Germany, <sup>2)</sup>SMA Japan K.K., Japan, <sup>3)</sup>SMA America LLC, U.S.A

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**Wednesday, November 26**

**10:15 - 11:25 Room E**

**Area 2**

**2WeO.13 Light Management I**

Chairpersons:

Bjoern Niesen (Photovoltaics and thin film electronics laboratory (PV-Lab) / Ecole polytechnique federale de Lausanne (EPFL), Switzerland)  
Hitoshi Sai (AIST, Japan)

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**10:15-10:40 2WeO.13.1**

**⟨Invited⟩ Light Trapping and Modeling of Thin-Film Silicon Solar Cells**

M. Zeman, A. Ingenito, F.T. Si, R. Santbergen, H. Tan, O. Isabella, A.H.M. Smets

Delft University of Technology, The Netherlands

**10:40-10:55 2WeO.13.2**

**Optimization of Nano and Macro Scale Textures for High-performance Tandem Micromorph Solar Cells**

J. Krc<sup>1)</sup>, E. Moulin<sup>2)</sup>, M. Kovacic<sup>1)</sup>, M. Sever<sup>1)</sup>, A. Campa<sup>1)</sup>, B. Lipovsek<sup>1)</sup>, M. Steltenpool<sup>3)</sup>, A. J. M. van Erven<sup>3)</sup>, F-J Haug<sup>2)</sup>, C. Ballif<sup>2)</sup> and M. Topic<sup>1)</sup>

<sup>1)</sup>University of Ljubljana, Faculty of Electrical Engineering, Slovenia, <sup>2)</sup>Ecole Polytechnique Fédérale de Lausanne (EPFL), Institute of Microengineering (IMT), Photovoltaics and Thin-Film Electronics Laboratory, Switzerland, <sup>3)</sup>OM&T B.V., High Tech Campus, The Netherlands

**10:55-11:10 2WeO.13.3**

**Critical Review on Plasmonic Light Trapping for Thin-film Solar Cells**

R. Santbergen, H. Tan, M. Zeman and A. H. M. Smets  
Photovoltaic Materials and Devices laboratory, Delft University of Technology, the Netherlands

**11:10-11:25 2WeO.13.4**

**Plasmon-enhanced Light-trapping in Microcrystalline Silicon Solar Cells**

R. S. A. Sesuraj<sup>1)</sup>, D. M. Bagnall<sup>1,2)</sup>, H. Sai<sup>3)</sup> and M. Kondo<sup>3)</sup>

<sup>1)</sup>Nano Research Group, University of Southampton, United Kingdom, <sup>2)</sup>School of Photovoltaic and Renewable Energy Engineering, University of New South Wales, Australia, <sup>3)</sup>Research Center for Photovoltaic Technologies, National Institute of Advanced Industrial Science and Technology (AIST), Japan

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## **Wednesday, November 26**

**13:00 - 14:25 Room E**

**Area 2**

### **2WeO.14 Light Management II**

Chairpersons:

Hiroyuki Fujiwara (Gifu University, Japan)  
Arno Hendrikus Marie Smets (Delft University of Technology, The Netherlands)

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**13:00-13:25      2WeO.14.1**

#### **⟨Invited⟩ High-efficiency Thin-film Silicon Solar Cells Using Honeycomb Textured Substrates**

H. Sai<sup>1)</sup>, K. Maejima<sup>2)</sup>, T. Matsui<sup>1)</sup>, T. Koida<sup>1)</sup>, M. Kondo<sup>1)</sup>, S. Nakao<sup>2)</sup>, Y. Takeuchi<sup>2)</sup>, H. Katayama<sup>3)</sup> and I. Yoshida<sup>4)</sup>

<sup>1)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan, <sup>2)</sup>Mitsubishi Heavy Industries Ltd. (MHI), Japan, <sup>3)</sup>Panasonic Corporation, Japan, <sup>4)</sup>Photovoltaic Power Generation Technology Research Association (PVTEC), Japan

**13:25-13:40      2WeO.14.2**

#### **Micro-textured Glass Combining Nano-textures and Highly Transparent Conductive Oxides for High-efficiency Multijunction Thin-film Silicon Solar Cells**

H. Tan<sup>1)</sup>, F. -J. Haug<sup>2)</sup>, F. T. Si<sup>1)</sup>, C. Ballif<sup>2)</sup>, M. Zeman<sup>1)</sup> and A. H. M. Smets<sup>1)</sup>

<sup>1)</sup>Photovoltaic Materials and Devices Laboratory, Delft University of Technology, The Netherlands,

<sup>2)</sup>Photovoltaics and Thin Film Electronics Laboratory,

EPFL, Switzerland

13:40-13:55 2WeO.14.3

**Efficient Amorphous Silicon Solar Cells  
on Imprinted SiO<sub>x</sub> Periodic Arrays of 3D  
Microstructure**

C. Niikura<sup>1,3)</sup> and M. Konagai<sup>2,3)</sup>

<sup>1)</sup>Photovoltaic Materials Unit, National Institute for Materials Sciences, Japan, <sup>2)</sup>Department of Physical Electronics, Tokyo Institute of Technology, Japan,  
<sup>3)</sup>MEXT/FUTURE-PV Innovation Research, JST, Japan

13:55-14:10 2WeO.14.4

**Novel Textured TCO Substrates and Their Applications to the Solar Cells**

P. Sichanugrist<sup>1)</sup>, Y. Abe<sup>1)</sup>, M. Konagai<sup>1,2)</sup>, H. Konishi<sup>3)</sup>, Y. Tsuda<sup>3)</sup>, T. Shinagawa<sup>3)</sup>, H. Tokioka<sup>3)</sup> and H. Fuchigami<sup>3)</sup>

<sup>1)</sup>Department of Physical Electronics, <sup>2)</sup>Photovoltaics Research Center (PVREC), Tokyo Institute of Technology, Japan, <sup>3)</sup>Advanced Technology R&D Center, Mitsubishi Electric Corporation, Japan

14:10-14:25 2WeO.14.5

**Amorphous SiO<sub>x</sub>:H as Antireflection Layer for Glass/ZnO Interface of Thin Film A-Si:H Solar Cell**

Amartya Chowdhury<sup>1)</sup>, Porpong Sichanugrist<sup>1)</sup> and Makoto Konagai<sup>1, 2)</sup>

<sup>1)</sup>Department of Physical Electronics, Tokyo Institute of Technology, Japan, <sup>2)</sup>Photovoltaic Research Center (PVREC), Tokyo Institute of Technology, Japan

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**Wednesday, November 26**

**14:45 - 16:10 Room E**

**Area 3**

**3WeO.15 CIGS : Module**

Chairpersons:

Katsumi Kushiya (Solar Frontier, Japan)

Michael Powalla (Center for Solar Energy and Hydrogen

Research, Baden-Wuerttemberg, Germany)

**14:45-15:10 3WeO.15.1**

**(Invited) Thin-Film Solar Cells and Modules based on CIGS with High Efficiency and Manufacturability**

M. Powalla

Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg (ZSW), Germany

**15:10-15:25 3WeO.15.2**

**Reliability of Laser Patterned CIGSe Solar Cells**

M. Schüle<sup>1)</sup>, C. Schultz<sup>1)</sup>, K. Stelmaszczyk<sup>2)</sup>, M. Weizman<sup>1)</sup>, C. Wolf<sup>2)</sup>, C. A. Kaufmann<sup>2)</sup>, B. Rau<sup>2)</sup>, R. Schlatmann<sup>1,2)</sup>, V. Quaschning<sup>1)</sup>, B. Stegemann<sup>1)</sup> and F. Fink<sup>1)</sup>

<sup>1)</sup>PVcomB / HTW Berlin - University of Applied Sciences, Germany, <sup>2)</sup>PVcomB / Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Germany

**15:25-15:40 3WeO.15.3**

**Sequential Processing of CIGSSe: Sulfurization After Selenization at Atmospheric Pressure Using Elemental Chalcogen Sources**

C. Wolf<sup>1)</sup>, E. Waack<sup>1)</sup>, S. S. Schmidt<sup>1)</sup>, H. Rodriguez-Alvarez<sup>1)</sup>, N. Papathanasiou<sup>1)</sup>, K. Mack<sup>2</sup>, F. Friedrich<sup>2)</sup>, H-W. Schock<sup>2)</sup>, C. A. Kaufmann<sup>1)</sup> and R. Schlatmann<sup>1)</sup>

<sup>1)</sup>PVcomB/Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Germany, <sup>2)</sup>PVcomB/Technical University Berlin, Germany

**15:40-15:55 3WeO.15.4**

**Innovative Front End Processing for Next Generation CIS Module Production**

V. Probst<sup>1)</sup>, A. Jasenek<sup>1)</sup>, C. Sandfort<sup>1)</sup>, A. Letsch<sup>2)</sup>, I. Kötschau<sup>1)</sup>, T. Hahn<sup>1)</sup>, J. Feichtinger<sup>2)</sup> and H. Eschrich<sup>1)</sup>

<sup>1)</sup>Bosch Solar CISTech GmbH, Germany, <sup>2)</sup>Robert Bosch GmbH, Corporate Research, Germany

15:55-16:10 3WeO.15.5

## Potential-Induced Degradation of Cu(In,Ga)Se<sub>2</sub> Photovoltaic Modules

Seira Yamaguchi<sup>1)</sup>, Kohjiro Hara<sup>2)</sup>, Hironori Komaki<sup>2)</sup>, Yukiko Shimizu-Kamikawa<sup>2)</sup>, Hajime Shibata<sup>2)</sup>, Shigeru Niki<sup>2)</sup>, Yuji Kawakami<sup>3)</sup> and Atsushi Masuda<sup>2)</sup>

<sup>1)</sup>School of Materials Science, Japan Advanced Institute of Science and Technology (JAIST), Japan,

<sup>2)</sup>Research Center for Photovoltaic Technologies, National Institute of Advanced Industrial Science and Technology (AIST), Japan, <sup>3)</sup>Department of Materials Science and Engineering, Kurume National College of Technology (Kurume-NCT), Japan

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**Wednesday, November 26**

**16:30 - 17:55 Room E**

**Area 3**

## 3WeO.16 CZTS: Characterization

Chairpersons:

Takayuki Negami (Panasonic Corporation, Japan)

Ayodhya N. Tiwari (EMPA, Switzerland)

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16:30-16:55 3WeO.16.1

### ⟨Invited⟩ Pioneering Achievement of Earth-abundant CZTS Thin Film Solar Cells

H. Katagiri<sup>1,2)</sup>

<sup>1)</sup>Nagaoka National College of Technology, Japan,

<sup>2)</sup>JST-CREST,Japan

16:55-17:10 3WeO.16.2

### In-situ Characterization of Band Alignment at CdS/CZTS Interface; Impact of Post-annealing

K. Chochi<sup>1)</sup>, S. Yoshimoto<sup>1)</sup>, T. Fukuyama<sup>1)</sup>, M. Mitsunaga<sup>1)</sup>, K. Obara<sup>1)</sup>, T. Okuda<sup>1)</sup>, T. Fukano<sup>2)</sup>, S. Tajima<sup>2)</sup>, K. Higuchi<sup>2)</sup> and N. Terada<sup>1)</sup>

<sup>1)</sup>Kagoshima Univ., Japan, <sup>2)</sup>Toyota Central R&D Labs., Inc., Japan

17:10-17:25 3WeO.16.3

**Minority-carrier Lifetime in Cu<sub>2</sub>ZnSn(S, Se)<sub>4</sub> Thin Films with Different Cu/Sn Ratio**

Mohammad Abdul Halim<sup>1)</sup>, Muhammad Monirul Islam<sup>1)</sup>, Xianjia Luo<sup>1)</sup>, Chong Xu<sup>1)</sup>, Takeaki Sakurai<sup>1)</sup>, Noriyuki Sakai<sup>2)</sup>, Takuya Kato<sup>2)</sup>, Hiroki Sugimoto<sup>2)</sup>, Hitoshi Tampo<sup>3)</sup>, Hajime Shibata<sup>3)</sup>, Shigeru Niki<sup>3)</sup> and Katsuhiro Akimoto<sup>1)</sup>

<sup>1)</sup>Institute of Applied Physics, University of Tsukuba, Japan, <sup>2)</sup>Energy Solution Business Center, Showa Shell Sekiyu K.K., Japan, <sup>3)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan

17:25-17:40 3WeO.16.4

**Origin and Suppression of the Void Formation in CZTS Solar Cells**

X. J. Hao and W. Li

School of Photovoltaic and Renewable Energy Engineering, University of New South Wales, Australia

17:40-17:55 3WeO.16.5

**The Observation of Intrinsic Defects in Cu<sub>2</sub>ZnSnSe<sub>4</sub> Thin Film by Photoluminescence**

Dan-Hua Hsieh<sup>1)</sup>, Shou-Yi Kuo<sup>2)</sup>, Jui-Fu Yang<sup>2,3)</sup>, Fang-I Lai<sup>3)</sup> and Hao-Chung Kuo<sup>1)</sup>

<sup>1)</sup>Department of Photonic & Institute of Electro-Optical Engineering, National Chiao Tung University, Taiwan, <sup>2)</sup>Department of Electronic Engineering, Chang Gung University, Taiwan, <sup>3)</sup>Department of Photonic Engineering, Yuan-Ze University, Taiwan

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**Wednesday, November 26****13:00 - 14:15 Room D****Area 4****4WeO.17 c-Si PV: Electrode**

Chairperson:

Tetsu Takahashi (NAMICS Corporation, Japan)

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13:00-13:15 4WeO.17.1

### **Next Generation Printing Technologies for Fine-Line Metallization of Si Solar Cells**

F. Clement, M. Pospischil, A. Lorenz, M. Linse, D. Erath, M. Kuchler, M. Klawitter, A. Spribile, R. Hoenig, R. Efinger, T. Fellmeth, B. Thaidigsmann and D. Biro

Fraunhofer Institute for Solar Energy Systems ISE,  
Germany

13:15-13:30 4WeO.17.2

### **Developing a High Throughput Rotational Metallization Technology for Silicon Solar Cells based on Flexographic Printing**

A. Lorenz, A. Kalio, T. Barnes Hofmeister, S. Kroh, A. Kraft, J. Bartsch, F. Clement and D. Biro

Fraunhofer Institute for Solar Energy Systems ISE,  
Germany

13:30-13:45 4WeO.17.3

### **All-Screen-Printed Dopant Ink Interdigitated Back Contact Solar Cell**

Daniel Inns, Dmitry Poplavskyy, Giuseppe Scardera, Shannon Dugan, Gonghou Wang, Elena Rogojina and Francesco Lemmi

DuPont Silicon Valley Technology Center, USA

13:45-14:00 4WeO.17.4

### **Advanced Metallization and Interconnection for Silicon Heterojunction Cells and Modules**

M. Despeisse<sup>1)</sup>, A. Faes<sup>1)</sup>, A. Lachowicz<sup>1)</sup>, N. Badel<sup>1)</sup>, C. Allebé<sup>1)</sup>, A. Descoeuadres<sup>1)</sup>, L. Barraud<sup>1)</sup>, F. Debrot<sup>1)</sup>, J. Champliaud<sup>1)</sup>, J. Levrat<sup>1)</sup>, P. J. Alet<sup>1)</sup>, F. Galliano<sup>1)</sup>, L. Perret-Aebi<sup>1)</sup>, T. Söderström<sup>2)</sup>, Y. Yao<sup>2)</sup> and C. Ballif<sup>1)</sup>

<sup>1)</sup>CSEM SA, PV-center, Switzerland, <sup>2)</sup>Meyer Burger AG, Switzerland

**14:00-14:15 4WeO.17.5**

**Reliability of a Printed Cu Busbar Electrode on a Conventional Silicon Solar Cell**

H. Tokuhisa, S. Ise, S. Morita, S. Tsukamoto, M. Tomita and M. Yoshida

National Institute of Advanced Industrial Science and Technology, Japan

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**Wednesday, November 26**

**14:45 - 15:45 Room D**

**Area 4**

**4WeO.18 c-Si PV: Passivation**

Chairpersons:

Jan Haschke (Helmholtz-Zentrum Berlin GmbH, Germany)

Shinichi Satoh (University of Hyogo, Japan)

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**14:45-15:00 4WeO.18.1**

**Surface Passivation of Crystalline Silicon by Sputtered AlOx/AlNx Stacks toward Low-Cost and High-Efficiency Silicon Solar Cells**

H. Lee<sup>1,4)</sup>, K. Ueda<sup>2)</sup>, Y. Enomoto<sup>2)</sup>, K. Arafune<sup>2),4)</sup>, H. Yoshida<sup>2,4)</sup>, S. Satoh<sup>2,4)</sup>, T. Chikyow<sup>3)</sup> and A. Ogura<sup>1,4)</sup>

<sup>1)</sup>Meiji University, Japan, <sup>2)</sup>University of Hyogo, Japan,

<sup>3)</sup>National Institute for Materials Science, Japan, <sup>4)</sup>Core Research for Evolutional Science and Technology (CREST), Japan Science and Technology Agency(JST), Japan

**15:00-15:15 4WeO.18.2**

**Activation of Cat-Doped Phosphorus Atoms by Flash Lamp Annealing**

Keisuke Ohdaira<sup>1,2)</sup>, Trinh Cham Thi<sup>1,2)</sup>, Shogo Tsuzaki<sup>1)</sup> and Hideki Matsumura<sup>1,2)</sup>

<sup>1)</sup>Japan Advanced Institute of Science and Technology (JAIST), Japan, <sup>2)</sup>CREST, Japan Science and Technology Agency (JST), Japan

15:15-15:30 4WeO.18.3

**PECVD Boron-doped Oxides as Diffusion Sources - Investigations of Diffusion Processes, and Integration in Silicon Solar Cell Concepts**

N. Wehmeier<sup>1)</sup>, B. Lim<sup>1)</sup>, A. Merkle<sup>1)</sup>, A. Tempez<sup>2)</sup>, S. Legendre<sup>2)</sup>, H. Wagner<sup>3)</sup> and P. P. Altermatt<sup>3)</sup>

<sup>1)</sup>Institute of Solar Energy Research Hameln (ISFH), Germany, <sup>2)</sup>Horiba Jobin Yvon SAS, Avenue de la Vauve, France, <sup>3)</sup>Department of Solar Energy Research, Univ. Hannover, Germany

15:30-15:45 4WeO.18.4

**Plasma Enhanced Chemical Vapor Deposition of High PID-Resistance Silicon Nitride Film for Crystalline Silicon Solar Cells**

K. Mishina<sup>1)</sup>, A. Ogishi<sup>1)</sup>, K. Ueno<sup>2)</sup>, N. Ikeno<sup>3)</sup>, T. Saruwatari<sup>1)</sup>, K. Hara<sup>4)</sup>, A. Ogura<sup>3)</sup>, T. Yamazaki<sup>2)</sup>, T. Doi<sup>4)</sup> and A. Masuda<sup>4)</sup>

<sup>1)</sup>Shimadzu Corporation, Semiconductor Equipment Division, Equipment Department, Japan, <sup>2)</sup>Choshu Industry Co., Ltd., Japan, <sup>3)</sup>Meiji University, Japan, <sup>4)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan

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**Wednesday, November 26**

**16:30 - 17:55 Room D**

**Area 4**

**4WeO.19 c-Si PV: Cell 2**

Chairpersons:

Kyotaro Nakamura (Meiji University, Japan)

Yang Yang (Trina Solar, China)

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16:30-16:55 4WeO.19.1

**<Invited> Development of 25.6% Record Efficiency Silicon Heterojunction Solar Cell**

N. Matsubara, K. Masuko, K. Fujishima, M. Kai, T. Tsunomura, T. Yamanishi, T. Takahama, M. Taguchi, E.

Maruyama and S. Okamoto

Solar Business Unit, Eco Solutions Company,  
Panasonic Corporation, Japan

16:55-17:10      4WeO.19.2

**21% Efficiency of n-Type Monocrystalline Silicon  
Passivated Emitter and Rear Totally Diffused  
Photovoltaic Cell**

S. Nishimura<sup>1)</sup>, Y. Yuda<sup>1)</sup>, D. Niinobe<sup>1)</sup>, T. Watahiki<sup>1)</sup>, T. Sato<sup>1)</sup>, Y. Sakai<sup>1)</sup>, H. Fuchigami<sup>1)</sup> and S. Kano<sup>2)</sup>

<sup>1)</sup>Advanced Technology R & D Center, Mitsubishi Electric Corporation, Japan, <sup>2)</sup>Manufacturing Engineering Center, Mitsubishi Electric Corporation, Japan

17:10-17:25      4WeO.19.3

**High Volume Manufacturing of High Efficiency,  
N-type Cells and Modules for Space-constrained  
Applications**

D. De Ceuster, D. Crafts, O. Schultz-Wittmann and A. Turner

First Solar, USA

17:25-17:40      4WeO.19.4

**Large Area n-type c-Si Solar Cells Featuring Rear  
Emitter and Efficiency Beyond 21%**

E. Cornagliotti<sup>1)</sup>, A. Sharma<sup>1,2)</sup>, L. Tous<sup>1)</sup>, L. Black<sup>3)</sup>, A. Uruena<sup>1)</sup>, M. Aleman<sup>1)</sup>, F. Duerinckx<sup>1)</sup>, R. Russell<sup>1)</sup>, P. Choulat<sup>1)</sup>, J. John<sup>1)</sup>, B. Dielissen<sup>4)</sup>, R. Görtzen<sup>4)</sup> and J. Szlufcik<sup>1)</sup>

<sup>1)</sup>imec, Belgium, <sup>2)</sup>Katholieke Universiteit Leuven, Belgium, <sup>3)</sup>Centre for Sustainable Energy Systems, Australian National University, Australia, <sup>4)</sup>SolayTec, The Netherlands

17:40-17:55      4WeO.19.5

**High-Efficiency Approach for NiCu-plated n-type  
Silicon Solar Cells**

Bernd Steinhauser, J. Benick, M. Kamp, J. Bartsch and

**M. Hermle**

**Fraunhofer ISE, Germany**

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**Plenary**

**Thursday, November 27**

**8:30 - 10:00 Room A**

Chairpersons:

Christiana Honsberg (Arizona State University, USA)

Arnulf Jäger-Waldau (European Commission, DG JRC, Italy)

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**8:30-9:00**

**2ThPl.1**

**Area 2**

**[Plenary] Next Generation Thin Film Silicon Solar Cells**

Makoto Konagai

Tokyo Institute of Technology

**9:00-9:30**

**7ThPl.2**

**Area 7**

**[Plenary] Moving to a Higher Level for PV Reliability through Comprehensive Standards Based on Solid Science**

Sarah Kurtz

National Renewable Energy Laboratory

**9:30-10:00**

**6ThPl.3**

**Area 6**

**[Plenary] Future Prospects of Organic and Hybrid Solar Cells for Next Generation Photovoltaics**

Hiroshi Segawa

RCAST, The University of Tokyo, Japan

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**Thursday, November 27**

**10:15 - 11:40 Room A**

**Area 7**

**7ThO.1 PV Performance Characterzation**

Chairpersons:

Ulrike Jahn (TUV Rheinland, Germany)

Kengo Morita (TUV Rheinland Japan Ltd., Japan)

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10:15-10:40 7ThO.1.1

**⟨Invited⟩ Power Rating of CPV Modules**

Gerald Siefer<sup>1)</sup>, Matthew Muller<sup>2)</sup>, Christoph Rapp<sup>1)</sup>,  
Marc Steiner<sup>1)</sup> and Andreas W. Bett<sup>1)</sup>

<sup>1)</sup>Fraunhofer Institute for Solar Energy Systems ISE,  
Germany, <sup>2)</sup>National Renewable Energy Laboratory,  
USA

10:40-10:55 7ThO.1.2

**Large-Area LED/Halogen Hybrid Solar Simulator  
and Silicon Heterojunction Solar Modules Indoor  
to Outdoor Performance Monitoring**

M. Despeisse<sup>1,2)</sup>, A. Lo<sup>2)</sup>, M. Bonnet Eymard<sup>1,2)</sup>, Y.  
Riesen<sup>2)</sup>, J. Levrat<sup>1)</sup>, P. J. Alet<sup>1)</sup> and C. Ballif<sup>2)</sup>

<sup>1)</sup>CSEM SA, PV-center, Switzerland, <sup>2)</sup>Ecole  
Polytechnique Fédérale de Lausanne (EPFL), Institute  
of Microengineering (IMT), Photovoltaics and thin film  
electronics laboratory (PV-Lab), Switzerland

10:55-11:10 7ThO.1.3

**IEC 60904-9 Spectral Classification and Impact on  
Industrial Rating of c-Si Devices**

C. Monokroussos<sup>1)</sup>, D. Etienne<sup>1)</sup>, K. Morita<sup>2)</sup>, C. Dreier<sup>1)</sup>  
and U. Therhaag<sup>1)</sup>

<sup>1)</sup>TÜV Rheinland (Shanghai) Co., Ltd., China, <sup>2)</sup>TÜV  
Rheinland Japan Ltd., Japan

11:10-11:25 7ThO.1.4

**Photovoltaic Characterization for Various Light  
Conditions**

Y. Nishikawa<sup>1)</sup>, K. Imai<sup>1)</sup>, K. Miyao<sup>1)</sup>, S. Uchida<sup>2)</sup>, S.  
Magaino<sup>3)</sup>, K. Takagi<sup>3)</sup>, S. Saitoh<sup>3)</sup> and D. Aoki<sup>3)</sup>

<sup>1)</sup>Konica Minolta, Inc., Japan, <sup>2)</sup>The University of  
Tokyo, Japan, <sup>3)</sup>Kanagawa Academy of Science and  
Technology, Japan

11:25-11:40 7ThO.1.5

### A New Procedure to Measure Large Area CPV Modules

C. Rapp, M. Steiner, G. Siefer and A. W. Bett

Fraunhofer Institute for Solar Energy Systems ISE,  
Germany

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**Thursday, November 27**

**13:00 - 14:25 Room A**

**Area 7**

### 7ThO.2 PVQAT 1

Chairpersons:

Sarah Kurtz (NREL, USA)

Tadanori Tanahashi (ESPEC Corporation, Japan)

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13:00-13:25 7ThO.2.1

### **⟨Invited⟩ Characterization Techniques for Studying PV Module's Reliability, Durability and Quality**

Jaeckel Bengt

UL

13:25-13:40 7ThO.2.2

### **Rapid Thermal Cycle Test Consisting of Repeated Stress Based on IEC Qualification Test**

M. Fujimori<sup>1)</sup>, T. Kohno<sup>1</sup> and K. Gokita<sup>2)</sup>, P. Sochor<sup>3)</sup>, K. Morita<sup>3)</sup>

<sup>1)</sup>Central Research Laboratory, Hitachi Ltd., Japan,

<sup>2)</sup>Hitachi Works, Hitachi Ltd., Japan, <sup>3)</sup>TÜV Rheinland Japan Ltd., Japan

13:40-13:55 7ThO.2.3

### **Ultra-violet Radiation Testing of Various Back-sheets for PV-modules**

Michael Koehl and Amal Ballion

Fraunhofer-Institut für Solare Energiesysteme (ISE),  
Germany

13:55-14:10 7ThO.2.4

### UV Exposure Test and UV-DH-TC Sequential Test for 4 Cells Mini Modules

T. Doi<sup>1)</sup>, H. Morita<sup>2)</sup>, T. Amioka<sup>2)</sup>, T. Shioda<sup>3)</sup>, S. Suzuki<sup>4)</sup> and A. Masuda<sup>1)</sup>

<sup>1)</sup>National Institute of Advanced Industrial Science and Technology (AIST)), Japan, <sup>2)</sup>Toray Industries, Inc., Japan, <sup>3)</sup>Mitsui Chemicals, Inc., Japan, <sup>4)</sup>Espec Corp., Japan

14:10-14:25 7ThO.2.5

### Effect of Shading on the Reliability of PV Modules

N. G. Dhere, E. Schneller and N. S. Shiradkar

Florida Solar Energy Center, University of Central Florida, USA

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**Thursday, November 27**

**14:45 - 16:10 Room A**

**Area 7**

**7ThO.3 PVQAT 2**

Chairpersons:

Neelkanth G Dhere (University of Central Florida, USA)  
Masaaki Yamamichi (AIST, Japan)

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14:45-15:10 7ThO.3.1

### [Invited] A New Era of Quality Assurance for Solar Investability

Burkhard Holder

VDE Testing & Certification Institute, Germany

15:10-15:25 7ThO.3.2

### Japanese Efforts in International PV Module Quality Assurance Task Force

M. Yamamichi<sup>1)</sup>, Y. Eguchi<sup>2)</sup>, T. Tanahashi<sup>3)</sup>, T. Doi<sup>1)</sup>, Y. Uchida<sup>4)</sup>, T. Shioda<sup>2)</sup>, M. Takani<sup>5)</sup>, M. Kondo<sup>1)</sup>

<sup>1)</sup>National Institute of Advanced Industrial Science and

Technology (AIST), Tsukuba, Japan, <sup>2)</sup>Mitsui Chemicals, Inc., Japan, <sup>3)</sup>ESPEC Corp., Japan, <sup>4)</sup>Japan Electrical Safety & Environment Technology Laboratories (JET), Japan, <sup>5)</sup>Solar Frontier K.K., Japan

15:25-15:40 7ThO.3.3

### **Investigation of Thermo-mechanical Stresses on PV Modules: a Collaborative Research within the European Photovoltaic Infrastructure Research Project SOPHIA**

K. A. Berger<sup>1)</sup>, B. Kubicek<sup>1)</sup>, G. Ujvari<sup>1)</sup>, R. Leidl<sup>1)</sup>, T. Krametz<sup>1)</sup>, S. Zamini<sup>1)</sup>, S. Hoffmann<sup>2)</sup>, M. Koehl<sup>2)</sup>, A. Pozza<sup>3)</sup>, T. Sample<sup>3)</sup>, D. Bertani<sup>4)</sup>, F. Paletta<sup>4)</sup>, I. J. Bennett<sup>5)</sup>, E. Gerritsen<sup>6)</sup>, P. Malbranche<sup>6)</sup>, J. Zhu<sup>7)</sup>, R. Gottschalg<sup>7)</sup>, P. Pugliatti<sup>8)</sup>, A. Di Stefano<sup>8)</sup>, F. Aleo<sup>8)</sup>, F. Roca<sup>9)</sup>, G. Graditi<sup>9)</sup>, M. Pellegrino<sup>9)</sup>, O. Zubillaga<sup>10)</sup> and P. Cano<sup>10)</sup>

<sup>1)</sup>Austrian Institute of Technology, Energy Department (AIT), Austria, <sup>2)</sup>Fraunhofer ISE, Germany, <sup>3)</sup>JRC, Italy, <sup>4)</sup>RSE, Italy, <sup>5)</sup>ECN, Netherlands, <sup>6)</sup>CEA, France, <sup>7)</sup>CREST, UK, <sup>8)</sup>ENEL, Italy, <sup>9)</sup>ENEA, Italy, <sup>10)</sup>Tecnalia, Spain

15:40-15:55 7ThO.3.4

### **Correlation between Thermal Cycling Test and Outdoor Exposure for Major Degradation Modes of PV modules**

K. Morita<sup>1)</sup>, P. Sochor<sup>1)</sup>, Y. Tsuno<sup>1)</sup>, Y. Yasuda<sup>1)</sup>, S. Kera<sup>1)</sup>, T. Kohno<sup>2)</sup> and M. Fujimori<sup>2)</sup>

<sup>1)</sup>TÜV Rheinland Japan Ltd., Japan, <sup>2)</sup>Hitachi Ltd., Japan

15:55-16:10 7ThO.3.5

### **Effects of Light Exposure on Photovoltaic Modules in the Combined Acceleration Test of Light Irradiation and Damp Heat**

T. Ngo<sup>1)</sup>, Y. Heta<sup>1)</sup>, T. Doi<sup>2)</sup> and A. Masuda<sup>2)</sup>

<sup>1)</sup>Photovoltaic Power Generation Technology Research Association (PVTEC), Japan, <sup>2)</sup>National Institute of

Advanced Industrial Science and Technology (AIST),  
Japan

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**Thursday, November 27**

**16:15-17:00 Room A**

**Closing Ceremony**

Chairperson:

Akira Yamada (Tokyo Institute of Technology, Japan)

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**16:15-16:30**

**Overall Conference Summary**

Michio Kondo (FREA, AIST, Japan)

**16:30-16:45**

**Award Ceremony**

Best Paper Award

Best Poster Award

Young Researcher Award

**16:45-17:00**

**Greetings from the Future Conference  
Representatives**

PVSEC-25

42nd IEEE PVSC

31st EU PVSEC

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**Thursday, November 27**

**10:15 - 11:45 Room B-1**

J4

**J4ThO.4 NEDO's PV R&D Projects & High  
Efficiency Solar Cells**

Chairpersons:

Hiroyuki Yamada (NEDO, Japan)

Masafumi Yamaguchi (Toyota Technological Institute,  
Japan)

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10:15-10:30 J4ThO.4.1

**Introductory**

H. Yamada

NEDO, Japan

10:30-10:45 J4ThO.4.2

**⟨Invited⟩ R&D on Ultimate Wafer-based Si Solar Cells under NEDO in Japan**

K. Nakamura<sup>1)</sup>, T. Sekiguchi<sup>2)</sup>, A. Tanizaki<sup>3)</sup>, K. Kakimoto<sup>4)</sup>, A. Ogura<sup>1)</sup> and Y. Ohshita<sup>4)</sup>

<sup>1)</sup>Meiji University, Japan, <sup>2)</sup>National Institute for Materials Science, Japan, <sup>3)</sup>Komatsu NTC Ltd., Japan,

<sup>4)</sup>Kyushu University, Japan, <sup>5)</sup>Toyota Technological Institute, Japan

10:45-11:00 J4ThO.4.3

**⟨Invited⟩ Thin-film Si Solar Cells**

H. Sai

AIST

11:00-11:15 J4ThO.4.4

**⟨Invited⟩ CIGS Solar Cells**

H. Sugimoto

Solar Frontier

11:15-11:30 J4ThO.4.5

**⟨Invited⟩ World-record Efficiency Si Solar Cells**

Naoteru Matsubara

Panasonic Corporation

11:30-11:45 J4ThO.4.6

**⟨Invited⟩ World-record Efficiency III-V Compound Multi-junction Solar Cells**

T. Takamoto

**13:00 - 14:30 Room B-1****Area 3****3ThO.5 CIGS 2**

Chairpersons:

Volker Probst (Bosch Solar CISTech GmbH, Germany)

Takahiro Wada (Ryukoku University, Japan)

**13:00-13:15 3ThO.5.1****Wide-gap Solar Cells Using a Novel ZnCuGaSe<sub>2</sub> Absorber**T. Yamamoto<sup>1)</sup>, T. Negami<sup>1)</sup>, K. Matsubara<sup>2)</sup> and S. Niki<sup>2)</sup><sup>1)</sup>Panasonic Corporation, <sup>2)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan**13:15-13:30 3ThO.5.2****Importance of Precursor Deposition Temperature of Cu(In,Ga)Se<sub>2</sub> Films Under Multi-layer Precursor Method**J. Chantana<sup>1)</sup>, D. Hironiwa<sup>1)</sup>, Z. Tang<sup>1)</sup>, T. Watanabe<sup>2)</sup>, S. Teraji<sup>2)</sup>, K. Kawamura<sup>2)</sup> and T. Minemoto<sup>1)</sup><sup>1)</sup>Department of Electrical and Electronic Engineering, Ritsumeikan University, Japan, <sup>2)</sup>Environment and Energy Research Center, Nitto Denko Corporation, Japan**13:30-13:45 3ThO.5.3****Cu(In,Ga)Se<sub>2</sub> Solar Cells with Transparent Amorphous Oxide Semiconducting Buffer Layers**T. Koida, H. Takahashi, Y. Kamikawa-Shimizu, A. Yamada, H. Shibata and S. Niki

National Institute of Advanced Industrial Science and Technology, Japan

**13:45-14:00 3ThO.5.4****Flexible CIGS Solar Cells Fabricated Using a Polyimide-coated Soda-lime Glass Substrate**A. Sadono<sup>1)</sup>, M. Hino<sup>3)</sup>, M. Ichikawa<sup>3)</sup>, K. Yamamoto<sup>3)</sup>, Y.

Kurokawa<sup>1)</sup>, M. Konagai<sup>1,2)</sup> and A. Yamada<sup>1,2)</sup>

<sup>1)</sup>Department of Physical Electronics, Tokyo Institute of Technology, Japan, <sup>2)</sup>Photovoltaics Research Center (PVREC), Tokyo Institute of Technology, Japan,

<sup>3)</sup>Kaneka Corporation, Japan

14:00-14:15 3ThO.5.5

**10.7 % Efficient Cu(In,Ga)(S,Se)<sub>2</sub> Thin Film Solar Cell from Selenization of Spray Pyrolysed Sulfide Precursor Film**

Wilman Septina<sup>1)</sup>, Masaaki Kurihara<sup>2)</sup>, Toshiyuki Hirano<sup>2)</sup>, Yasuhiro Nakajima<sup>2)</sup>, Yoshihito Kawasaki<sup>1)</sup>, Takashi Harada<sup>1)</sup>, Shigeru Ikeda<sup>1)</sup> and Michio Matsumura<sup>1)</sup>

<sup>1)</sup>Research Center for Solar Energy Chemistry, Osaka University, Japan, <sup>2)</sup>Renewable Energy Material Development Group, Energy & Environment R&D Center, Corporate Research & Development, Asahi Kasei Corporation, Japan

14:15-14:30 3ThO.5.6

**Effect of Selenium Partial Pressure during Annealing on CuInSe<sub>2</sub> Thin Films Prepared by Electrodeposition**

Y. I. Park<sup>1,3)</sup>, D. H. Kim<sup>1,2)</sup> and H. Kim<sup>3)</sup>

<sup>1)</sup>Green School, Korea University, Korea, <sup>2)</sup>Department of Material Engineering, Korea University, Korea, <sup>3)</sup>National Agenda Research Division, Korea Institute of Science & Technology, Korea

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**Thursday, November 27**

**14:45 - 15:30 Room B-1**

**Area 3**

**3ThO.6 CdTe and Novel Materials**

Chairperson:

Takashi Minemoto (Ritsumeikan University, Japan)

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14:45-15:00 3ThO.6.1

**Characterization of Narrow Bandgap CIGSe Solar Cells Under Concentration in Tandem Conditions**

Zacharie Jehl Li Kao, Hirofumi Fukai, Isamu Matsuyama and Tokio Nakada

Tokyo University of Science, Research Institute for Science & Technology, Photovoltaic Science and Technology Research Division, Japan

15:00-15:15 3ThO.6.2

**14.26% Efficiency of CdTe Solar Cells by Radio-frequency Magnetron Sputtering**

H. Li, X. Liu and B. Yang

The Key Laboratory of Solar Thermal Energy and Photovoltaic System, Institute of Electrical Engineering, China

15:15-15:30 3ThO.6.3

**Fabrication of High Efficient Cu<sub>2</sub>ZnSnS<sub>4</sub> Based Thin Film Solar Cells from Electro-deposited Metallic Stacks**

Feng Jiang, Shigeru Ikeda, Takashi Harada and Michio Matsumura

Research Center for Solar Energy Chemistry, Osaka University, Japan

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**Thursday, November 27**

**13:00 - 14:35 Room B-2**

**J1 (Area 2 & 4)**

**J1ThO.7 Karfless Thin Crystalline Silicon Solar Cells**

Chairpersons:

Keisuke Ohdaira (Japan Advanced Institute of Science and Technology, Japan)

K. Yamamoto (Kaneka Corporation, Japan)

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**13:00-13:25 J1ThO.7.1**

**⟨Invited⟩ i<sup>x</sup>-module Concept: Where Thin Crystalline Si and Thin-film Crystalline Si Meet**

J. Poortmans<sup>1,2,3)</sup>, I. Gordon<sup>1)</sup>, T. Bearda<sup>1)</sup>, H. Sivaramakrishnan Radhakrishnan<sup>1)</sup>, J. Govaerts<sup>1)</sup>, K. Van Nieuwenhuysen<sup>1)</sup>, Valerie Depauw<sup>1)</sup>, L. Tous<sup>1)</sup>, S. Granata<sup>1)</sup>, R. Martini<sup>1)</sup>, C. Trompoukis<sup>1)</sup>, O. El Daif<sup>1)</sup>, Y. Abdulraheem<sup>4)</sup>, A. Hajjiah<sup>4)</sup>, F. Alajmi<sup>4)</sup>, R. Mertens<sup>1)</sup>

<sup>1)</sup>IMEC, Belgium, <sup>2)</sup>KUL, Departement Elektrotechniek, ESAT, Belgium, <sup>3)</sup>University Hasselt, Belgium, <sup>4)</sup>Kuwait University, Kuwait

**13:25-13:50 J1ThO.7.2**

**⟨Invited⟩ Epitaxial Layer Transfer Technology and Application - Review and Outlook for PV -**

Takao Yonehara

Applied Materials Inc., USA

**13:50-14:05 J1ThO.7.3**

**Epitaxially Grown Wafer Based Silicon Heterojunction Cells**

E. Kobayashi<sup>1)</sup>, N. Kusunoki<sup>1)</sup>, Y. Watabe<sup>1)</sup>, R. Hao<sup>2)</sup> and T. S. Ravi<sup>2)</sup>

<sup>1)</sup>Choshu Industry Co., Ltd., Japan, <sup>2)</sup>Crystal Solar Co., Ltd., USA

**14:05-14:20 J1ThO.7.4**

**Kerfless Wafering by Mechanically Induced Spallation - Observation of the Process Dynamics with Digital Image Correlation**

S. Kajari-Schröder<sup>1)</sup>, J. Hensen<sup>1)</sup>, R. Niepelt<sup>1)</sup> and R. Brendel<sup>2)</sup>

<sup>1)</sup>Institute for Solar Energy Research Hamelin, Germany, <sup>2)</sup>Institute for Solid State Physics, Leibniz Universität Hannover, Germany

14:20-14:35 J1ThO.7.5

## Recent Progress in Back Contacted Thin-Film Crystalline Silicon Heterojunction Solar Cells on Glass

J. Haschke, D. Amkreutz, T. Hänel, L. Korte, F. Ruske and B. Rech

Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Institute for Silicon-Photovoltaics, Germany

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**Thursday, November 27**

**14:45 - 16:05 Room B-2**

**Area 2**

## 2ThO.8 Innovative Approach

Chairpersons:

Jun Lin (Tokyo Electron Limited, Japan)

Pauls Stradins (NREL, USA)

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14:45-15:10 2ThO.8.1

### **⟨Invited⟩ Crossover of Crystalline Silicon and Thin Film Silicon Technology for Next Generation Solar Cells**

Michio Kondo<sup>1,2)</sup>

<sup>1)</sup>Fukushima Renewable Energy Institute, AIST,

Koriyama, Japan, <sup>2)</sup>Fukushima University, Fukushima Japan

15:10-15:35 2ThO.8.2

### **⟨Invited⟩ From a-Si:H/μc-Si:H to Liquid-phase Crystallized Silicon on Glass: Towards Production of Next-generation Thin Film Silicon PV Modules**

Onno Gabriel<sup>1)</sup>, Tim Frijnts<sup>2)</sup>, Simon Kirner<sup>1)</sup>, Sebastian Neubert<sup>1)</sup>, Sonya Calnan<sup>1)</sup>, Sven Ring<sup>1)</sup>, Matthias Zelt<sup>1)</sup>, Björn Rau<sup>1)</sup>, Jens-Hendrik Zollondz<sup>2)</sup>, Andreas Heidelberg<sup>2)</sup>, Daniel Amkreutz<sup>3)</sup>, Jan Haschke<sup>3)</sup>, Stefan Gall<sup>3)</sup>, Bernd Stannowski<sup>1)</sup>, Bernd Rech<sup>3)</sup>, Rutger Schlatmann<sup>1)</sup>

<sup>1)</sup>PVcomB, Helmholtz-Zentrum Berlin für Materialien

und Energie GmbH, Germany, <sup>2)</sup>Masdar PV GmbH, Germany, <sup>3)</sup>Institute for Silicon Photovoltaics, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Germany

**15:35-15:50      2ThO.8.3**

### **Highly Crystalline Microcrystalline Silicon Solar Cells for Enhanced Near-Infrared Absorption**

S. Hänni<sup>1)</sup>, J. Persoz<sup>1)</sup>, B. Niesen<sup>1)</sup>, M. Boccard<sup>1)</sup>, J.-W. Schüttauf<sup>1)</sup>, M. Ledinsky<sup>1)</sup>, L. Lüfgren<sup>2)</sup>, J. Bailat<sup>2)</sup>, F.-J. Haug<sup>1)</sup>, F. Meillaud<sup>1)</sup> and C. Ballif<sup>1,2)</sup>

<sup>1)</sup>Ecole Polytechnique Fédérale de Lausanne (EPFL), Institute of Microengineering (IMT), Photovoltaics and Thin Film Electronics Laboratory (PVLab), Switzerland,

<sup>2)</sup>CSEM SA, Photovoltaic Division (PV-Center), Switzerland

**15:50-16:05      2ThO.8.4**

### **Addressing the Key Challenges in the Successful Implementation of High Efficiency Porous Silicon-based Layer-transferred Epitaxial Solar Modules**

H. Sivaramakrishnan Radhakrishnan<sup>1)</sup>, V. Depauw<sup>1)</sup>, R. Martini<sup>1,2)</sup>, K. Van Nieuwenhuysen<sup>1)</sup>, T. Bearda<sup>1)</sup>, J. Govaerts<sup>1)</sup>, I. Gordon<sup>1)</sup>, J. Szlufcik<sup>1)</sup> and J. Poortmans<sup>1,2,3)</sup>

<sup>1)</sup>IMEC, Belgium, <sup>2)</sup>KU Leuven, Belgium, <sup>3)</sup>Universiteit Hasselt, Belgium

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**Thursday, November 27**

**10:15 - 11:30 Room E**

**Area 6**

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### **6ThO.9 Perovskite Solar Cells 1**

Chairpersons:

Andreas Hinsch (Fraunhofer ISE, Germany)

Hideo Ohkita (Kyoto University, Japan)

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10:15-10:30 6ThO.9.1

## Air Stable Cocktail Sn/Pb Halide Perovskite Sensitized Solar Cells for Near Infrared Photoconversion

Yuhei Ogomi<sup>1)</sup>, Atsushi Morita<sup>1)</sup>, Shota Tsukamoto<sup>1)</sup>,  
Takahiro Saitho<sup>1)</sup>, Naotaka Fujikawa<sup>1)</sup>, Shen Qing<sup>2,4)</sup>,  
Taro Toyoda<sup>2,4)</sup>, Kenji Yoshino<sup>3,4)</sup>, Shyam S. Pandey<sup>1)</sup>,  
Tingli Ma<sup>1)</sup> and Shuzi Hayase<sup>1,4)</sup>

<sup>1)</sup>Graduate School of Life Science and Systems Engineering, Kyushu Institute of Technology, Japan,

<sup>2)</sup>Graduate School of Informatics and Engineering, University of Electro-Communications, Japan,

<sup>3)</sup>Department of Electrical and Electronic Engineering, University of Miyazaki, Japan, <sup>4)</sup>CREST, Japan Science and Technology Agency (JST), Japan

10:30-10:45 6ThO.9.2

## Charge Transfer and Recombination at the Metal Oxide/Perovskite/Spiro-OMeTAD Interfaces: Uncovering the Mechanism behind High Efficiency Perovskite-based Solar Cells

Qing Shen<sup>1,5)</sup>, Yuhei Ogomi<sup>2,5)</sup>, Syota Tsukamoto<sup>2)</sup>,  
Kenji Kukihara<sup>2)</sup>, Jin Chang<sup>1)</sup>, Takuya Oshima<sup>1)</sup>, Naoya  
Osada<sup>1,3)</sup>, Kenji Yoshino<sup>4,5)</sup>, Kenji Katayama<sup>3)</sup>, Taro  
Toyoda<sup>1,5)</sup> and Shuzi Hayase<sup>2,5)</sup>

<sup>1)</sup>The University of Electro-Communications, Japan,

<sup>2)</sup>Kyushu Institute of Technology, Japan, <sup>3)</sup>Chuo

University, Japan, <sup>4)</sup>Miyazaki University, Japan, <sup>5)</sup>

CREST, Japan Science and Technology Agency (JST),  
Japan

10:45-11:00 6ThO.9.3

## High Photoluminescence Efficiency, Ultrafast Free Charge Generation and Optically-Pumped Lasing in Solution Processed Halide Perovskite Semiconductors

Michael Price<sup>1)</sup>, Felix Deschler<sup>1)</sup>, Sandeep Pathak<sup>1,2)</sup> and Richard H Friend<sup>1)</sup>

<sup>1)</sup>Cavendish Laboratory, UK, <sup>2)</sup>Clarendon Laboratory,

UK

11:00-11:15 6ThO.9.4

**Dynamics of Photocarriers in Organic-inorganic Hybrid Perovskite  $\text{CH}_3\text{NH}_3\text{PbI}_3$  for Solar-cell Applications**

Y. Yamada<sup>1)</sup>, M. Endo<sup>1)</sup>, A. Wakamiya<sup>1,2)</sup> and Y. Kanemitsu<sup>1,3)</sup>

<sup>1)</sup>Kyoto University, Japan, <sup>2)</sup>JST-PRESTO, Japan, <sup>3)</sup>JST-CREST, Japan

11:15-11:30 6ThO.9.5

**Photoemission Studies of  $\text{CH}_3\text{NH}_3\text{PbI}_{3-x}\text{Cl}_x$  Films by Vapor Deposition**

Lili Wu<sup>1,2)</sup>, Mehmet Baran Bas<sup>2)</sup>, Philip Reckers<sup>2)</sup>, Eric Mankel<sup>2)</sup> and Wolfram Jaegermann<sup>2)</sup>

<sup>1)</sup>College of Materials Science and Engineering, Sichuan University, China, <sup>2)</sup>Department of Materials and Earth Sciences, Technische Universität Darmstadt, Germany

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**Thursday, November 27****13:00 - 14:30 Room E****Area 6****6ThO.10 Perovskite Solar Cells 2**

Chairpersons:

Tsutomu Miyasaka (Toin University of Yokohama, Japan)  
Lili Wu (Sichuan University, China)

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13:00-13:15 6ThO.10.1

**Film Morphology Control for High Efficiency Perovskite Solar Cells**

L. Han<sup>1)</sup>, Y. Wu<sup>1)</sup>, X. Yang<sup>1)</sup>, H. Chen<sup>2)</sup>, J. Liu<sup>1)</sup>, C. Qin<sup>1)</sup> and A. Islam<sup>1)</sup>

<sup>1)</sup>Photovoltaic Materials Unit, National Institute for Materials Science, Japan, <sup>2)</sup>State Key Laboratory of Metal Matrix Composites, Shanghai Jiaotong University, China

13:15-13:30 6ThO.10.2

### **Cloride Assisted Perovskite Solar Cells with High Efficiency**

Ludmila Cojocaru<sup>1)</sup>, Satoshi Uchida<sup>2)</sup>, Ajay Kumar Jena<sup>3)</sup>, Tsutomu Miyasaka<sup>3)</sup>, Kazuteru Nonomura<sup>1)</sup>, Takaya Kubo<sup>1)</sup> and Hiroshi Segawa<sup>1)</sup>

<sup>1)</sup>Research Center for Advanced Science and Technology (RCAST), The University of Tokyo, Japan,

<sup>2)</sup>Komaba Organization for Educational Excellence (KOMEX), The University of Tokyo, Japan, <sup>3)</sup>Graduate School of Engineering, Toin University of Yokohama, Japan

13:30-13:45 6ThO.10.3

### **Si-based Tandem Solar Cells with Organometallic Lead Halide High-band Gap Top-cells**

P. Löper<sup>1)</sup>, S. J. Moon<sup>2)</sup>, S. Martin de Nicolas<sup>1)</sup>, M. Ledinsky<sup>1)</sup>, B. Niesen<sup>1)</sup>, J. Bailat<sup>2)</sup>, S. Nicolay<sup>2)</sup>, J. H. Yum<sup>2)</sup>, S. De Wolf<sup>1)</sup> and C. Ballif<sup>1,2)</sup>

<sup>1)</sup>Photovoltaics and Thin Film Electronics Laboratory (PVLab), École Polytechnique Fédérale de Lausanne (EPFL), Switzerland, <sup>2)</sup>CSEM, Switzerland

13:45-14:00 6ThO.10.4

### **Cation Replacement in Lead Trihalide Perovskites: Broad Bandgap Tunability for Highly Efficient Planar Heterojunction Solar Cells**

Giles E. Eperon, Samuel D. Stranks, Christopher Menelaou, Michael B. Johnston, Laura M. Herz and Henry J. Snaith

Department of Physics, University of Oxford, Clarendon Laboratory, UK

14:00-14:15 6ThO.10.5

### **Inorganic Hole Conductor Based 12.4% Efficient Printed Photovoltaic Using MesoporousTiO<sub>2</sub>, Lead-halide Perovskite, and CuSCN**

Soichiro Tanaka<sup>1)</sup>, Peng Qin<sup>2)</sup>, Seigo Ito<sup>1)</sup>, Nicolas Tetreault<sup>2)</sup>, Kyohei Manabe<sup>3)</sup>, Hitoshi Nishino<sup>3)</sup>,

Mohammad Khaja Nazeeruddin<sup>2)</sup> and Michael Grätzel<sup>2)</sup>

<sup>1)</sup>Department of Electric Engineering and Computer Science, Graduate School of Engineering, University of Hyogo, Japan, <sup>2)</sup>Laboratory of Photonics and Interfaces, Department of Chemistry and Chemical Engineering, Swiss Federal Institute of Technology, Switzerland, <sup>3)</sup>Energy Technology Laboratories, Osaka Gas Co., Ltd., Japan

14:15-14:30 6ThO.10.6

### **Organometallic Perovskite Toward High Performing and Upscale Solar Cell**

Soo-Jin Moon, Jun-Ho Yum, Larent Sansonnens, Linus Löfgren, Sylvain Nicolay, Julien Bailat and Christophe Ballif

PV-center, Switzerland

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**Thursday, November 27**

**14:45-15:45 Room E**

**Area 6**

### **6ThO.11 Perovskite Solar Cells 3**

Chairpersons:

Hironori Arakawa (Tokyo University of Science, Japan)  
Liyuan Han (National Institute for Materials  
Science(NIMS), Japan)

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14:45-15:00 6ThO.11.1

### **The Chemical and Electronic Structure of Lead-iodide Perovskite and Its Interfaces**

M. Bär<sup>1,2,3)</sup>, G. Sadoughi<sup>4)</sup>, D. E. Starr<sup>1)</sup>, E. Handick<sup>1)</sup>, F. Meyer<sup>5)</sup>, A. Benkert<sup>5,6)</sup>, W. Yang<sup>7)</sup>, M. Gorgoi<sup>1)</sup>, M. Blum<sup>3)</sup>, L.. Weinhardt,<sup>3,6,8)</sup>, C. Heske,<sup>3,6,8)</sup>, R. G. Wilks<sup>1)</sup> and H. Snaith<sup>4)</sup>

<sup>1)</sup>Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Germany, <sup>2)</sup>Institut für Physik und Chemie, Brandenburgische Technische Universität Cottbus-Senftenberg, Germany, <sup>3)</sup>Department of Chemistry, University of Nevada, USA, <sup>4)</sup>Department

of Physics, Clarendon Laboratory, University of Oxford, UK, <sup>5)</sup>Experimentelle Physik 7, Universität Würzburg, Germany, <sup>6)</sup>Institute for Photon Science and Synchrotron Radiation, Karlsruhe Institute of Technology, Germany, <sup>7)</sup>Advanced Light Source, Lawrence Berkeley National Laboratory, USA, <sup>8)</sup>ANKA Synchrotron Radiation Facility, Karlsruhe Institute of Technology, Germany

**15:00-15:15 6ThO.11.2**

**Highly Stable Hole-transporting Layer for Perovskite Solar Cells Based on Functionalized Single-walled Carbon Nanotubes**

Severin N. Habisreutinger, Tomas Leijtens, Giles E. Eperon, Samuel D. Stranks, Henry J. Snaith and Robin J. Nicholas

Clarendon Laboratory, Department of Physics, University of Oxford, United Kingdom

**15:15-15:30 6ThO.11.3**

**Materials Development for Perovskite-based DSSC**

K. Kawata, K. Tamaki, T. Goto and K. Kato  
Merck Ltd., Japan

**15:30-15:45 6ThO.11.4**

**Kelvin Probe Force Microscopy Study of Perovskite-Based Solar Cells**

J. Yun<sup>1)</sup>, S. Woo<sup>1)</sup>, J. Seidel<sup>2)</sup>, A. Ho-Baillie<sup>1)</sup> and M. Green<sup>1)</sup>

<sup>1)</sup>School of Photovoltaics and Renewable Energy Engineering, University of New South Wales, Australia,  
<sup>2)</sup>School of Materials Science and Engineering, University of New South Wales, Australia

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**Thursday, November 27**

**13:00 - 14:25 Room D**

**Area 4**

**4sThO.12 Crystalline Silicon Solar Cells: Past, Present and Future 3**

Chairperson:  
Noritaka Usami (Nagoya University, Japan)

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13:00-13:25 4sThO.12.1

**⟨Invited⟩ Solar Power Generation: a Huge Contribution to the Human Beings**

Hiroshi Morimoto

Sharp Corporation

3:25-13:45 4sThO.12.2

**⟨Invited⟩ Crystal Growth Technologies for Si Solar Cells on the View Point of Dislocations**

Kazuo Nakajima

FUTURE-PV Innovation, JST Koriyama Site, Japan

13:45-14:05 4sThO.12.3

**⟨Invited⟩ Recent Progress of Multi-crystalline Silicon for Photovoltaic Industry**

C. W. Lan<sup>1)</sup>, Y. M. Yang<sup>2)</sup>, A. Yu<sup>2)</sup>, B. Hsu<sup>2)</sup>, W. C. Hsu<sup>2)</sup>, A. Yang<sup>3)</sup>

<sup>1)</sup>Department of Chemical Engineering, National Taiwan University, Taiwan, <sup>2)</sup>Sino-American Silicon Productions Inc., Taiwan, <sup>3)</sup>Solartech Energy Inc., Taiwan

14:05-14:25 4sThO.12.4

**⟨Invited⟩ Activities of Korea Photovoltaic Development Organization (KPVDO, 2004~2008) and the Evolution of PV Technology and Industry in Korea**

Donghwan Kim<sup>1)</sup>, Hae-Seok Lee<sup>1)</sup>, and Yoonmook Kang<sup>2)</sup>

<sup>1)</sup>Department of Materials Science and Engineering, Korea University, Seoul, Korea, <sup>2)</sup>KU-KIST Green School, Graduate School of Energy and Environment Korea University, Seoul, Korea

**14:45 - 16:10 Room D****Area 4****4ThO.13 c-Si PV: Crystallization, Feedstock**

Chairpersons:

Koji Arafune (University of Hyogo, Japan)

Chung Wen Lan (National Taiwan University, Taiwan)

**14:45-15:10      4ThO.13.1****⟨Invited⟩ Characterization of Dislocations and Oxygen Precipitates in Photovoltaic Si by Deep-Level Photoluminescence**

M. Tajima<sup>1,2)</sup>, G. Kato<sup>1,2)</sup>, Y. Iwata<sup>1)</sup>, K. Komatsu<sup>1)</sup>, H. Toyota<sup>1)</sup> and A. Ogura<sup>2)</sup>

<sup>1)</sup>Institute of Space and Astronautical Science / JAXA, Japan, <sup>2)</sup>Meiji University, Japan

**15:10-15:25      4ThO.13.2****Application of Three-dimensional Alexander-haasen Model to Analyzing Experimental Dislocation-density Distribution in Single-crystal Silicon**

B. Gao<sup>1)</sup>, J. Karolin<sup>2)</sup>, S. Nakano<sup>1)</sup>, H. Harada<sup>2)</sup>, Y. Miyamura<sup>2)</sup>, T. Sekiguchi<sup>2)</sup> and K. Kakimoto<sup>1)</sup>

<sup>1)</sup>Research Institute for Applied Mechanics, Kyushu University, Japan, <sup>2)</sup>National Institute for Materials Science, Japan

**15:25-15:40      4ThO.13.3****Characterization of Silicon Ingots: Mono-like vs. HP Multicrystalline**

K. Kutsukake<sup>1,2)</sup>, M. Deura<sup>1)</sup>, Y. Ohno<sup>1)</sup> and I. Yonenaga<sup>1)</sup>

<sup>1)</sup>Tohoku University, Japan, <sup>2)</sup>JST PRESTO, Japan

**15:40-15:55      4ThO.13.4****Comparison of Phosphorus Gettering Effect in Faceted Dendrite and Small Grain of Multicrystalline Silicon Wafers Grown by Floating Cast Method**

S. Joonwichien, I. Takahashi, S. Matsushima and N. Usami

Graduate School of Engineering, Nagoya University,  
JAPAN

15:55-16:10      4ThO.13.5

**Update on Recent Results and Development from  
Ingot to Module Level for the Compensated Elkem  
Solar Silicon (ESS<sup>®</sup>) Feedstock**

K. Friestad<sup>1)</sup>, J. O. Odden<sup>1)</sup>, A. K. Soiland<sup>1)</sup>, T. Buseth<sup>2)</sup>, H. Date<sup>3)</sup> and T. Ulset<sup>1)</sup>

<sup>1)</sup>Elkem Solar AS, Norway, <sup>2)</sup>Elkem Technology, Norway,

<sup>3)</sup>Elkem Japan KK, Japan

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**Tuesday, November 25****10:15 - 11:30 Annex****Area 1****1TuPo.1 Si-Based Novel Technologies and Light Management Concepts**

Chairpersons:

Seth Hubbard (Rochester Institute of Technology, USA)  
Koji Matsubara (AIST, Japan)**1TuPo.1.1****Effect of Anodization Process of Aluminum Oxide Template on Selective Growth of Si Nanowires**Van Hoang NGUYEN<sup>1,2)</sup>, Sergii TUTASHKONKO<sup>1,2)</sup>,  
Yusuke HOSHI<sup>1)</sup> and Noritaka USAMI<sup>1,2)</sup><sup>1)</sup>MEXT, FUTURE-PV Innovation, Japan Science  
and Technology Agency (JST), <sup>2)</sup>Graduate School of  
Engineering, Nagoya University**1TuPo.1.2****Efficiency Enhancement of Si Solar Cells through  
a Downshifting and Antireflective Oxsulfide  
Phosphor Layer**Wen-Bin Hung and Teng-Ming ChenPhosphor Research Laboratory, Department of Applied  
Chemistry National Chiao Tung University, Taiwan**1TuPo.1.3****The Next Generation Coating Material for PV**Yasukazu Kishimoto<sup>1)</sup>, YingYing Fan<sup>1)</sup> and Toru  
Yoshida<sup>2)</sup><sup>1)</sup>KIES New Energy Co., Ltd., China, <sup>2)</sup>MORESCO  
Corporation, Japan**1TuPo.1.4****A Versatile Optical Model for Optimization of  
Advanced Solar Cell Concepts**R. Santbergen<sup>1)</sup>, J. M. Veerhoek<sup>2)</sup>, J. L. Linden<sup>2)</sup>, V.  
Geyer<sup>2)</sup>, A. H. M. Smets<sup>1)</sup> and M. Zeman<sup>1)</sup>

<sup>1)</sup>Photovoltaic Materials and Devices laboratory, Delft University of Technology, the Netherlands, <sup>2)</sup>Scheuton, the Netherlands

### 1TuPo.1.5

#### **A Proposal of Photonic Nanostructures Coupled with Textured Si Substrates for Advanced Light Trapping**

Y. Hoshi<sup>1)</sup>, T. Tayagaki<sup>2)</sup>, Y. Kishimoto<sup>2)</sup> and N. Usami<sup>1)</sup>

<sup>1)</sup>Graduate School of Engineering, Nagoya University, Japan, <sup>2)</sup>Institute for Chemical Research, Kyoto University, Japan

### 1TuPo.1.6

#### **Development of New Production Technology for High-Purity SiH<sub>4</sub> Based on Hydrogen Plasma Etching of Metallurgical-Grade Si: Optimization of Surface Temperature and H<sub>2</sub> Flow Rate for Si Etch Rate**

T. Yamada<sup>1,2)</sup>, K. Yamada<sup>1)</sup>, T. Hirano<sup>1)</sup>, H. Ohmi<sup>1,2)</sup>, H. Kakiuchi<sup>1,2)</sup> and K. Yasutake<sup>1,2)</sup>

<sup>1)</sup>Department of Precision Science and Technology, Graduate School of Engineering, Japan, <sup>2)</sup>Japan Science and Technology Agency, CREST, Japan

### 1TuPo.1.7

#### **Optical Design of 4-terminal Solar Modules Combining CuGaSe<sub>2</sub> and IBC c-Si Cells**

D. Zhang, W. Soppe and R. E. I. Schropp

ECN-Solliance, the Netherlands

### 1TuPo.1.8

#### **Optical Design for the Performance Improvement of Heterojunction Silicon Nanowire Solar Cells**

Y. Kurokawa<sup>1,2)</sup>, Y. Yamada<sup>1)</sup>, M. Yano<sup>1)</sup> and A. Yamada<sup>1,3)</sup>

<sup>1)</sup>Department of Physical Electronics, Tokyo Institute of Technology, Japan, <sup>2)</sup>PRESTO, Japan Science and Technology Agency (JST), Japan, <sup>3)</sup>Photovoltaics Research Center (PVREC), Tokyo Institute of

Technology, Japan

### 1TuPo.1.9

#### **Optical Approach of Solar Cell Efficiency Enhancement Using Plasmonic Nanowires**

Y. Feng, J. Yang, S. Lin, S. Huang, S. Shrestha and G. Conibeer

School of Photovoltaic and Renewable Energy Engineering, Australia

### 1TuPo.1.10

#### **Geometry in Si-based Photonic Nanostructures Coupled with Ge Quantum Dot Multilayers and Its Impact on Optical Properties**

O. Aonuma<sup>1)</sup>, Y. Hoshi<sup>1)</sup>, T. Tayagaki<sup>2)</sup>, A. Novikov<sup>3)</sup>, D. Yurasov<sup>3,4)</sup> and N. Usami<sup>1)</sup>

<sup>1)</sup>Graduate School of Engineering, Nagoya University, Japan, <sup>2)</sup>Institute for Chemical Research, Kyoto University, Japan, <sup>3)</sup>Institute for Physics of Microstructures, Russian Academy of Science, Russia,  
<sup>4)</sup>Nizhny Novgorod State University, Russia

### 1TuPo.1.11

#### **Nanoparticles Seeded Single-crystal Si Nanowires Growth for Good Trapping Incident Light Within Solar Cells**

Xiaomei Zhang<sup>1,2)</sup>, Kairi Yamada<sup>1)</sup>, Hiroshi. Akita<sup>1)</sup> and Manabu Ihara<sup>1)</sup>

<sup>1)</sup>Tokyo Institute of Technology, Department of Chemistry, Japan, <sup>2)</sup>Japan Science and Technology Agency, FUTURE-PV Innovation, Fukushima Renewable Energy Institute, Japan

### 1TuPo.1.12

#### **Plasmonic Degradation and Its Effect on Solar Cell Properties**

S. Pillai, Y. Yang, C. F. J. Lau, C. Disney, Y. Jiang and M. A. Green

Australian Centre for Advanced Photovoltaics,

University of New South Wales, Australia

**1TuPo.1.13**

**Application of Heterojunction to Si-based Solar Cells Using Photonic Nanostructures Coupled with Vertically Aligned Ge Quantum Dots**

I. Takahashi<sup>1)</sup>, Y. Hoshi<sup>1)</sup>, T. Tayagaki<sup>2)</sup>, T. Oikawa<sup>3)</sup>, K. Ohdaira<sup>3)</sup> and N. Usami<sup>1)</sup>

<sup>1)</sup>Nagoya University, Japan, <sup>2)</sup>Kyoto university, Japan, <sup>3)</sup>Japan Advanced Institute of Science and Technology, Japan

**1TuPo.1.14**

**Angular Response of Nano-sphere Lithography based Rear Reflectors for Thin Silicon Solar Cells**

Claire Disney<sup>1)</sup>, Supriya Pillai<sup>1)</sup>, Qi Xu<sup>1,2)</sup>, Craig Johnson<sup>1)</sup> and Martin Green<sup>1)</sup>

<sup>1)</sup>University of New South Wales, Australia, <sup>2)</sup>Tsinghua University, China

**1TuPo.1.15**

**Solar Cell with Metal-Oxide-Semiconductor to Suppress the Carrier Recombination**

Kohei Oki, Shota Wakamiya, Naoto Matsuo and Akira Heya

Department of Materials Science and Chemistry  
University of Hyogo, Japan

**1TuPo.1.16**

**Fast Formation of Poly-Si Thin Films with 200um Grains by Aluminum-Induced Crystallization with a Temperature Profiling**

Sergii Tutashkonko<sup>1,2)</sup>, Van Hoang Nguyen<sup>1,2)</sup> and Noritaka Usami<sup>1,2)</sup>

<sup>1)</sup>MEXT, FUTURE-PV Innovation, Japan Science and Technology Agency (JST), Japan, <sup>2)</sup>Graduate School of Engineering, Nagoya University, Japan

**1TuPo.1.17****Thin-Film GaAs Solar Cells Mechanically Stacked on Plasmonic Substrates**

H. Mizuno<sup>1)</sup>, K. Makita<sup>2)</sup>, Y. Hozumi<sup>2)</sup>, H. Sai<sup>2)</sup>, K. Matsubara<sup>2)</sup> and H. Takato<sup>1)</sup>

<sup>1)</sup>Renewable Energy Research Center, Fukushima Renewable Energy Institute, National Institute of Advanced Industrial Science and Technology, Japan,

<sup>2)</sup>Research Center for Photovoltaic Technologies, National Institute of Advanced Industrial Science and Technology, Japan

**1TuPo.1.18****Withdrawn****1TuPo.1.19****Enhanced Light Harvesting of InN with Various Growth Temperature Using Indium-Tin Oxide Nanowhiskers**

Lung-Hsing Hsu<sup>1)</sup>, Chien-Chung Lin<sup>2)</sup>, Peichen Yu<sup>3)</sup>, Hau-Vei Han<sup>3)</sup>, Da-Wei Lin<sup>3)</sup> and Hao-Chung Kuo<sup>3)</sup>

<sup>1)</sup>Institute of Lighting and Energy Photonics, National Chiao Tung University, Taiwan, <sup>2)</sup>Institute of Photonic System, National Chiao Tung University, Taiwan,

<sup>3)</sup>Department of Photonic & Institute of Electro-Optical Engineering, National Chiao Tung University, Taiwan

**1TuPo.1.20****Maskless Broadband Antireflection Technology on Glass for Flat and Concentrator PV**

E. E. Tamayo R.<sup>1,2)</sup>, K. Watanabe<sup>1)</sup>, T. Hoshii<sup>1,2)</sup>, R. Tamaki<sup>1)</sup>, M. Sugiyama<sup>2)</sup>, Y. Shoji<sup>1)</sup>, Y. Okada<sup>1,2)</sup>, and K. Miyano<sup>1)</sup>

<sup>1)</sup>Research Center for Advanced Science and Technology (RCAST), The University of Tokyo, Japan,

<sup>2)</sup>School of Engineering, The University of Tokyo, Japan

### 1TuPo.1.21

#### **Relaxed Ge Film on Porous Si for Virtual Ge Substrate**

S. Lee, X. Hao, A. Ho-Baillie and M. A. Green

School of Photovoltaic and Renewable Energy Engineering, University of New South Wales, Australia

### 1TuPo.1.22

#### **Harnessing Plasmonics for Flexible CIGS Thin-film Photovoltaics**

Shih-Chen Chen<sup>2)</sup>, Yi-Ju Chen<sup>3)</sup>, Wei-Ting Chen<sup>4)</sup>, Yu-Ting Yen<sup>3)</sup>, Tsung-Sheng Kao<sup>1)</sup>, Tung-Po Hsieh<sup>5)</sup>, Yu-Lun Chueh<sup>3)</sup>, Martin D. B. Charlton<sup>6)</sup>, Din-Ping Tsai<sup>4,7)</sup> and Hao-Chung Kuo<sup>1)</sup>

<sup>1)</sup>Department of Photonics and Institute of Electro-Optical Engineering, National Chiao-Tung University, Taiwan, <sup>2)</sup>Department of Electrophysics, National Chiao-Tung University, Taiwan, <sup>3)</sup>Department of Materials Science and Engineering, National Tsing Hua University, Taiwan, <sup>4)</sup>Department of Physics and Graduate Institute of Applied Physics, National Taiwan University, Taiwan, <sup>5)</sup>Compound Semiconductor Solar Cell Department, Next Generation Solar Cell Division, Green Energy and Environment Research Laboratories, Industrial Technology Research Institute, Taiwan, <sup>6)</sup>School of Electronics and Computer Science, University of Southampton, United Kingdom, <sup>7)</sup>Research Center for Applied Sciences, Academia Sinica, Taiwan

### 1TuPo.1.23

#### **A Rapid Thermal Process for Silicon Recycle and Refining from Cutting Kerf-loss Slurry**

C. F. Yang, H. P. Hsu and C. W. Lan

Department of Chemical Engineering, National Taiwan University, Taiwan

**1TuPo.1.24****Enhanced Light Absorption in Thin Film Solar Cells Using Al Nanoparticles Supporting Surface Plasmon Polaritons**

Huiying Hao, Ming He, Jingjing Dong, Hua Gao and Jie Xing

School of Science, China University of Geosciences, China

**1TuPo.1.25****Cylindrical and Square Fibre Luminescent Solar Concentrators Compared**

J. J. H. Videira<sup>1)</sup>, E. Bilotti<sup>2,3)</sup> and A. J. Chatten<sup>1)</sup>

<sup>1)</sup>Department of Physics, Imperial College London, UK, <sup>2)</sup>School of Engineering and Materials Science, Queen Mary University of London, UK, <sup>3)</sup>Nanoforce Technology Ltd., Queen Mary University of London, UK

**1TuPo.1.26****The Formation of Thin Poly-si Films on Textured TCO by Flash Lamp Annealing**

T. Watanabe and K. Ohdaira

Japan Advanced Institute of Science and Technology, Japan

**1TuPo.1.27****Laser Nd:YAG Texturing for Lower Cost and High Efficiency c-Si Solar Cell**

Nurul Huda Abdul Razak<sup>1)</sup> and Nowshad Amin<sup>1,2)</sup>

<sup>1)</sup>Department of Electrical, Electronic and Systems Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, Malaysia, <sup>2)</sup>Solar Energy Research Institute (SERI), Universiti Kebangsaan Malaysia, Malaysia

## 1TuPo.1.28 LN

### Transmittance and Fermi Level Modulation in Graphene and Its Study with Graphene/Silicon Solar Cell

S. Adhikari<sup>1,2)</sup>, Y. H. Lee<sup>1,2)</sup>

<sup>1)</sup>IBS Center for Integrated Nanostructure Physics (CINAP), Institute for Basic Science (IBS), Sungkyunkwan University, Korea <sup>2)</sup>Department of Energy Science, Sungkyunkwan University, Korea

## 1TuPo.1.29 LN

### Growth and Characterization of $\text{Si}_{1-x-y}\text{Sn}_x\text{C}_y$ Ternary Alloy Thin Films for Solar Cell Application

T. Yamaha<sup>1)</sup>, H. Oda<sup>1)</sup>, M. Kurosawa<sup>1,2)</sup>, W. Takeuchi<sup>1)</sup>, O. Nakatsuka<sup>1)</sup>, and S. Zaima<sup>1)</sup>

<sup>1)</sup>Grad. Schl of Eng., Nagoya Univ., Japan, <sup>2)</sup>Research Fellow of JSPS, Japan

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**Tuesday, November 25**

**13:00 - 14:25 Annex**

**Area 1**

## 1TuPo.2 New Materials and Emerging Technologies

Chairpersons:

Jean-François Guillemoles (NextPV, Joint CNRS and RCAST Laboratory, France/Japan)

Yasuaki Ishikawa (Nara Institute of Science and Technology, Japan)

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## 1TuPo.2.1

### Light Trapping for Emission from Photovoltaic Cells Used Under Monochromatic Illumination

Y. Takeda<sup>1)</sup>, H. Iizuka<sup>1)</sup>, T. Ito<sup>1)</sup>, S. Mizuno<sup>1)</sup>, K. Hasegawa<sup>1)</sup>, T. Ichikawa<sup>1)</sup>, H. Ito<sup>1)</sup>, T. Kajino<sup>1)</sup>, K. Higuchi<sup>1,2)</sup>, A. Ichiki<sup>2)</sup> and T. Motohiro<sup>2)</sup>

<sup>1)</sup>Toyota Central Research and Development Laboratories, Inc., Japan, <sup>2)</sup>Green Mobility Collaborative Research Center, Nagoya University, Japan

**1TuPo.2.2****Interface Engineering for Efficient and Stable Chemical-Doping-Free Graphene-on-Silicon Solar Cell by Introducing a Graphene Oxide Interlayer**

Lifei Yang, Xuegong Yu, Mingshen Xu, Hongzheng Chen and Deren Yang

State Key Lab of Silicon Materials Department of Materials Science and Engineering Zhejiang University, P. R. China

**1TuPo.2.3****Effects of Nitrogen Content on the Photovoltaic Properties of Nitrogen Doped Amorphous Carbon/Fullerene Junctions**

T. Soga, A. Mimuro, N. Kishi and Y. Hayashi

Nagoya Institute of Technology, Japan

**1TuPo.2.4****Predictive Modeling of Electronic and Absorption Properties of Novel CuInS<sub>2</sub> Wurtzite Phase: Implications To PV Applications**

S. Tomić<sup>1)</sup>, L. Bernasconi<sup>2)</sup>, B. G. Searle<sup>3)</sup> and N. M. Harrison<sup>4)</sup>

<sup>1)</sup>University of Salford, UK, <sup>2)</sup>STFC Rutherford-Appleton Laboratories, UK, <sup>3)</sup>STFC Daresbury Laboratories, UK,

<sup>4)</sup>Imperial College London, UK

**1TuPo.2.5****High Temperature Photonics for Effective Solar-thermophotovoltaic Systems**

M. Shimizu, A. Kohiyama, F. Iguchi and H. Yugami

Graduate School of Engineering, Tohoku University, Japan

**1TuPo.2.6****A Thin Film Nc-Si:H/Silicon Wafer Heterojunction Tandem Solar Cell for Silicon-based Photoelectrochemical Water Splitting**

R. Vasudevan, Z. Thanawala, L. Han, H. Tan, M. Zeman and A. H. M. Smets

Photovoltaic Materials and Devices (PVMD) Laboratory, Delft University of Technology, the Netherlands

#### 1TuPo.2.7

**Effect of Oxidation and Its Role in Carbon Nanotube Growth Via Quantum Confined Silicon Nanocrystals and Impact on Hybrid Silicon/Nano-carbon Devices**

C. Rocks<sup>1)</sup>, S. Mitra<sup>1)</sup>, V. Svrcek<sup>2)</sup> and D. Mariotti<sup>1)</sup>

<sup>1)</sup>Nanotechnology & Integrated Bio-Engineering Centre (NIBEC), University of Ulster, UK , <sup>2)</sup>Research Center for Photovoltaics, National Institute of Advanced Industrial Science and Technology (AIST), Japan

#### 1TuPo.2.8

**AgInTe<sub>2</sub> Thin Films by Sputtering Deposition for Narrow Bandgap Thin Film Solar Cells**

Abdullah Uzum, Naoya Takahashi and Seigo Ito

Department of Electrical Engineering and Computer Sciences University of Hyogo, Japan

#### 1TuPo.2.9

**Fabrication of Size-controlled Quantum Dots for Electron Energy Selective Contact for Thermionic Applications to Convert Solar Energy to Electricity**

Y. Kusano, A. Ichiki and T. Motohiro

Green Mobility Collaborative Research Center, Nagoya University, Japan

#### 1TuPo.2.10

**Enhancement of Water Splitting Efficiency by Hydrogenation of TiO<sub>2</sub> Nanotubes with H<sub>2</sub>, H<sub>2</sub>O, HCOOH and CH<sub>3</sub>OH under Moderate Temperature and Pressure Conditions**

Tsai-Te Wang, Yung-Lin Chang, J. C. Li, P. Raghunath and M. C. Lin

Center for Interdisciplinary Molecular Science,  
Department of Applied Chemistry National Chiao Tung  
University, Taiwan

#### 1TuPo.2.11

### I-V Characteristics of $\text{In}_x\text{Ga}_{1-x}\text{As}$ and Si Photocells Under the Illumination of a $1.06\mu\text{m}$ Laser Which is to Be the Output of Solar-pumped Lasers

D. Kanou<sup>1)</sup>, H. Ito<sup>2)</sup>, A. Ichiki<sup>3)</sup>, K. Hasegawa<sup>2)</sup>, S.  
Mizuno<sup>2)</sup>, T. Ichikawa<sup>2)</sup>, T. Ito<sup>2)</sup>, T. Kajino<sup>2)</sup>, Y. Takeda<sup>2)</sup>, K.  
Higuchi<sup>2,3)</sup> and T. Motohiro<sup>1,2,3)</sup>

<sup>1)</sup>Department of Material Sciences and Engineering,  
Nagoya University, Japan, <sup>2)</sup>Toyota Central Research  
and Development Laboratories, Inc., Japan, <sup>3)</sup>Green  
Mobility Collaborative Research Center, Nagoya  
University, Japan

#### 1TuPo.2.12

### Carbon Based Solar Cells with Graphene

M. Umeno, S. Adhikari and D. C. Ghimire, H. Uchida

Department of Electronics and Information  
Engineering, Chubu University, Japan

#### 1TuPo.2.13

### The Photoelectrochemical Performances of Silver- Tin-Selenide Thin Films Using Selenization of Thermal Evaporated Metal Precursors

Kong-Wei Cheng and Yi Chiu and Wei-Tseng Tsai

Department of Chemical and Materials Engineering,  
Chang Gung University, Taiwan

#### 1TuPo.2.14

### MOVPE Growth of Thick (~1 $\mu\text{m}$ ) InGaN on AlN/Si Substrates for InGaN/Si Tandem Solar Cell

A. Yamamoto<sup>1,2)</sup>, Md. Tanvir Hasan<sup>1,2)</sup>, N. Shigekawa<sup>3)</sup>  
and M. Kuzuhara<sup>1)</sup>

<sup>1)</sup>University of Fukui, Japan, <sup>2)</sup>JST-CREST, Japan,  
<sup>3)</sup>Osaka City University, Japan

### 1TuPo.2.15

#### **Effects of Surface Treatment on Type II Ge Clathrate Films**

F. Ohashi, T. Sugiyama, I. Funato, R. Himeno, T. Kume, T. Ban and S. Nonomura

Faculty of Engineering, Gifu University, Japan

### 1TuPo.2.16

#### **Demonstration of N-polar InGaN/GaN MQW Solar Cells with Possibility of Promoting Photocarrier Extraction**

T. Tanikawa<sup>1,2)</sup>, J. H. Choi<sup>1,2)</sup>, K. Shojiki<sup>1)</sup>, R. Katayama<sup>1,2)</sup> and T. Matsuoka<sup>1, 2)</sup>

<sup>1)</sup>Institute for Materials Research, Tohoku University, Japan, <sup>2)</sup>CREST, Japan Science and Technology Agency, Japan

### 1TuPo.2.17

#### **Application of Zonyl Fluorosurfactant on Silicon Nanowire/Organic Heterojunction Solar Cells**

H.-J. Syu<sup>1)</sup>, T. Subramani<sup>1)</sup>, S.-C. Shiu<sup>1)</sup> and C.-F. Lin<sup>1,2,3,4)</sup>

<sup>1)</sup>Graduate Institute of Photonics and Optoelectronics, National Taiwan University, Taiwan, <sup>2)</sup>Graduate Institute of Electronic Engineering, National Taiwan University, Taiwan, <sup>3)</sup>Department of Electrical Engineering, National Taiwan University, Taiwan, <sup>4)</sup>Innovative Photonics Advanced Research Center, National Taiwan University, Taiwan

### 1TuPo.2.18

#### **LO-Phonon Lifetime Calculations for Hot Carrier Solar Cell Materials**

S. Laribi, H. Levard and J.-F. Guillemoles

IRDEP Institute of Research and Development on Photovoltaic Energy, France

**1TuPo.2.19****Self-regeneration Mechanism and Self-organization of Nano-structures by Spinodal Nano-decomposition in Perovskite  $\text{CsSn}(\text{I}_{1-x},\text{Cl}_x)_3$  and  $\text{CsSn}(\text{I}_{1-x},\text{Br}_x)_3$  for the Low-Cost, Environment-Friendly and High-Efficiency Photovoltaic Solar Cells**

T. Fukushima<sup>1)</sup>, K. Sato<sup>2,3)</sup>, H. Asahina<sup>1)</sup> and H. Katayama-Yoshida<sup>1)</sup>

<sup>1)</sup>Department of Materials Engineering Science, Graduate School of Engineering Science, Osaka University, Japan, <sup>2)</sup>PRESTO, Japan Science and Technology Agency (JST), Japan, <sup>3)</sup>Division of Materials and Manufacturing Science, Graduate School of Engineering, Osaka University, Japan

**1TuPo.2.20****Evaluation of Optical Properties of  $\text{Cu}_2\text{O}$  Ceramics Prepared by Thermal Oxidation**

H. Nakahara, J. Ueda and S. Tanabe

Kyoto University, Japan

**1TuPo.2.21****New Concept of Photovoltaic Solar Cell Based on Spontaneous Electric Field in Polar Semiconductors**

S. Emura<sup>1)</sup> and K. Sato<sup>2)</sup>

<sup>1)</sup>The Institute of Scientific and Industrial Research, Osaka University, Japan, <sup>2)</sup>Division of Materials and Manufacturing Science, Graduate School of Engineering, Osaka University, Japan

**1TuPo.2.22****Optimized Methods for Increased Performance Photovoltaic Cells by Nanoparticles Integration**

Dr. E.-L. Niederhäuser<sup>1)</sup>, Dr. M. Wiatrowski<sup>2)</sup>, Dr. J. Ulanski<sup>2)</sup>, Dr. Alke Fink<sup>3)</sup> and Dr. Marc Jobin<sup>4)</sup>

<sup>1)</sup>Ecole d'ingénieurs et d'architectes de Fribourg (EIA-

FR), Switzerland, <sup>2)</sup>Lodz University of Technology, Poland, <sup>3)</sup>Adolphe Merkle Institute, University of Fribourg, Switzerland, <sup>4)</sup>Haute école du paysage, d'ingénierie et d'architecture (HEPIA), Switzerland

#### 1TuPo.2.23

### **CuInS<sub>2</sub>/CdS Tetrapod Nanostructures for Efficient Photovoltaic Devices**

Bomi Kim and Sungjee Kim

Department of Chemistry, Pohang University of Science and Technology, South Korea

#### 1TuPo.2.24

### **Approach to Boost up V<sub>oc</sub>: Transparent Double Junction Structure**

Juhhyung Yun<sup>1)</sup>, Seungmoo Lee<sup>1)</sup>, Jaihyung Won<sup>1)</sup>, Joondong Kim<sup>2)</sup>, Wayne A. Anderson<sup>3)</sup>

<sup>1)</sup>Thin Film Technology Team, Samsung Electronics, Korea, <sup>2)</sup>Dept. of Electrical Engineering, Incheon National University, Korea, <sup>3)</sup>Dept. of Electrical Engineering, University at Buffalo, USA

#### 1TuPo.2.25

### **Can Thermodynamics Help Us to Improve the Operation of Solar Cells ?**

T. Markwart

Solar Energy Laboratory, University of Southampton, UK

#### 1TuPo.2.26

### **Electrochemical Formation of Calcium Silicide on Silicon Substrate in CaCl<sub>2</sub>-KCl Melt**

S. Takashima<sup>1)</sup>, S. Ueda<sup>1)</sup>, T. Goto<sup>1)</sup> and K. Hachiya<sup>2)</sup>

<sup>1)</sup>Department of Environmental System Science, Doshisha University, Japan, <sup>2)</sup>Department of Fundamental Energy Science, Kyoto University, Japan

**1TuPo.2.27****Formation of Titania Nanotube with Visible Light Activity by Electrochemical Reduction**

M. Kinoshita<sup>1)</sup>, T. Sasa<sup>1)</sup>, T. Goto<sup>1)</sup> and K. Hachiya<sup>2)</sup>

<sup>1)</sup>Department of Environmental System Science,  
Doshisha University, Japan, <sup>2)</sup>Department of  
Fundamental Energy Science, Kyoto University, Japan

**1TuPo.2.28LN****Synthesis and Characterization of CIBS Nanocrystals and Film with Addition of Sb by A Simple Solution Process for Photovoltaics Applications**

Cheng Han Tsai, Tsai Li Sung and Chie Gau

Institute of Aeronautics and Astronautics/Research Center for Energy Technology and Strategy, National Cheng Kung University, Taiwan

**1TuPo.2.29LN****Synthesis and Characterization of Oleylamine Capped Cu<sub>2</sub>ZnSn(S,Se)<sub>4</sub> Nanoparticles Using 1-dodecanethiol as Sulphur Source**

S. Ananthakumar<sup>1)</sup>, J. Ramkumar<sup>1)</sup>, S. Moorthy Babu<sup>1)</sup> and Y.Hayakawa<sup>2)</sup>

<sup>1)</sup>Crystal Growth Centre, Anna University, India,

<sup>2)</sup>Research Institute of Electronics, Shizuoka University, Japan

**1TuPo.2.30LN****Phase Selective Synthesis and Characterization of Cu<sub>1.81</sub>S Nanoparticles by Hot Injection Method**

M. Senthilkumar<sup>1)</sup>, J. Ramkumar<sup>1)</sup>, S. Ananthakumar<sup>1)</sup>, S. Moorthy Babu<sup>1)</sup> and Y.Hayakawa<sup>2)</sup>

<sup>1)</sup>Crystal growth centre, Anna University, India,

<sup>2)</sup>Research Institute of Electronics, Shizuoka University, Japan

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**Tuesday, November 25**

**14:45 - 16:10 Annex**

**Area 2**

**2TuPo.3 Thin Film Silicon Based Photovoltaics 1**

Chairpersons:

Takuya Matsui (AIST, Japan)

Kimihiko Saito (Fukushima University, Japan)

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**2TuPo.3.1**

**Hydrogen Mediated Double Layer ZnO: Al Films for High Efficiency Triple-junction Solar Cells**

Qian Huang, Dekun Zhang, Jian Ni, Lisha Bai, Bofei Liu, Changchun Wei, Ying Zhao and Xiaodan Zhang

Institute of photo electronics thin film devices and technique of Nankai university, Key laboratory of photo electronics thin film devices and technique of Tianjin, Key laboratory of optoelectronic information science and technology, Ministry of education, China

**2TuPo.3.2**

**Improved Light Harvesting in The Tandem Structured Thin-Film Silicon-Based Solar Cell Using A Very Thin LiF Intermediate Layer**

J. H. Yang<sup>1)</sup>, Y. H. Hong<sup>1)</sup>, Y. J. Lee<sup>1,2)</sup> and K. S. Lim<sup>1)</sup>

<sup>1)</sup>Department of Electrical Engineering, Korea Advanced Institute of Science and Technology, Republic of Korea, <sup>2)</sup>R&D Center, TG Optoelectronics Technology, Republic of Korea

**2TuPo.3.3**

**Thin film Poly-Si N-I-P Solar Cell Fabricated by Metal Induced Crystallization of Amorphous Si**

He LI, Guijun LI, Man WONG and Hoi Sing KWOK

State Key Laboratory on Advanced Displays and Optoelectronics Technologies, Department of Electronic and Computer Engineering, the Hong Kong University of Science and Technology, China

**2TuPo.3.4****Void-Hydrogen Structures in a-Si:H/c-Si Heterojunctions: Parameterization for Ellipsometry Analysis via Positron Annihilation Spectroscopy**

N. Matsuki<sup>1)</sup> and A. Uedono<sup>2)</sup>

<sup>1)</sup>Center for Innovative Photovoltaic Systems (CIPS), Gifu University, Japan, <sup>2)</sup>Division of Applied Physics, Faculty of Pure and Applied Science, University of Tsukuba, Japan

**2TuPo.3.5****LiF/AI as a Back Contact for Thin Film Solar Cells Based on Amorphous Silicon**

A. S. Togonal<sup>1,2,3)</sup>, D. Tondelier<sup>3)</sup>, B. Geffroy<sup>3,4)</sup>, J. C. Vanel<sup>3)</sup>, Y. Bonnassieux<sup>3)</sup>, Rusli<sup>1)</sup> and P. Roca i Cabarrocas<sup>3)</sup>

<sup>1)</sup>School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore,

<sup>2)</sup>CINTRA UMI CNRS/NTU/THALES, Singapore,

<sup>3)</sup>LPICM-CNRS, Ecole Polytechnique, France,

<sup>4)</sup>LICSEN, CEA Saclay IRAMIS/NIMBE, France

**2TuPo.3.6****Electrodeposition of Crystalline Silicon Films in Molten KF-KCl-K<sub>2</sub>SiF<sub>6</sub> at 923 K**

K. Maeda<sup>1)</sup>, K. Yasuda<sup>1,2)</sup>, T. Nohira<sup>1,3)</sup>, R. Hagiwara<sup>1)</sup> and T. Homma<sup>3,4)</sup>

<sup>1)</sup>Graduate School of Energy Science, Kyoto University, Japan, <sup>2)</sup>Environment, Safety, and Health Organization, Kyoto University, Japan, <sup>3)</sup>CREST, Japan Science and Technology Agency, Japan, <sup>4)</sup>Faculty of Science and Engineering, Waseda University, Japan

**2TuPo.3.7****The Effect of I/N Buffer Layer On the Performance of PIN Type Hydrogenated Microcrystalline Silicon Solar Cells**

Lisha Bai, Bofei Liu, Ze Chen, Qian Huang, Dekun Zhang, Jian Sun, Changchun Wei, Ying Zhao and

Xiaodan Zhang

Institute of Photo Electronics thin Film Devices and Technology of Nankai University, Key Laboratory of Photoelectronic Thin Film Devices and Technology, P. R. China

## 2TuPo.3.8

### **Fabrication of a-Si:H Layers with Very Low SiH<sub>2</sub> Contents by Reactive Magnetron Sputtering Using a New Process**

T. Fujiseki, M. Sato and H. Fujiwara

Center of Innovative Photovoltaic Systems (CIPS), Gifu University, Japan

## 2TuPo.3.9

### **Simulation Study of Electrical Properties of Window Layers in a-Si:H Solar Cells**

C. Ke<sup>1,2)</sup>, N. Sahraei<sup>1,2)</sup>, R. Stangl<sup>1)</sup> and I. M. Peters<sup>1)</sup>

<sup>1)</sup>Solar Energy Research Institute of Singapore,  
National University of Singapore, Singapore,

<sup>2)</sup>Department of Electrical and Computer Engineering,  
National University of Singapore, Singapore

## 2TuPo.3.10

### **Bilayer TCO Structure as Front Electrode for Thin-film Silicon Solar Cell Applications**

X. Yan<sup>1)</sup>, S. Venkataraj<sup>1)</sup>, W. Li<sup>1,2)</sup> and A. G. Aberle<sup>1,2)</sup>

<sup>1)</sup>Solar Energy Research Institute of Singapore,  
National University of Singapore, Singapore,

<sup>2)</sup>Department of Electrical and Computer Engineering,  
National University of Singapore, Singapore

## 2TuPo.3.11

### **A New Formation Process of Crystalline Silicon Film by Molten Salt Electrolysis**

T. Nohira<sup>1,2)</sup>, K. Maeda<sup>1)</sup>, K. Yasuda<sup>1,3)</sup>, R. Hagiwara<sup>1)</sup> and T. Homma<sup>2,4)</sup>

<sup>1)</sup>Graduate School of Energy Science, Kyoto University,

Japan, <sup>2)</sup>CREST, Japan Science and Technology Agency, Japan, <sup>3)</sup>Environment, Safety, and Health Organization, Kyoto University, Japan, <sup>4)</sup>Faculty of Science and Engineering, Waseda University, Japan

## 2TuPo.3.12

### **Textured Zn<sub>1-x</sub>Mg<sub>x</sub>O as a Light Scattering Layer for Thin-film Silicon Solar Cells**

H. Konishi, Y. Tsuda, T. Shinagawa, H. Tokioka and H. Fuchigami

Advanced Technology R&D Center, Mitsubishi Electric Corporation, Japan

## 2TuPo.3.13

### **Parasitic Absorption Loss by Surface Plasmon Polariton in Thin Film Solar Cells**

Guijun. Li, He. Li and Hoi-Sing Kwok

State Key Lab on Advanced Displays and Optoelectronics Technologies, Hong Kong University of Science and Technology, Hong Kong

## 2TuPo.3.14

### **Low Temperature Processed a-SiO:H/a-Si:H Tandem Cells for Full Spectrum Solar Cells**

D. W. Kang<sup>1)</sup>, P. Sichanugrist<sup>1)</sup> and M. Konagai<sup>1,2)</sup>

<sup>1)</sup>Department of Physical Electronics, Tokyo Institute of Technology, Japan, <sup>2)</sup>Photovoltaic Research Center (PVREC), Tokyo Institute of Technology, Japan

## 2TuPo.3.15

### **Characterization of the Local Network Structures at a-SiC:H/a-Si:H Interface by Real-time Diagnostic Techniques**

M. Sato and H. Fujiwara

Center of Innovative Photovoltaic Systems (CIPS), Gifu University, Japan

## 2TuPo.3.16

### **Photonic Crystal Microcrystalline Silicon Solar Cells**

M. De Zoysa<sup>1,2)</sup>, K. Ishizaki<sup>1)</sup>, Y. Tanaka<sup>1)</sup>, T. Umeda<sup>1)</sup>, Y. Kawamoto<sup>1)</sup>, S. Fujita<sup>1)</sup> and S. Noda<sup>1)</sup>

<sup>1)</sup>Department of Electronic Science and Engineering, Kyoto University, Japan, <sup>2)</sup>Hakubi Center for Advanced Research, Kyoto University, Japan

## 2TuPo.3.17

### **Optimization of a-SiGeH Films for Using as the Bottom Cell of a-SiOHa-SiGeH Tandem Solar Cell Structure**

S. Inthisang, T. Krajangsang, J. Sritharathikhun, A. Hongsingthong, A. Limmanee, S. Kittisontirak, S. Jaroensathainchok, A. Moollakorn and K. Sriprapha

Solar Energy Technology Laboratory (STL), National Electronics and Computer Technology Center (NECTEC), Thailand

## 2TuPo.3.18

### **Single-Crystalline pin-Si Thin-Film Solar Cells Grown on Si Substrate by Sputter-Epitaxy**

Wenchang Yeh, Kyohei Tatebe and Keisuke Sugihara

Interdisciplinary Graduate School of Science and Engineering, Shimane University, Japan

## 2TuPo.3.19

### **Withdrawn**

## 2TuPo.3.20

### **Self-Aligned Series Connection of Amorphous Silicon Based Thin-Film Solar Cells Fabricated on Micro-Imprinted Polymer Film Substrates**

Y. J. Lee<sup>1,2)</sup>, Y. H. Hong<sup>1)</sup>, J. H. Yang<sup>1)</sup>, S. Kadokura<sup>3)</sup>, J. H. Lee<sup>2)</sup> and K. S. Lim<sup>1)</sup>

<sup>1)</sup>Department of Electrical Engineering, Korea Advanced Institute of Science and Technology,

Republic of Korea, <sup>2)</sup>R&D Center, TG Optoelectronics Technology, Republic of Korea, <sup>3)</sup>FTS corporation, Japan

## 2TuPo.3.21

### **Enhanced Short-wavelength Response by Low-temperature P-type $\mu$ c-SiO<sub>x</sub>:H as Highly Transparent Window Layer in Microcrystalline Silicon Solar Cells**

P. L. Chen, C. H. Hsu and C. C. Tsai

Department of Photonics, National Chiao Tung University, Taiwan

## 2TuPo.3.22

### **Electrical Characterization of Hydrogenated Amorphous Silicon Oxide Films**

T. Itoh<sup>1)</sup>, R. Katayama<sup>1)</sup>, K. Yamakawa<sup>1)</sup>, K. Matsui<sup>1)</sup>, M. Saito<sup>2)</sup>, S. Sugiyama<sup>2)</sup>, P. Sichanugrist<sup>3)</sup>, S. Nonomura<sup>1)</sup> and M. Konagai<sup>3)</sup>

<sup>1)</sup>Gifu University, Japan, <sup>2)</sup>Sharp Corporation, Japan,

<sup>3)</sup>Tokyo Institute of Technology, Japan

## 2TuPo.3.23

### **Changed to 3TuPo.5.29**

## 2TuPo.3.24

### **Graphene Transparent Electrode with Low Contact Barrier in Silicon Thin-Film Solar Cells**

R. Ishikawa<sup>1)</sup>, Y. Kurokawa<sup>2)</sup>, S. Miyajima<sup>2)</sup> and M. Konagai<sup>2)</sup>

<sup>1)</sup>Faculty of Engineering, Niigata University, Japan,

<sup>2)</sup>Department of Physical Electronics, Tokyo Institute of Technology, Japan

## 2TuPo.3.25

### **Sub-bandgap Defect Analysis of Amorphous Silicon by Fourier-transform Photocurrent Spectroscopy**

A. Bidiville and T. Matsui

National Institute of Advanced Industrial Science and Technology (AIST), Japan

**2TuPo.3.26**

**Modifying Plasmon Polaritons Resonant Absorption in Metal Back Reflector**

Z. Chen, X. Zhang, J. Liang, X. Liang, J. Sun, D. Zhang, X. Chen, Q. Huang, C. Wei and Y. Zhao

Institute of Photoelectronic Thin Film Devices and Technology, Nankai University, China

**2TuPo.3.27**

**Conversion Efficiency Improvement of SiGe:H Solar Cell by Changing RF Power and Using Si<sub>2</sub>H<sub>6</sub> Gas**

Yen-Chen Lai<sup>1)</sup>, Fang-I Lai<sup>1)</sup>, Ming-Hsuan Kao<sup>2,3)</sup>, Jia-Min Shieh<sup>2,3)</sup> and Chang-Hong Shen<sup>2)</sup>

<sup>1)</sup>Department of Photonics Engineering, Yuan-Ze University, Taiwan, <sup>2)</sup>National Nano Device Laboratories, Taiwan, <sup>3)</sup>Institute of Electro-Optical Engineering, National Chiao Tung University, Taiwan

**2TuPo.3.28**

**Effects of Gas Residence Time on Amount of Si Clusters Incorporated into a-Si:H Films**

S. Toko, Y. Torigoe, Y. Kanemitsu, H. Seo, N. Itagaki, K. Koga and M. Shiratani

Kyushu University, Japan

**2TuPo.3.29**

**Fabrication of P-N Junction Diode Using Amorphous Mg<sub>2</sub>Si-based Semiconductors as a Low Cost Solar Cell Material**

S. Hara and H. Fujiwara

Center of Innovative Photovoltaic Systems (CIPS), Gifu University, Japan

**2TuPo.3.30****Characterization of a-Si:H Photovoltaic Modules with Different B<sub>2</sub>H<sub>6</sub> Doping Concentration**

N. Silsirivanich<sup>1)</sup>, D. Chenvidhya<sup>1)</sup>, C. Jivacate<sup>1)</sup>, K. Kirtikara<sup>1)</sup>, K. Sriprapha<sup>2)</sup> and J. Sritharathikhun<sup>2)</sup>

<sup>1)</sup>CES Solar Cell Testing Center (CSSC), Thailand, Pilot Plant Development and Training Institute (PDTI), King Mongkut's University of Technology Thonburi (KMUTT), <sup>2)</sup>National Electronics and Computer Technology Center (NECTEC), National Science and Technology Development Agency (NSTDA), Thailand

**2TuPo.3.31****Ag/ZnO Back Reflectors on Stainless Steel for a-Si and a-Si/ $\mu$ c-Si Tandem Solar Cells**

Cheng Liu

Shanghai University, China

**2TuPo.3.32****Quantum Efficiency Simulation for Textured a-Si:H Solar Cells Based on Modified Optical Admittance Method**

D. Murata<sup>1)</sup>, T. Matsui<sup>2)</sup> and H. Fujiwara<sup>1)</sup>

<sup>1)</sup>Center of Innovative Photovoltaic Systems (CIPS), Gifu University, Japan, <sup>2)</sup>Research Center for Photovoltaic Technologies, National Institute of Advanced Industrial Science and Technology (AIST), Japan

**2TuPo.3.33****Dependence of Electrical Properties of IWO Films on the Post-annealing Process**

Leilei Shen<sup>1,3)</sup>, Fanying Meng<sup>1)</sup>, Jianhua Shi<sup>1)</sup>, Zhongdan Lu<sup>2)</sup>, Yucheng Liu<sup>1)</sup> and Zhengxin Liu<sup>1)</sup>

<sup>1)</sup>Research Center for New Energy Technology, Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, PR China, <sup>2)</sup>State Key Lab of PV Science and Technology,

Trina Solar Limited, PR China, <sup>3)</sup>University of Chinese Academy of Sciences, PR China

## 2TuPo.3.34

### New Anode Materials for Electrochemical Si Production in Molten Salts

A. Tabushi<sup>1)</sup>, Y. Sakanaka<sup>1)</sup>, T. Goto<sup>1)</sup>, F. Tsujii<sup>1)</sup>, K. Hirota<sup>2)</sup> and M. Kato<sup>2)</sup>

<sup>1)</sup>Department of Environmental System Science, Doshisha University, Japan, <sup>2)</sup>Department of Molecular Chemistry and Biochemistry, Doshisha University, Japan

## 2TuPo.3.35

### Effect of Surface Chemical Treatment of MOCVD-grown ZnO (TCO) Layers on The Microcrystalline Silicon Solar Cell Properties

S. Sugiyama<sup>1)</sup>, H. Sai<sup>2)</sup> and T. Matsui<sup>2)</sup>

<sup>1)</sup>Sharp Corporation, Japan, <sup>2)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan

## 2TuPo.3.36

### Elimination of Light Elements from Soluble Silica via Solvent Extraction using Flow-Type Reactor toward High-Purity Source for Solar-Grade Silicon

N. Matsuo<sup>1)</sup>, T. Ishihara<sup>1)</sup>, T. Oyanagi<sup>1)</sup>, K. Nakajima<sup>1)</sup>, Y. Fukunaka<sup>2,3)</sup> and T. Homma<sup>1,2,3)</sup>

<sup>1)</sup>Department of Applied Chemistry, Waseda University, Japan, <sup>2)</sup>JST, CREST, Japan, <sup>3)</sup>Nanotechnology Research Center, Waseda University, Japan

## 2TuPo.3.37

### Large-grained Ge Thin Films on Glass Formed by Al-induced Crystallization for Inexpensive Tandem Solar Cells

K. Toko<sup>1)</sup>, K. Nakazawa<sup>1)</sup>, N. Oya<sup>1)</sup>, N. Usami<sup>2)</sup> and T. Suemasu<sup>1)</sup>

<sup>1)</sup>Institute of Applied Physics, University of Tsukuba,

Japan, <sup>2)</sup>Materials, Phys. and Energy Eng., Nagoya Univ., Japan

### 2TuPo.3.38

#### **Periodically Textured Front Scattering and Back Reflective Electrodes Fabricated Using a Self-Assembled Polystyrene**

Xiaodan Zhang, Xuejiao Liang, Bofei Liu, Lisha Bai, Haibo Gao, Qian Huang, Xinliang Chen, Changchun Wei and Ying Zhao

Institute of Photo Electronics thin Film Devices and Technology of Nankai University, Key Laboratory of Photoelectronic Thin Film Devices and Technology, P. R. China

### 2TuPo.3.39

#### **High Open-circuit Voltage (>1.0 V) Approach by Hybrid Amorphous Silicon Carbide Intrinsic Material**

J. Ma, J. Ni , J. Zhang, Q. Liu, X. Chen, X. Zhang and Y. Zhao

Institute of Photo-Electronic Thin Film Devices and Technology of Nankai University, Tianjin Key Laboratory of Photo-Electronic Thin Film Devices and Technology, Key Laboratory of Opto-Electronic Information Science and Technology, Nankai University, PR China

### 2TuPo.3.40

#### **Withdrawn**

### 2TuPo.3.41

#### **Influence of Wide Bandgap p-nc-SiC:H Layers on Performance of Flexible Silicon Thin-film Solar Cells in n-i-p Configuration**

E. S. Jang, D. Lim, S. K. Ahn, J. H. Park, K. S. Shin, K. H. Yoon and J. S. Cho

Photovoltaic Laboratory, Korea Institute of Energy Research, Korea

## 2TuPo.3.42

### **Thin-Film Silicon Triple-Junction Solar Cells for Hydrogen Production**

D. Dominé<sup>1)</sup>, L. Löfgren<sup>1)</sup>, M. Modestino<sup>2)</sup>, J.-H. Yum<sup>1)</sup>, P. Kohler<sup>1)</sup>, M. Benkhaira<sup>1)</sup>, L. Sansonnens<sup>1)</sup>, S. Nicolay<sup>1)</sup>, J. Bailat<sup>1)</sup> and C. Ballif<sup>1)</sup>

<sup>1)</sup>CSEM SA, Switzerland, <sup>2)</sup>EPFL STI IMT LO, Ecole Polytechnique Fédérale de Lausanne, Switzerland

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**Tuesday, November 25**

**16:30 - 17:55 Annex**

**Area 2**

## **2TuPo.4 Thin Film Silicon Based Photovoltaics 2**

Chairpersons:

Kimihiko Saito (Fukushima University, Japan)

Akira Terakawa (Panasonic Corporation, Japan)

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## **2TuPo.4.1**

### **Nanostructured Dielectric Layer for Thin-film c-Si Light Trapping**

Yusi Chen<sup>1)</sup>, Yangsen Kang<sup>1)</sup>, Yijie Huo<sup>1)</sup>, Solène Coutant<sup>3)</sup>, Pawan Kapur<sup>3)</sup>, Jieyang Jia<sup>1)</sup>, Li Zhao<sup>2)</sup>, Huiyang Deng<sup>1)</sup> and James Harris<sup>1,2)</sup>

<sup>1)</sup>Department of Electrical Engineering, Stanford University, USA, <sup>2)</sup>Department of Material Science and Engineering, Stanford University, USA, <sup>3)</sup>Solexel INC., USA

## **2TuPo.4.2**

### **Effect of Al Addition on the Electrical, Optical and Structural Properties of Sol-gel Derived $Zn_{1-x}Mg_xO$ Thin Film**

L. Meng, S. Miyajima and M. Konagai

Department of Physical Electronics, Graduate School of Science and Engineering, Tokyo Institute of Technology, Japan

**2TuPo.4.3****Process Induced Defect in Polycrystalline Silicon Thin-film Solar Cells on Glass by Liquid-phase Crystallisation**

Jialiang Huang, Miga Jung, Sergey Varlamov and Martin A. Green

University of New South Wales, Australia

**2TuPo.4.4****Periodic Textured Glass Surface Morphologies for High Transmittance, Haze Ratio and Low Sheet Resistance Of ITO:Zr Films in Thin Film Solar Cells**

Shahzada Qamar Hussain<sup>1)</sup>, Giduk Kwon<sup>1)</sup>, Shihyun Ahn<sup>2)</sup>, Sunbo Kim<sup>1)</sup>, Hyeongsik Park<sup>2)</sup>, Anh Huy Tuan Le<sup>2)</sup>, Subramaniam Velumani<sup>2,3)</sup> and Junsin Yi<sup>1,2)</sup>

<sup>1)</sup>Department of Energy Science, Sungkyunkwan University, Korea, <sup>2)</sup>College of Information and Communication Engineering, Sungkyunkwan University, Korea, <sup>3)</sup>Department of Electrical Engineering-SEES, Mexico

**2TuPo.4.5****Enhanced Infrared Spectral Response in Si-Based Thin-Film Solar Cells by Employing  $\mu$ c-Si<sub>1-x</sub>Ge<sub>x</sub>:H Absorbers with Optimized Film Quality**

Y. T. Huang, C. H. Hsu and C. C. Tsai

Department of Photonics, National Chiao Tung University, Taiwan

**2TuPo.4.6****Improved Polycrystalline-Silicon Crystallinity by Inserting a Thin Al<sub>2</sub>O<sub>3</sub> Barrier Layer in Inverted Aluminum-induced Layer Exchange**

Weiyuan Duan<sup>1,2)</sup>, Jiantao Bian<sup>1)</sup>, Liping Zhang<sup>1)</sup>, Fanying Meng<sup>1)</sup> and Zhengxin Liu<sup>1)</sup>

<sup>1)</sup>Research Center for New Energy Technology, Shanghai Institute of Microsystem and Information Technology, PR China, <sup>2)</sup>University of Chinese

Academy of Sciences, PR China

**2TuPo.4.7**

**Structural Engineering for Optical and Electronic Properties of a-Si:H/c-Si**

J. Mitchell

The National Institute of Advanced Industrial Science and Technology, Japan

**2TuPo.4.8**

**Development of p-type Nano Crystalline Silicon Oxide Film for Wide Band Gap and Highly Conducting Window Layer of Thin Film Solar Cell**

Chonghoon Shin<sup>1)</sup>, Sk Md Iftiquar<sup>2)</sup>, Jinjoo Park<sup>2)</sup>, Sangho Kim<sup>1)</sup>, Junhee Jung<sup>1)</sup>, Sungjae Bong<sup>2)</sup> and Junsin Yi<sup>1,2)</sup>

<sup>1)</sup>Department of Energy Science, Sungkyunkwan University, Republic of Korea, <sup>2)</sup>College of Information and Communication Engineering, Sungkyunkwan University, Republic of Korea

**2TuPo.4.9**

**Application of Wide Band-gap Absorber and Doped Layers in High V<sub>oc</sub> Amorphous Silicon Oxide Solar Cells**

S. Wang<sup>1,2)</sup>, V. Smirnov<sup>2)</sup>, T. Chen<sup>2)</sup>, X. Zhang<sup>1)</sup>, S. Xiong<sup>1)</sup>, Y. Zhao<sup>1)</sup> and F. Finger<sup>2)</sup>

<sup>1)</sup>Institute of Photo-electronic Thin Film Device and Technique, Nankai University, People's Republic of China , <sup>2)</sup>IEK5-Photovoltaik, Germany

**2TuPo.4.10**

**Application Research of Polystyrenes Sphere Self-assemble Technology on Three-Dimension Thin Film Solar cells**

H. Gao, X. Zhang and Y. Zhao

Institute of Photo Electronic Thin Films Devices and Technology, Nankai University, P. R. China

**2TuPo.4.11**

**Improved Light Management in a-Si<sub>1-x</sub>Ge<sub>x</sub>:H-Based Multi-Junction Cells by Using N-type  $\mu$ c-SiO<sub>x</sub>:H as Intermediate Reflecting Layer and Back Reflecting Layer**

H. J. Hsu, C. C. Chien, C. H. Hsu and C. C. Tsai

Department of Photonics, National Chiao Tung University, Taiwan

**2TuPo.4.12**

**Influence of Substrate Morphology on the Growth of Thin-film Microcrystalline Silicon Studied by In-situ Raman Spectroscopy**

T. Fink, S. Muthmann, U. W. Paetzold, N. Sommer, A. Gordijn, A. Mück, R. Schmitz, M. Hüsbeck, R. Carius and M. Meier

IEK5-Photovoltaik, Germany

**2TuPo.4.13**

**Light-trapping in Crystalline Silicon Thin-film Solar Cells Featuring Self-masking Plasma Texture**

R. Pavlovic, T. Dannenberg, S. Lindekugel and S. Reber

Fraunhofer Institute for Solar Energy Systems (ISE), Germany

**2TuPo.4.14**

**Highly Conductive  $\mu$ c-SiO<sub>x</sub>:H with High Oxygen-Content Employed as Integrated Doped and Reflecting Layers for Improving Light Management in  $\mu$ c-Si:H Single-Junction and a-Si:H/ $\mu$ c-Si:H Tandem Solar Cells**

S. W. Liang, Y. F. Tsai, C. H. Hsu and C. C. Tsai

Department of Photonics, National Chiao Tung University, Taiwan

## 2TuPo.4.15

### **Effects of Front and Rear Texturing on Absorption Enhancement in Laser-crystallised Silicon Thin-films on Glass**

M. Z. Pakhuruddin<sup>1,2)</sup>, J. Dore<sup>1,3)</sup>, J. Huang<sup>1)</sup> and S. Varlamov<sup>1)</sup>

<sup>1)</sup>School of Photovoltaic and Renewable Energy Engineering, University of New South Wales, Australia,

<sup>2)</sup>School of Physics, Malaysia, Universiti Sains

Malaysia, <sup>3)</sup>Suntech Research and Development Australia, Australia

## 2TuPo.4.16

### **Microcrystalline Silicon Alloys as Wide Gap Window Layer in Silicon Heterojunction Solar Cells**

K. Ding<sup>1)</sup>, L. Zhao<sup>1,2)</sup>, A. Richter<sup>1)</sup>, M. Pomaska<sup>1)</sup>, T. Chen<sup>1,3)</sup>, V. Smirnov<sup>1)</sup>, F. Finger<sup>1)</sup> and U. Rau<sup>1)</sup>

<sup>1)</sup>IEK5-Photovoltaik, Forschungszentrum Jülich,

Germany , <sup>2)</sup>Institute of Electrical Engineering, Chinese

Academy of Sciences, China, <sup>3)</sup>Now with: Jiangyin

Sino-Germany Technology Transfer Center Co., Ltd, China

## 2TuPo.4.17

### **Investigation of the Correlation Between Chemical Bonding States and Fixed Charge States for Sr-silicate Passivation Films on Si(100) Substrates**

S. Taniwaki<sup>1)</sup>, Y. Hotta<sup>1,3)</sup>, H. Yoshida<sup>1,3)</sup>, K. Arafune<sup>1,3)</sup>, A. Ogura<sup>2,3)</sup> and S. Satoh<sup>1,3)</sup>

<sup>1)</sup>Univ. of Hyogo, Japan, <sup>2)</sup>Meiji Univ., Japan, <sup>3)</sup>JST-CREST, Japan

## 2TuPo.4.18

### **Improve The p/ITO Contact Properties of SHJ Solar Cells by Adopting Dual-layer Boron Doped Silicon Thin Films Emitter**

F. Wang<sup>1)</sup>, X. Zhang<sup>1)</sup>, Y. Jiang<sup>1)</sup>, L. Wang<sup>1,2)</sup> and Y. Zhao<sup>1)</sup>

<sup>1)</sup>Institute of Photo-electronics Thin Film Devices and

Technique of Nankai University, Key Laboratory of Photo-electronics Thin Film Devices and Technique of Tianjin, Key Laboratory of Photo-Electronic Information Science and Technology of Ministry of Education (Nankai University), China, <sup>2)</sup>Institute of Semiconductor Materials, Hebei University of Technology, China

## 2TuPo.4.19

### **Development of High-quality a-SiO:H Film Using Triode Type PECVD and Low Temperature Deposition**

Riku Yamamoto<sup>1)</sup>, Porponth Sichanugrist<sup>1)</sup> and Makoto Konagai<sup>1,2)</sup>

<sup>1)</sup>Department of Physical Electronics, Tokyo Institute of Technology, Japan, <sup>2)</sup>Photovoltaic Research Center (PVREC), Tokyo Institute of Technology, Japan

## 2TuPo.4.20

### **Withdrawn**

## 2TuPo.4.21

### **Photothermal Radiometry for Estimation of Spin Density in Si Thin Films**

N. Yoshida<sup>1,2)</sup>, K. Ishii<sup>1)</sup>, S. Takahashi<sup>1)</sup>, Y. Matsuda<sup>1)</sup>, A. Yasui<sup>1)</sup>, H. Kondo<sup>1)</sup> and S. Nonomura<sup>1,2)</sup>

<sup>1)</sup>Environmental and renewable Energy Division Systems, Graduate School of Engineering, Gifu University, Japan, <sup>2)</sup>Center of Innovative Photovoltaic Systems, Gifu University, Japan

## 2TuPo.4.22

### **Development of High Open-circuit Voltage Hydrogenated Nanocrystalline Silicon Oxide Thin-film Solar Cell for Multi-junction Photovoltaics**

P. W. Chen, C. H. Hsu and C. C. Tsai

Department of Photonics, National Chiao Tung University, Taiwan

## 2TuPo.4.23

### **Hydrogenated MGZO Thin Films for Solar Cells Under Different Deposition Ways**

Jie-ming Liu, Xin-liang Chen, Cong-sheng Tian, De-kun Zhang, Ying Zhao and Xiao-dan Zhang

Institute of Photo-Electronic Thin Film Devices and Technology, Nankai University, People's Republic of China

## 2TuPo.4.24

### **Optical Simulations of Selective Nanostructured-substrates for Silicon Thin Film Solar Cells**

B. Janthong<sup>1)</sup>, S. Kato<sup>1)</sup> and M. Konagai<sup>1,2)</sup>

<sup>1)</sup>MEXT/FUTURE-PV Innovation Research, JST, Japan,

<sup>2)</sup>Department of Physical Electronics, Tokyo Institute of Technology, Japan

## 2TuPo.4.25

### **Growth Process of Electrodeposited Si Thin Films in Ionic Liquid for Solar Cell Applications**

Y. Tsuyuki<sup>1)</sup>, A. Pham<sup>1)</sup>, J. Komadina<sup>2)</sup>, Y. Fukunaka<sup>3,4)</sup> and T. Homma<sup>1,3,4)</sup>

<sup>1)</sup>Department of Applied Chemistry, Waseda University, Japan, <sup>2)</sup>School of Engineering, UC Merced, Japan,

<sup>3)</sup>JST, CREST, Japan, <sup>4)</sup>Nanotechnology Research Center, Waseda University, Japan

## 2TuPo.4.26

### **Triple-textured Electrode Architectures for Light Trapping in Triple Junction Solar Cells:A Numerical Study**

Bofei Liu, Lisha Bai, Xiaodan Zhang and Ying Zhao

Institute of Photo Electronics thin Film Devices and Technology of Nankai University, Key Laboratory of Photoelectronic Thin Film Devices and Technology, P. R. China

**2TuPo.4.27****Reduction of Light Reflectance of Thin Film Silicon Solar Cells by Insertion of Anti-Reflection Layer between Boron-Doped ZnO Films and Glass**

K. Maejima<sup>1)</sup>, T. Koida<sup>2)</sup>, H. Sai<sup>2)</sup>, T. Matsui<sup>2)</sup> and I. Yoshida<sup>1)</sup>

<sup>1)</sup>Thin Film Silicon Laboratory, Photovoltaic Power Generation Technology Research Association, JAPAN,

<sup>2)</sup>Research Center for Photovoltaic Technologies, National Institute of Advanced Industrial Science and Technology, JAPAN

**2TuPo.4.28****Investigation of Amorphous Silicon Oxide Thin Films Based on Surface Passivation of Crystalline Silicon**

Liping Zhang<sup>1)</sup>, Wanwu Guo<sup>1)</sup>, Wenzhu Liu<sup>1)</sup>, Jian Bao<sup>2)</sup>, Jinning Liu<sup>1)</sup>, Dongliang Wang<sup>2)</sup>, Fanying Meng<sup>1)</sup> and Zhengxin Liu<sup>1)</sup>

<sup>1)</sup>Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, China,

<sup>2)</sup>State Key Laboratory of PV Science and Technology, Trina Solar, China

**2TuPo.4.29****The Light-induced Degradation Behavior of Hydrogenated Amorphous Silicon Thin Film Solar Cells Prepared by Expanding Thermal Plasma Chemical Vapor Deposition**

T. Nagai<sup>1)</sup>, T. Matsui<sup>1)</sup>, J. Melskens<sup>2)</sup>, M. Fischer<sup>2)</sup>, A. H. M. Smets<sup>2)</sup>, M. Zeman<sup>2)</sup> and M. Kondo<sup>3)</sup>

<sup>1)</sup>Research Center for Photovoltaic technology, National Institute of Advanced Industrial Science and Technology (AIST), Japan, <sup>2)</sup>Photovoltaic Materials and Devices, Delft University of Technology, The Netherlands, <sup>3)</sup>Fukushima Renewable Energy Institute, National Institute of Advanced Industrial Science and Technology (AIST), Japan

**2TuPo.4.30****One Step Electrochemical Process for Production of Si Film from SiO<sub>2</sub>**

Y. Sakanaka<sup>1)</sup> and T. Goto<sup>1)</sup>, T. Ishikawa<sup>2)</sup> and Y. Fukunaka<sup>2)</sup>

<sup>1)</sup>Depart of Environmental System Science, Doshisha University, Japan, <sup>2)</sup>Japan Aerospace Exploration Agency, Japan

**2TuPo.4.31****Crystalline Silicon Germanium Films Grown On Crystalline Silicon Substrates by Solid Phase Crystallization**

Y. Kojima<sup>1)</sup> and M. Isomura<sup>1, 2)</sup>

<sup>1)</sup>Graduate school of Engineering, Tokai University, Japan, <sup>2)</sup>Department of Electrical and Electronic Engineering, Tokai University, Japan

**2TuPo.4.32****Simulation Study of Effect of Heteroepitaxial Growth on Crystalline Germanium Heterojunction Solar Cell**

S. Nakano and Y. Takeuchi

Mitsubishi Heavy Industries (MHI), Ltd., Japan

**2TuPo.4.33****A Reliable Method for Etching Lines to Separate a-Si:H Solar Cells on Flexible Polyimide Substrates**

Xiaoyu Jiao<sup>1)</sup> and Cheng Liu<sup>2)</sup>

<sup>1)</sup>Shanghai Institute of Space Power Sources, China,  
<sup>2)</sup>Shanghai University, China

**2TuPo.4.34****Texturization of Al:ZnO Glass Substrate by Reactive Ion Etching and Its Application to Single Junction a-Si Solar Cells**

Gourab Das, Sourav Mandal, Sukanta Dhar, Sukanta Bose, Arpita Jana, Sumita Mukhopadhyay, Chandan

Banerjee, A. K. Barua

Centre of Excellence for Green Energy and Sensor systems, Indian Institute of Engineering Science & Technology, India

## 2TuPo.4.35

### **Device Modeling and Simulation of High Efficiency n-type HIT Solar Cells**

Wei-Cheng Kuo<sup>1)</sup>, Po-Wei Cheng<sup>4)</sup>, Teng-Hsiang Chang, Yen-Ho Chu<sup>4)</sup>, Chien-Chieh Lee<sup>2)</sup>, Jenq-Yang Chang<sup>4)</sup>, Tomi Li<sup>3)</sup> and I-Chen Chen<sup>1)</sup>

<sup>1)</sup>Institute of Materials Science and Engineering, National Central University, Taiwan, <sup>2)</sup>Optical Science Center, National Central University, Taiwan, <sup>3)</sup>Department of Mechanical Engineering, National Central University, Taiwan, <sup>4)</sup>Department of Optics and Photonics, National Central University, Taiwan

## 2TuPo.4.36

### **A Study of Back Electrode Stacked With Low Cost Reflective Layers For Amorphous Si Thin-Film Silicon Solar Cell**

Jun-Chin Liu<sup>1,2)</sup>, Chen-Cheng Lin<sup>1)</sup>, Yu-Hung Chen<sup>1)</sup>, Hsin-Wei Lu<sup>1)</sup>, Yung-Tsung Liu<sup>1)</sup>, Yu-Ming Wang<sup>3)</sup> and Chung-Yuan Kung<sup>2)</sup>

<sup>1)</sup>Photovoltaic Technology Division, Green Energy and Environment Research Laboratories, Industrial Technology Research Institute (ITRI), Taiwan,  
<sup>2)</sup>Department of Electrical Engineering, National Chung Hsing University, Taiwan, <sup>3)</sup>Micro/Nano Manufacturing Technology Department, Mechanical and Systems Research Laboratories, Industrial Technology Research Institute (ITRI), Taiwan

## 2TuPo.4.37

### **Development of Large-size Double-textured ZnO:B Substrates and Their Applications to the Solar Cells**

Y. Abe<sup>1)</sup>, P. Sichanugrist<sup>1)</sup>, C. R. Wronski<sup>3)</sup> and M.

Konagai<sup>1,2)</sup>

<sup>1)</sup>Department of Physical Electronics, <sup>2)</sup>Photovoltaics Research Center (PVREC), Japan, <sup>3)</sup>The Pennsylvania State University, USA

## 2TuPo.4.38

### **Sensitivity Analysis Design of Photonic Crystals for Optical Absorption Enhancement of Thin Film Silicon Solar Cells**

Y. Kawamoto<sup>1)</sup>, Y. Tanaka<sup>1)</sup>, K. Ishizaki<sup>1)</sup>, M. De. Zoysa<sup>1,2)</sup> and S. Noda<sup>1)</sup>

<sup>1)</sup>Department of Electronic Science and Engineering, Kyoto University, Japan, <sup>2)</sup>Hakubi Center for Advanced Research, Kyoto University, Japan

## 2TuPo.4.39

### **Properties of Double Layered Silicon Emitter Films Epitaxially Deposited by Sputtering for Crystalline Silicon Solar Cells**

Hyejeong Jeong, Inki Kim and Seongjae Boo

Applied Optics and Energy R&BD Group, Korea Institute of Industrial Technology, Republic of Korea

## 2TuPo.4.40

### **Multi-functional P-type Hydrogenated Microcrystalline Silicon Oxide Layers in Thin-film Silicon Solar Cells**

J. Fang, X. Zhang, Z. Chen, G. Hou, J. Sun, C. Wei and Y. Zhao

Institute of Photo Electronics thin Film Devices and Technology of Nankai University, Key Laboratory of Photoelectronic Thin Film Devices and Technology, P. R. China

## 2TuPo.4.41

### **Control of Photo-induced Degradation in a-Si:H Prepared Under PADS Condition**

Y. Sobajima<sup>1,2)</sup>, D. Sugihara<sup>1)</sup>, Y. Nishio<sup>1)</sup>, C. Sada<sup>1,2)</sup>, A. Matsuda<sup>1,2)</sup> and H. Okamoto<sup>1,2)</sup>

<sup>1)</sup>Graduate school of engineering science, Osaka University, Japan, <sup>2)</sup>JST-CREST, Japan

## 2TuPo.4.42LN

### **Enhancement of Light Trapping in C-Si Solar Cell for Different Periodicities Using Silver (Ag) as the Core of Plasmonic Nanowire**

M. M. Alam, S. M. Saifuddin, A. Rahman and Z. U. Mozumder

North South University, Bangladesh

## 2TuPo.4.43LN

### **Ellipsometry Study for Inline Diagnosis for Thin Film Silicon Solar Cells**

Xiaojing Liu<sup>1)</sup>, Wei Zi<sup>1)</sup>, Shengzhong Liu<sup>1,2)</sup>

<sup>1)</sup>Key Laboratory of Applied Surface and Colloid Chemistry, National Ministry of Education; School of Materials Science and Engineering, Shaanxi Normal University, China, <sup>2)</sup>Dalian Institute of Chemical Physics, Dalian National Laboratory for Clean Energy, Chinese Academy of Sciences, China

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## Tuesday, November 25

**14:45 - 16:10 Annex**

**Area 3**

### **3TuPo.5 Thin Film Compound Semiconductor Based PV 1**

Chairpersons:

Takayuki Negami (Panasonic Corporation, Japan)  
Takahiro Wada (Ryukoku University, Japan)

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## 3TuPo.5.1

### **Novel Fabrication Route for Carbon-free and Dense CuInSe<sub>2</sub> (CIS) Thin Films via a Non-vacuum Process for Solar Cell Application**

Young-Joo Eo<sup>1)</sup>, Wonha Lee<sup>1)</sup>, Kyunhwan Kim<sup>1)</sup>, SeJin Ahn<sup>1)</sup>, Ara Cho<sup>1)</sup>, Jihye Gwak<sup>1)</sup>, Kyunghoon Yoon<sup>1)</sup>, Keeshik Shin<sup>1)</sup>, Seung Kyu Ahn<sup>1)</sup>, Jun Sik Cho<sup>1)</sup>, Ju

Hyung Park<sup>1)</sup>, Jin Su Yu<sup>1)</sup>, Kihwan Kim<sup>1)</sup>, Se Youn Moon<sup>2)</sup>, Hyo Rim Jung<sup>3)</sup>, Jin Hyeok Kim<sup>3)</sup> and Jae Ho Yun<sup>1)</sup>

<sup>1)</sup>Photovoltaic Laboratory, Korea Institute of Energy Research(KIER), Korea, <sup>2)</sup>High Enthalpy Plasma Research Center, Chonbuk National University, Korea,  
<sup>3)</sup>Department of Materials Science and Engineering, Chonnam National University, Korea

### 3TuPo.5.2

#### **Effect of Deposition Pressure on the Properties of Magnetron Sputter Deposited Mo Back Contact for CIGS Solar Cells**

W. Li<sup>1,2)</sup>, S. Venkataraj<sup>2)</sup>, X. Yan<sup>1)</sup> and A. Aberle<sup>1,2)</sup>

<sup>1)</sup>Solar Energy Research Institute of Singapore, National University of Singapore, Singapore,

<sup>2)</sup>Department of Electrical and Computer Engineering, National University of Singapore, Singapore

### 3TuPo.5.3

#### **Study of CIGS Absorber Layer for Photovoltaic Cell Fabricated by CIG Ternary Target During Sputtering Process**

Jeon Ryang Lee, Hak-Jun Chung<sup>\*</sup> and Jin-Koog Shin

Korea printed Electronics center, Korea Electronic Technology Institute, Korea

### 3TuPo.5.4

#### **Wide Band Gap Cu(In,Ga)S<sub>2</sub> Solar Cells with the Junction Prepared on the Rear Surface of the 3-stage Cu-deficiency Absorber Films**

S. Nakano<sup>1)</sup>, P. Gerhardt<sup>2)</sup>, R. Klenk<sup>2)</sup> and R. Kaigawa<sup>1)</sup>

<sup>1)</sup>Department of Electronics and Informatics, Ryukoku University, Japan, <sup>2)</sup>Helmholtz-Zentrum für Materialien und Energie, Institute for Heterogeneous Material Systems, Germany

### 3TuPo.5.5

#### The Role of Metal-Alkanolamine Complexes in Hybrid Inks for CIS Thin Films

Ara Cho, SeJin Ahn, Jae Ho Yun, Jihye Gwak, Seung Kyu Ahn, Young-Joo Eo, Jun Sik Cho, Ju Hyung Park, Jin Su Yu, Kihwan Kim, Keeshik Shin and Kyunghoon Yoon

Photovoltaic Laboratory, Korea Institute of Energy Research (KIER), Korea

### 3TuPo.5.6

#### Properties of Deep-level Defect in Cu(In, Ga)Se<sub>2</sub> Thin Films Studied by Steady-state Photo-capacitance

X. B. Hu<sup>1)</sup>, T. Sakurai<sup>1)</sup>, A. Yamada<sup>2)</sup>, S. Ishizuka<sup>2)</sup>, S. Niki<sup>2)</sup> and K. Akimoto<sup>1)</sup>

<sup>1)</sup>Institute of Applied Physics, University of Tsukuba, Japan, <sup>2)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan

### 3TuPo.5.7

#### Selenization of CIS and CIGS Layers Deposited by Spray Pyrolysis

B. J. Babu<sup>1,2)</sup>, B. Egaas<sup>3)</sup>, S. Velumani<sup>1,4)</sup> and R. Asomoza<sup>1)</sup>

<sup>1)</sup>Department of Electrical Engineering-SEES, CINVESTAV-IPN, Mexico, <sup>2)</sup>Institute of Molecules and Materials, France, <sup>3)</sup>National Renewable Energy Laboratory, USA, <sup>4)</sup>School of Information and Communication Engineering, Sungkyunkwan University, Korea

### 3TuPo.5.8

#### Photocarrier Dynamics of Cu(In,Ga)Se<sub>2</sub> Thin Films Revealed by Time-resolved Photoluminescence and Transient Absorption Measurements

M. Okano<sup>1)</sup>, Y. Takabayashi<sup>2)</sup>, T. Sakurai<sup>2)</sup>, K. Akimoto<sup>2)</sup>, H. Shibata<sup>3)</sup>, S. Niki<sup>3)</sup> and Y. Kanemitsu<sup>1,4)</sup>

<sup>1)</sup>Institute for Chemical Research, Kyoto University, Japan, <sup>2)</sup>Institute of Applied Physics, University of Tsukuba, Japan, <sup>3)</sup>National Institute of Advanced Industrial Science and Technology (AIST), <sup>4)</sup>Japan Science and Technology, CREST, Japan

### 3TuPo.5.9

#### **Photocatalytic Application of Cu<sub>2</sub>ZnSnS<sub>4</sub> (CZTS) and Au/CZTS Core/Shell Nanostructures**

L. Y. S. Lee, E. Ha, S. C. E. Tsang and K.-Y. Wong

Department of Applied Biology and Chemical Technology, The Hong Kong Polytechnic University, Hongkong SAR

### 3TuPo.5.10

#### **Cu<sub>2</sub>ZnSnS<sub>4</sub> Thin Films Grown by Multi-stage co-evaporation**

T. Mise<sup>1)</sup>, S. Tajima<sup>1)</sup>, T. Fukano<sup>1)</sup>, K. Higuchi<sup>1)</sup>, T. Washio<sup>2,3)</sup>, K. Jimbo<sup>2,3)</sup> and H. Katagiri<sup>2,3)</sup>

<sup>1)</sup>Toyota Central Research and Development Laboratories, Inc., Japan, <sup>2)</sup>Department of Electrical and Electronic Engineering, Nagaoka National College of Technology, Japan, <sup>3)</sup>CREST, Japan Science and Technology Agency, Japan

### 3TuPo.5.11

#### **Influence of Capping During Annealing of Cu<sub>2</sub>ZnSn(S,Se)<sub>4</sub> Thin Films**

Bhagyashree Pani<sup>1)</sup> and Udai P Singh<sup>2)</sup>

<sup>1)</sup>School of Applied Sciences, <sup>2)</sup>School of Electronics Engineering, KIIT University, India

### 3TuPo.5.12

#### **Direct Preparation of Cu<sub>2</sub>ZnSnSe<sub>4</sub> Films Using Microwave Irradiation and Its Dependence on the Sn/(Sn+Zn) Ratio**

S. Hashimoto<sup>1)</sup>, R. Klenk<sup>2)</sup> and R. Kaigawa<sup>1)</sup>

<sup>1)</sup>Department of Electronics and Informatics, Ryukoku University, Japan, <sup>2)</sup>Helmholtz-Zentrum Berlin für

Materialien und Energie, Institute for Heterogeneous Material Systems, Germany

### 3TuPo.5.13

#### **Characterization of Cu<sub>2</sub>ZnSn(S,Se)<sub>4</sub> Solar Cells Annealed under Different Atmospheres**

Y. Zhang<sup>1)</sup>, N. Suyama<sup>2)</sup>, M. Goto<sup>2)</sup>, J. Kuwana<sup>2)</sup>, K. Sugimoto<sup>2)</sup>, T. Satake<sup>1)</sup>, Y. Kurokawa<sup>2)</sup>, M. Yin<sup>1)</sup> and A. Yamada<sup>2)</sup>

<sup>1)</sup>Technical Research Institute, Toppan Printing Co., Ltd., Japan, <sup>2)</sup>Department of Physical Electronics, Tokyo Institute of Technology, Japan

### 3TuPo.5.14

#### **Cu<sub>2</sub>ZnSnSe<sub>4</sub> Films Directly Synthesized by the Reaction for One Second from Elemental Metal Precursor Using a Spot Welding Machine**

S. Shibata<sup>1)</sup>, R. Klenk<sup>2)</sup> and R. Kaigawa<sup>1)</sup>

<sup>1)</sup>Department of Electronics and Informatics, Ryukoku University, Japan, <sup>2)</sup>Helmholtz-Zentrum für Materialien und Energie, Institute for Heterogeneous Material Systems, Germany

### 3TuPo.5.15

#### **Effects of Sodium on Electrical Properties in CZTS Single Crystal**

A. Nagaoka<sup>1)</sup>, K. Yoshino<sup>2)</sup> and Y. Nose<sup>1)</sup>

<sup>1)</sup>Department of Materials Science and Engineering, Kyoto University, Japan, <sup>2)</sup>Department of Applied Physics and Electronic Engineering, University of Miyazaki, Japan

### 3TuPo.5.16

#### **Photoluminescence of CdTe Doped with a Novel Cu Doping for CdTe/CdS Solar Cells**

S. Seto<sup>1)</sup>, Y. Ogawa<sup>2)</sup>, A. Hosono<sup>2)</sup> and T. Okamoto<sup>2)</sup>

<sup>1)</sup>Department of Electrical Engineering, Ishikawa National College of Technology, Japan, <sup>2)</sup>Department of Electrical and Electronic Engineering, Kisarazu

National College of Technology, Japan

### 3TuPo.5.17

**Withdrawn**

### 3TuPo.5.18

**Pulsewidth Dependence of 532 nm Laser Scribing of Thin Film CdTe Photovoltaic Devices in the Picosecond Regime**

B. Baird<sup>1)</sup> and T. Gerke<sup>2)</sup>

<sup>1)</sup>Summit Photonics LLC, USA, <sup>2)</sup>Fianium Ltd., USA

### 3TuPo.5.19

**Low Temperature Solution Process for the Deposition of CuCdS<sub>2</sub> Thin Films as a Novel Absorber for the Fabrication of Thin Film Solar Cells**

V. Nirmal Kumar<sup>1,2)</sup>, R. Gopalakrishnan<sup>1)</sup>, R. Suriakarthick<sup>1)</sup>, Y. Hayakawa<sup>2)</sup>, H. Shamima<sup>3)</sup>, S. Chakravarty<sup>3)</sup> and G. M. Bhalerao<sup>3)</sup>

<sup>1)</sup>Anna University, INDIA, <sup>2)</sup>Research Institute of Electronics, GSST, Shizuoka University, JAPAN,

<sup>3)</sup>UGC-DAE Consortium for Scientific Research, INDIA

### 3TuPo.5.20

**Evaluation of Surface Potential Distributions Around Grain Boundaries and Minority-carrier Diffusion Lengths in Impurity Doped n- and p- type BaSi<sub>2</sub> Epitaxial Films**

D. Tsukahara<sup>1)</sup>, M. Baba<sup>1)</sup>, K. Toko<sup>1)</sup>, K. O. Hara<sup>2)</sup>, N. Usami<sup>2,3)</sup>, K. Watanabe<sup>1)</sup>, T. Sekiguchi<sup>4)</sup> and T. Suemasu<sup>1,3)</sup>

<sup>1)</sup>Institute of Applied Physics, University of Tsukuba, Japan, <sup>2)</sup>Graduate School of Engineering, Nagoya University, Japan, <sup>3)</sup>Japan Science and Technology Agency, CREST, Japan, <sup>4)</sup>National Institute for Materials Science, Japan

**3TuPo.5.21****Evaluation of Diffusion Coefficients of n-type and p-type Impurities in BaSi<sub>2</sub> Epitaxial Films Grown by Molecular Beam Epitaxy**

N. Zhang<sup>1)</sup>, K. Nakamura<sup>1)</sup>, M. Baba<sup>1)</sup>, K. Toko<sup>1)</sup> and T. Suemasu<sup>1, 2)</sup>

<sup>1)</sup>Institute of Applied Physics, University of Tsukuba, Japan, <sup>2)</sup>CREST-JST, Japan

**3TuPo.5.22****Properties of Bismuth Selenide and Copper Doped Bismuth Selenide Films Deposited by Solution Route**

Fatima Subait Al Wahshi, Shifaa Mohsen Al Baity, Saeed Ali Abdulla Yalyali, Abeer Ali Al Yafeai, Muntaser Al Mansoori and Sovannary Phok

National Energy and Water Research Center, Abu Dhabi Water and Electricity Authority, United Arab Emirates

**3TuPo.5.23****Effects of Surface Conditions and Grain Boundaries on Minority-carrier Lifetime in Undoped n-BaSi<sub>2</sub> on Si(111)**

R. Takabe<sup>1)</sup>, K. O. Hara<sup>2)</sup>, M. Baba<sup>1)</sup>, W. Du<sup>1)</sup>, K. Toko<sup>1)</sup>, N. Usami<sup>2,3)</sup> and T. Suemasu<sup>1,3)</sup>

<sup>1)</sup>Institute of Applied Physics, University of Tsukuba, Japan, <sup>2)</sup>Graduate School of Engineering, Nagoya University, Japan, <sup>3)</sup>Japan Science and Technology Agency, CREST, Japan

**3TuPo.5.24****Transparent p-type NiO Films by Reactive-sputtering Method Using the Facing Target System**

Y. Furuya, T. Nomoto and N. Tsuboi

Niigata University, Japan

**3TuPo.5.25****Sulfur Annealing of Electrochemically Deposited Iron Sulfide Films and Its Impact on Properties of pn Heterojunction with ZnO**

T. Kajima<sup>1)</sup>, S. Kawai<sup>2)</sup> and M. Ichimura<sup>1)</sup>

<sup>1)</sup>Dept. Eng. Phys., Electron., Mech., Nagoya Institute of Technology, Japan, <sup>2)</sup>DENSO CORP. Research Laboratories, Japan

**3TuPo.5.26****Theoretical and Experimental Studies on Wide Band Gap p-type Conductive BaCuSeF and Related Compounds**

Hiroshi. Sakakima<sup>1)</sup>, Koichi. Yamamoto<sup>1)</sup>, Mikihiko Nishitani<sup>2)</sup> and Takahiro. Wada<sup>1)</sup>

<sup>1)</sup>Ryukoku University, Japan, <sup>2)</sup>Osaka University, Japan

**3TuPo.5.27****Nano-dipole Thin Film Solar Cell with Conversion Efficiency of 9.36%**

B. Yang<sup>1)</sup>, F. Huang<sup>1)</sup>, X. Liu<sup>1)</sup>, H. Li<sup>1)</sup>, J. Han<sup>2)</sup>, M. Besland<sup>2)</sup>

<sup>1)</sup>The Key Laboratory of Solar Thermal Energy and Photovoltaic System, Institute of Electrical Engineering, China, <sup>2)</sup>Institut des Matériaux Jean Rouxel (IMN), Université de Nantes, France

**3TuPo.5.28LN****Kinetically Metallized Carbon-free CuInGaSe<sub>2</sub> Solar Cell by Supersonic Spraying Dry Nanoparticles**

J. J. Park, J. G. Lee, D. Y. Kim, M. Liou, and S. S. Yoon  
Korea University, Republic of Korea

**3TuPo.5.29****Polarized Raman spectroscopy of single crystal Cu<sub>2</sub>ZnSnSe<sub>4</sub>**

D. Nam<sup>1)</sup>, J. Kim<sup>1)</sup>, J.-U. Lee<sup>1)</sup>, A. Nagaoka<sup>2)</sup>, K. Yoshino<sup>2)</sup>, W. Cha<sup>1)</sup>, H. Kim<sup>1)</sup>, I. C. Hwang<sup>3)</sup>, K. B. Yoon<sup>3)</sup>

and H. Cheong<sup>1)</sup>

<sup>1)</sup>Department of Physics, Sogang University, Korea,  
<sup>2)</sup>Department of Electrical and Electronic Engineering,  
University of Miyazaki, Japan, <sup>3)</sup>Korea Center for  
Artificial Photosynthesis, Center for Microcrystal  
Assembly, Department of Chemistry, Sogang  
University, Korea

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**Tuesday, November 25**

**16:30 - 17:55 Annex**

**Area 3**

**3TuPo.6 Thin Film Compound Semiconductor  
Based PV 2**

Chairpersons:

Katsumi Kushiya (Solar Frontier, Japan)

Akira Yamada (Tokyo Institute of Technology, Japan)

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**3TuPo.6.1**

**Cu(In,Ga)Se<sub>2</sub> Polycrystalline Thin Films Deposition  
by Hybrid Process**

P. Reyes<sup>1,2)</sup>, T. Painchaud<sup>2)</sup>, L. Arzel<sup>2)</sup> and N. Barreau<sup>2)</sup>  
and S. Velumani<sup>1,3)</sup>

<sup>1)</sup>Department of Electrical Engineering (SEES),  
Mexico, <sup>2)</sup>Institut des Matériaux Jean Rouxel (IMN),  
Universit de Nantes, France, <sup>3)</sup>School of Information  
and Communication Engineering, Sungkyunkwan  
University, Korea

**3TuPo.6.2**

**Structural And Morphological Studies of CIGS  
Thin Film Deposited by Spin Coating Using  
Nanoparticle- Based Ink**

M. Rohini<sup>1)</sup>, P. Reyes<sup>1)</sup>, S. Velumani<sup>1,2)</sup> and I. G. Becerril-  
Juárez<sup>1)</sup>

<sup>1)</sup>Department of Electrical Engineering (SEES),  
Mexico, <sup>2)</sup>School of Information and Communication  
Engineering, Sungkyunkwan University, Korea

**3TuPo.6.3****Study on the DC Sputtered Mo On Soda-lime Glass for CIGS Solar Cells**

Heejin Ahn and Youngho Um

Physics of Ulsan, Republic of Korea

**3TuPo.6.4****Cu<sub>2</sub>ZnSn(S,Se)<sub>4</sub> Thin Films Prepared by Annealing in Sulfur, Selenium and Tin Mixing Atmosphere for Photovoltaic Applications**

Mitsuki Nakashima<sup>1)</sup>, Toshiyuki Yamaguchi<sup>1)</sup>, Yuichi Mizui<sup>1)</sup>, Junji Sasano<sup>2)</sup> and Masanobu Izaki<sup>2)</sup>

<sup>1)</sup>Wakayama National College of Technology, Japan, <sup>2)</sup> Toyohashi University of Technology, Japan

**3TuPo.6.5****The Photoelectrochemical Performances of AgInSSe Thin Films Created Using Selenization of Chemical Bath Deposition Ag-In-S precursors**

Kong-Wei Cheng, Yun-Ju Chang and Shan-Gche Hsieh

Department of Chemical and Materials Engineering, Chang Gung University, Taiwan

**3TuPo.6.6****The Effect of 2<sup>nd</sup> Time Dependence of Cu(In,Ga)Se<sub>2</sub> Films Deposited by Three Stage Methods**

Ho-Jung Jeong<sup>1)</sup>, Dae-Seon Kim<sup>2)</sup>, Guk-Jin Jeon<sup>2)</sup>, Yechan Kim<sup>2)</sup> and Jae-Hyung Jang<sup>1,2,3)</sup>

<sup>1)</sup>WCU Department of Nanobio Materials and Electronics, Gwangju Institute of Science and Technology, Korea, <sup>2)</sup>School of Information and Communications, Gwangju Institute of Science and Technology, Korea, <sup>3)</sup>Research Institute of Solar and Sustainable Energies, Gwangju Institute of Science and Technology, Korea

### 3TuPo.6.7

#### **Characterization of CuInS<sub>2</sub> Thin Films Prepared from Materials Grown by Mechanochemical Method and Their Photovoltaic Applications**

Y. Akaki<sup>1)</sup>, K. Sugimoto<sup>1)</sup>, S. Nakamura<sup>2)</sup>, T. Yamaguchi<sup>3)</sup> and K. Yoshino<sup>4)</sup>

<sup>1)</sup>Miyakonojo National College of Technology, Japan,

<sup>2)</sup>Nakamura National College of Technology, Japan,

<sup>3)</sup>Wakayama National College of Technology, Japan,

<sup>4)</sup>University of Miyazaki, Japan

### 3TuPo.6.8

#### **Fabrication of CuIn<sub>1-x</sub>Ga<sub>x</sub>Se<sub>2</sub> Thin Film Solar Cells from CuInSe<sub>2</sub>/CuGaSe<sub>2</sub> Bilayers**

S. Chatraphorn<sup>1,2)</sup>, B. Noikaew<sup>1,2)</sup>, B. Namnuan<sup>1,2)</sup>, S. Sukaiem<sup>1,2)</sup> and K. Yoodee<sup>1,2)</sup>

<sup>1)</sup>Department of Physics, Faculty of Science, Chulalongkorn University, Thailand, <sup>2)</sup>Research Center in Thin Film Physics, Thailand Center of Excellence in Physics, Thailand

### 3TuPo.6.9

#### **Study of Cu<sub>2</sub>ZnSnSe<sub>4</sub> Thin Film Deposited by co-evaporation**

Bhagyashree Pani<sup>1)</sup> and Udai P Singh<sup>2)</sup>

<sup>1)</sup>School of Applied Sciences, <sup>2)</sup>School of Electronics Engineering KIIT University, India

### 3TuPo.6.10

#### **Thin-Film Solar Cells with Cu<sub>2</sub>ZnSnS<sub>4</sub> / Cu<sub>2</sub>SnS<sub>3</sub> Double Heterojunctions**

T. Toyama and R. Tsuji

Kaneka Fundamental Technology Alliance Research Laboratories, Graduate School of Engineering, Osaka University, Japan

**3TuPo.6.11****Study of Kesterite Phase Formation by Selenization of Electrodeposited Cu-Sn-Zn Thin Films**

A. Crossay<sup>1)</sup>, D. Colombara<sup>1)</sup>, L. Vauche<sup>2)</sup>, S. Jaime<sup>2)</sup>, M. Guennou<sup>3)</sup>, N. Valle<sup>3)</sup>, P.-P. Grand<sup>2)</sup> and P. J. Dale<sup>1)</sup>

<sup>1)</sup>Laboratory for Energy Materials - Universit du Luxembourg, Luxembourg, <sup>2)</sup>NEXCIS, France, <sup>3)</sup>Département Science et Analyse des Matériaux Centre de Recherche Public-Gabriel Lippmann, Luxembourg

**3TuPo.6.12****Fabrication and Evaluation of Cu<sub>2</sub>ZnSnSe<sub>4</sub> Solar Cells by Co-sputtering Followed by Short Duration RTP Selenization for Large Area Application**

T. Prem kumar<sup>1)</sup>, Yon-kil Jeong<sup>1)</sup>, Hojung Jeong<sup>1,2)</sup>, N. L. Tarwal<sup>1)</sup>, Kwanwoo Nam<sup>1)</sup>, Guk-Jin Jeon<sup>1,2)</sup>, Kim Ye-Chan<sup>1,2)</sup> and Jae-Hyung Jang<sup>1,2)</sup>

<sup>1)</sup>Research Institute for Solar and Sustainable Energies, Gwangju Institute of Science and Technology, Republic of Korea, <sup>2)</sup>School of Information and Communications, Gwangju Institute of Science and Technology, Republic of Korea

**3TuPo.6.13****Influence of Cu Content on Properties of CZTSe Thin Films Fabricated by Co-evaporation**

Ding Sun, Yang Ge, Li Zhang, Sheng-zhi Xu, Chang-chun Wei, Ying Zhao and Xiao-dan Zhang

Institute of Photo Electronics thin Film Devices and Technology of Nankai University, Key Laboratory of Photoelectronic Thin Film Devices and Technology, P.R. China

**3TuPo.6.14****Study of Sulfurization Condition for Controlling the Morphology of CZTS Thin Films**

T. Washio<sup>1,2)</sup>, K. Jimbo<sup>1)</sup> and H. Katagiri<sup>1,2)</sup>

<sup>1)</sup>Nagaoka National College of Technology, Japan, <sup>2)</sup>JST-CREST, Japan

### 3TuPo.6.15

#### **Optical Properties of Cu<sub>2</sub>ZnSnSe<sub>4</sub> and Cu<sub>2</sub>SnSe<sub>3</sub> Thin Films Studied by Spectroscopic Ellipsometry**

S. Minoura<sup>1)</sup>, H. Tampo<sup>2)</sup>, Y. Hirate<sup>1)</sup>, K. Kim<sup>2)</sup>, H. Shibata<sup>2)</sup>, S. Niki<sup>2)</sup> and H. Fujiwara<sup>1)</sup>

<sup>1)</sup>Center of Innovative Photovoltaic Systems (CIPS), Japan, Gifu University, Japan, <sup>2)</sup>Research Center for Photovoltaic Technologies, National Institute of Advanced Industrial Science and Technology (AIST), Japan

### 3TuPo.6.16

#### **Fabrication of CdS/CdTe Solar Cells with Transparent p-type Conductive BaCuSeF Back Contact**

K. Yamamoto<sup>1)</sup>, H. Sakakima<sup>1)</sup>, Y. Ogawa<sup>2)</sup>, A. Hosono<sup>2)</sup>, T. Okamoto<sup>2)</sup> and T. Wada<sup>1)</sup>

<sup>1)</sup>Department of Materials Chemistry, Ryukoku University, Japan, <sup>2)</sup>Kisarazu National College of Technology, Japan

### 3TuPo.6.17

#### **Study on Laser Annealed CdTe Thin Films Deposited by Thermal Evaporation Technique**

N. A. Khan<sup>1)</sup>, M. A. Islam<sup>1)</sup>, K. S. Rahman<sup>1)</sup>, F. Haque<sup>1)</sup>, P. Chelvanathan<sup>1)</sup>, M. M. Alam<sup>3)</sup>, K. Sopian<sup>1)</sup> and N. Amin<sup>1,2,3)</sup>

<sup>1)</sup>Solar Energy Research Institute, The National University of Malaysia, Malaysia, <sup>2)</sup>Department of Electrical, Electronic and System Engineering, Faculty of Engineering and Built Environment, The National University of Malaysia, Malaysia, <sup>3)</sup>Advanced Materials Research Chair, Chemistry Department, College of Sciences, King Saud University, Saudi Arabia

### 3TuPo.6.18

#### **Epitaxial Growth of BaSi<sub>2</sub> Films on Ge(111) Substrates by Molecular Beam Epitaxy**

R. Takabe<sup>1)</sup>, M. Baba<sup>1)</sup>, W. Du<sup>1)</sup>, K. Toko<sup>1)</sup>, K. O. Hara<sup>2)</sup>, N. Usami<sup>2,3)</sup> and T. Suemasu<sup>1,3)</sup>

<sup>1)</sup>Institute of Applied Physics, University of Tsukuba, Japan, <sup>2)</sup>Graduate School of Engineering, Nagoya University, Japan, <sup>3)</sup>Japan Science and Technology Agency, CREST, Japan

### 3TuPo.6.19

#### **Intrinsic Point-Defect Engineering to Improve the Electronic Properties of Cuprous Oxide for Photovoltaics**

S. C. Siah<sup>1)</sup>, M. A. Lloyd<sup>1)</sup>, S. Johnston<sup>2)</sup>, R. E. Brandt<sup>1)</sup>, Y. S. Lee<sup>1)</sup> and T. Buonassisi<sup>1)</sup>

<sup>1)</sup>Massachusetts Institute of Technology, United States,  
<sup>2)</sup>National Renewable Energy Laboratory, United States

### 3TuPo.6.20

#### **Numerical Simulation of New Earth-abundant SnS/BaSi<sub>2</sub> Thin-film Solar Cells with High Efficiencies Exceeding 20 %**

K. O. Hara<sup>1,2)</sup> and N. Usami<sup>1,2)</sup>

<sup>1)</sup>Graduate School of Engineering, Nagoya University, Japan, <sup>2)</sup>JST-CREST, Japan

### 3TuPo.6.21

#### **Not Conventional Synthesis of Lead Telluride Applied to a Solar Cell**

K. J. Mendoza Peña<sup>1)</sup>, J. A. Heredia Cancino<sup>1)</sup>, R. Ochoa Landín<sup>2)</sup>, S. J. Castillo<sup>1)</sup>

<sup>1)</sup>Departamento de Investigación en Física, Universidad de Sonora, México, <sup>2)</sup>Departamento de Física, Universidad de Sonora, México

**3TuPo.6.22****Growth and Photoresponse Properties of Polycrystalline Ge Films Formed on Al-induced Crystallization Seed Layer**

K. Nakazawa, K. Toko and T. Suemasu

University of Tsukuba, Institute of Applied Physics,  
Japan

**3TuPo.6.23****Study on Optical Properties and Resistivity of RF Magnetron Sputtered AZO:H Film Used in CdTe Solar Cells**

Z. Du, H. Li and X. Liu

The Key Laboratory of Solar Thermal Energy and Photovoltaic System, Institute of Electrical Engineering, CAS, Canada

**3TuPo.6.24****Two-Step Heat-Treatment Effects on Properties of In<sub>2</sub>O<sub>3</sub> Based Transparent Conducting Thin Films Epitaxially Grown on Sapphire Substrate**

T. Aoshima, Y. Muraki and Y. Sato

Akita University, Japan

**3TuPo.6.25****Thin Films of Single Wall Carbon Nanotube and Reduced Graphene Oxide Back Electrodes for CdTe Solar Cell**

L. Bao<sup>1,2)</sup>, B. Yang<sup>1)</sup>, H. Li<sup>1)</sup>, H. Zhou<sup>2)</sup> and X. Liu<sup>1)</sup>

<sup>1)</sup>The Key Laboratory of Solar Thermal Energy and Photovoltaic System, Institute of Electrical Engineering, CAS, China <sup>2)</sup>The School of Electronic and Computer Engineering, Peking University Shenzhen Graduate School, Peking University, China

**3TuPo.6.26****Improvement of Electrical and Optical Characterization on Sprayed Ga-doped ZnO Films Grown by Hydrogen Annealing**

Kenta Hamachi<sup>1)</sup>, Akiko Ide<sup>1)</sup>, Akiko Mochihara<sup>1)</sup>, Kenji Yoshino<sup>1)</sup>, Minoru Oshima<sup>2)</sup>, Yujin Takemoto<sup>2)</sup>, Kouji Toyota<sup>2)</sup>, Koichiro Inaba<sup>2)</sup>, Ken-ichi Haga<sup>2)</sup> and Toshio Naka<sup>2)</sup>

<sup>1)</sup>Department of Electrical and Electronic Engineering, University of Miyazaki, Japan, <sup>2)</sup>Tosoh Finechem Corporation, Japan

**3TuPo.6.27****Computational Nano-Materials Design and General Rule of Self-regeneration, Self-organization, and Self-Survival of the Low-Cost, Environment-Friendly and High-Efficiency Photovoltaic Solar Cells**

H. Katayama-Yoshida<sup>1)</sup>, K. Sato<sup>2,3)</sup>, H. Asahina<sup>1</sup> and T. Fukushima<sup>1)</sup>

<sup>1)</sup>Department of Materials Engineering Science, Graduate School of Engineering Science, Osaka University, Japan, <sup>2)</sup>PRESTO, Japan Science and Technology Agency (JST), Japan, <sup>3)</sup>Division of Materials and Manufacturing Science, Graduate School of Engineering, Osaka University, Japan

**3TuPo.6.28LN****Synthesis, Characterization of CZTSSe Thin Film Materials and Related Solar Cells**

Xiaodong Ren<sup>1)</sup>, Shengzhong Liu<sup>1,2)</sup>

<sup>1)</sup>Key Laboratory of Applied Surface and Colloid Chemistry, National Ministry of Education, School of Materials Science and Engineering, Shaanxi Normal University, China, <sup>2)</sup>Dalian Institute of Chemical Physics, Dalian National Laboratory for Clean Energy, Chinese Academy of Sciences, China

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**Tuesday, November 25****10:15 - 11:30 Annex****Area 4****4TuPo.7 Wafer-Based Crystalline Silicon 1****Chairperson:**

Kentaro Kutsukake (Tohoku University, Japan)

**4TuPo.7.1****Comparative Study of Indium Tin Oxide Prepared by Pulsed-DC and RF Magnetron Sputtering at Low Temperature and Low Power Conditions**M. Huang<sup>1)</sup>, Z. Hameiri<sup>1,2)</sup>, A. G. Aberle<sup>1)</sup> and T. Mueller<sup>1)</sup><sup>1)</sup>Solar Energy Research Institute of Singapore,  
National University of Singapore, Singapore, <sup>2)</sup>Now  
with: School of Photovoltaic and Renewable Energy  
Engineering, University of New South Wales, Australia**4TuPo.7.2****Suppression of Carrier Tunneling Effect in Interdigitated Back-Contacted Back-Junction Silicon Solar Cell by Lateral Diffusion**C. M. Wei, H. L. Chen, Y. K. Tsao, S. Y. Liu, K. C. Lai  
and Y. P. Pai

Motech Industries, Inc., Science Park Branch, Taiwan

**4TuPo.7.3****Comparative Study of Laser Doping and Laser Transfer Doping of Boron from a Spin-on Source into Crystalline Silicon**M. Ernst, A. Fell and K. WeberCentre for Sustainable Energy Systems, Australian  
National University, Australia**4TuPo.7.4****Realization of Excellent Passivation with Wide Bandgap a-SiOx:H Thin Film for the Application to Silicon Heterojunction Solar Cells**He Zhang<sup>1)</sup>, Kazuyoshi Nakada<sup>2)</sup>, Shinsuke Miyajima<sup>2)</sup>

and Makoto Konagai<sup>1,2)</sup>

<sup>1)</sup>MEXT/FUTURE-PV Innovation Research, JST, Japan,

<sup>2)</sup>Department of Physical Electronics, Tokyo Institute of Technology, Japan

#### 4TuPo.7.5

##### **Solar Cells Based in ITO and ITON Thin Films**

M. Sparvoli<sup>1)</sup>, R. K. Onmori<sup>2)</sup> and J. F. D. Chubaci<sup>2)</sup>

<sup>1)</sup>Universidade Federal do ABC, Brasil, <sup>2)</sup>Universidade de São Paulo, Brasil

#### 4TuPo.7.6

##### **Numerical Simulation of Emitter Fraction on Interdigitated Back Contact Solar Cells**

Kuang-Chieh Lai, Chih-Ming Wei, Yu-Pan Pai, Yun-Kuo Tsao and Shu-Yen Liu

Back Contact Cell Technology Development Project,  
Motech Industries, Inc, Taiwan

#### 4TuPo.7.7

##### **Analysis of Small Area Interdigitiated Back Contact Silicon Solar Cells: The Influence of Boron Diffusion Process on Cell Performances**

S. Y. Liu, Y. K. Tsao, Z. L. Yao, B. S. Lee, K. C. Lai and Y. P. Pai

Motech Industries, Inc., Taiwan

#### 4TuPo.7.8

##### **Control of Passivation Properties by Plasma Diagnostics in a-Si:H/c-Si Heterojunction Solar Cells**

G. H. Wang, R. D. Hu, L. Zhao, H. W. Diao and W. J. Wang

Key Laboratory of Solar Thermal Energy and Photovoltaic System of Chinese Academy of Sciences, Institute of Electrical Engineering, the Chinese Academy of Sciences, China

**4TuPo.7.9****Approaching 20% Conversion Efficiency in Silicon IBC Solar Cells with Modulated Surface Textures Based on Nanotexturing of Micro-scale Pyramids**

A. Ingenito, O. Isabella and M. Zeman

Delft University of Technology, PVMD/Dimes, The Netherlands

**4TuPo.7.10****Influence of Texture Roughness on Contact Finger Geometry of Stencil Printed Silicon Solar Cells**

A. Lorenz, T. Strauch, M. Demant, T. Barnes Hofmeister, J. Seiffe, M. Linse, F. Clement and D. Biro

Fraunhofer Institute for Solar Energy Systems ISE, Germany

**4TuPo.7.11****Withdrawn****4TuPo.7.12****Spectrally-resolved Photoluminescence of Light Trapping Structures for Silicon Solar Cells**

C. Barugkin, T. P. White, T. K. Chong, T. Allen, K. J. Weber and K. R. Catchpole

Centre for Sustainable Energy Systems, The Australia National University, Australia

**4TuPo.7.13****Silicon Heterojunction Solar Cells with Novel Fluorinated n-type Nanocrystalline Silicon Oxide Emitters on p-type c-Si**

Sukanta Dhar, Sourav Mandal, Gourab Das, Chandan Banerjee, Sumita Mukhopadhyay and A. K. Barua

Centre of Excellence for Green Energy and Sensor Systems, Indian Institute of Engineering Science & Technology, India

#### 4TuPo.7.14

#### **The Influence of Metal Contact Ratio on IBC Solar Cell**

Z. L. Yao, Y. P. Pai, K. C. Lai, S. Y. Liu, Y. K. Tsao and B. S. Lee

Motech Industries, Inc., Science Park Branch, Taiwan

#### 4TuPo.7.15

#### **Investigation of Fine Line Screen-printed and Stencil-printed Ag Metal Contacts for Silicon Wafer Solar Cells**

Naomi Nandakumar<sup>2)</sup>, Vinodh Shanmugam<sup>1,2)</sup>, Johnson Wong<sup>1)</sup>, Jessen Cunnusamy<sup>3)</sup>, Michael Zahn<sup>3)</sup> Andrew Zhou<sup>3)</sup>, Rado Yang<sup>3)</sup>, Xiao Chen<sup>3)</sup>, Thomas Mueller<sup>1)</sup> and Armin G. Aberle<sup>1,2)</sup>

<sup>1)</sup>Solar Energy Research Institute of Singapore, National University of Singapore, Singapore, <sup>2)</sup>Electrical and Computer Engineering Department, National University of Singapore, Singapore, <sup>3)</sup>DEK Solar, U.K.

#### 4TuPo.7.16

#### **Spin-Coating Alumina Thin Films For Back Side Passivated Silicon Solar Cell**

Takuma Noguchi, Abdullah Uzum, Hiroyuki Kanda and Seigo Ito

University of Hyogo, Japan

#### 4TuPo.7.17

#### **Spatial Atomic Layer Deposition of Intrinsic Zinc Oxide Films for Application in the Photovoltaic Industry**

Naomi Nandakumar<sup>1,2)</sup>, Bas Dielissen<sup>3)</sup>, Diana Garcia-Alonso<sup>4)</sup>, W. M. M. Kessels<sup>4)</sup>, Roger Gortzen<sup>3)</sup>, Armin G. Aberle<sup>1,2)</sup> and Bram Hoex<sup>1)</sup>

<sup>1)</sup>Solar Energy Research Institute of Singapore (SERIS), National University of Singapore, Singapore,

<sup>2)</sup>Department of Electrical and Computer Engineering, National University of Singapore, Singapore, <sup>3)</sup>

SoLayTec B. V., Netherlands, <sup>4)</sup>Department of Applied Physics, Eindhoven University of Technology, Netherlands

#### 4TuPo.7.18

#### **Thermal Stability of Single Al<sub>2</sub>O<sub>3</sub> Film and Al<sub>2</sub>O<sub>3</sub>/SiN<sub>x</sub> Film Stack for c-Si Surface Passivation**

Chunlan Zhou, Yan Zhao, yehua Tang, Su Zhou and Wenjing Wang

Key Laboratory of Solar Thermal Energy and Photovoltaic System, Institute of Electrical Engineering, Chinese Academy of Sciences, China

#### 4TuPo.7.19

**Withdrawn**

#### 4TuPo.7.20

#### **Structure of AlOx Passivation Films Deposited by Mist CVD Method for Solar Cell Applications**

K. Iguchi<sup>1,3)</sup>, S. Kitano<sup>1)</sup>, S. Miki<sup>1,3)</sup>, A. Ogura<sup>2,3)</sup>, H. Yoshida<sup>1,3)</sup>, S. Satoh<sup>1,3)</sup> and K. Arafune<sup>1,3)</sup>

<sup>1)</sup>University of Hyogo, Japan, <sup>2)</sup>Meiji University, Japan,

<sup>3)</sup>JST-CREST, Japan

#### 4TuPo.7.21

#### **Characterization of Laser Transferred Contact through Aluminum Oxide Passivation Layer**

Shunsuke Urabe<sup>1)</sup>, Junpei Irikawa<sup>1)</sup>, Makoto Konagai<sup>1,2)</sup> and Shinsuke Miyajima<sup>1)</sup>

<sup>1)</sup>Graduation School of Science and Engineering,

Japan, <sup>2)</sup>PVREC, Japan

#### 4TuPo.7.22

#### **Impact of the Firing Step on the Al<sub>2</sub>O<sub>3</sub> Passivation on p-type Cz Si Wafers**

M. Pawlik<sup>1,2)</sup>, J-P. Vilcot<sup>1)</sup>, M. Halbwax<sup>1)</sup>, M. Gauthier<sup>3)</sup> and N. Le Quang<sup>3)</sup>

<sup>1)</sup>Institute of Electronics, Microelectronics and

Nanotechnology (IEMN), France, <sup>2)</sup>Ecole Centrale de

Lille, France, <sup>3)</sup>EDF ENR PWT (PHOTOWATT), France

#### 4TuPo.7.23

##### **Mercury: Record Efficiency of Industrial 6" IBC with Front Floating Emitter**

A. A. Mewe, I. Cesar, N. Guillemin, A. R. Burgers, E. E. Bende, L. J. Geerligs and A. W. Weeber

ECN Solar Energy, The Netherlands

#### 4TuPo.7.24

##### **Impact of Sputtering Ion Bombardment on the Heterointerfaces of a-Si:H/c-Si Solar Cells with Double-layered In<sub>2</sub>O<sub>3</sub>:Sn Structures**

M. Tamakoshi and N. Matsuki

Center for Innovative Photovoltaic Systems (CIPS), Gifu University, Japan

#### 4TuPo.7.25

##### **Loss Analysis of Laser-doping PERL Solar Cells with Various Substrate Thicknesses**

Dianlei Wang<sup>1)</sup>, Shuquan Chen<sup>1)</sup>, Zongcun Liang<sup>1,2)</sup>, Qinglin Zheng<sup>1)</sup> and Hui Shen<sup>1,2)</sup>

<sup>1)</sup>Institute for Solar Energy Systems, Sun Yat-sen University, China, <sup>2)</sup>Shunde SYSU Institute for Solar Energy, China

#### 4TuPo.7.26

##### **Ultra-fast, Single-side Alkaline Etching Process of Crystalline Silicon**

S. M. Yu<sup>1)</sup>, W. C. Sun<sup>2)</sup>, W. Y. Chou<sup>2)</sup>, S. Y. Wei<sup>2)</sup>, H. C. Chen<sup>3)</sup>, L. T. Huang<sup>3)</sup> and L. S. Huang<sup>3)</sup>

<sup>1)</sup>Department of Engineering and System Science, National Tsing Hua University, Taiwan, <sup>2)</sup>Material & Chemical Research Laboratories, Industrial Technology Research Institute, Taiwan, <sup>3)</sup>Infina Technology Co.,Ltd., Taiwan

**4TuPo.7.27****Automated Methods for Determining Bulk Doping Density from Simultaneous Photoconductance and Photoluminescence Measurements**

M. K. Juhl, Z. Hameiri and T. Trupke

The School of Photovoltaic and Renewable Energy Engineering, The University of New South Wales, Australia

**4TuPo.7.28****TiO<sub>2</sub> Nanoparticle/Liquid Source SiO<sub>2</sub> Back Reflector for Solar Cells**

T. Murooka and H. Nagayoshi

Tokyo National College of Technology, Japan

**4TuPo.7.29****Quantifying the Recombination Strength of Grain Boundaries in Multicrystalline Silicon Wafers Through Photoluminescence Imaging**

H. C. Sio<sup>1)</sup>, T. Trupke<sup>2)</sup> and D. Macdonald<sup>1)</sup>

<sup>1)</sup>Research School of Engineering, The Australian National University (ANU), Australia, <sup>2)</sup>BT Imaging Pty Ltd, Australia

**4TuPo.7.30****Crystallographic and Electronic Quality of Si Single Crystals Grown by the Noncontact Crucible Method**

K. Nakajima<sup>1)</sup>, R. Murai<sup>1)</sup>, S. Ono<sup>1)</sup>, K. Morishita<sup>2)</sup>, D. M. Powell<sup>3)</sup>, M. Kivambe<sup>3)</sup> and T. Buonassisi<sup>3)</sup>

<sup>1)</sup>FUTURE-PV Innovation, Japan, <sup>2)</sup>Graduate School of Engineering, Kyoto University, Japan, <sup>3)</sup>Massachusetts Institute of Technology, USA

**4TuPo.7.31****Interconnection Process by Using Conductive Film for Crystalline Silicon Photovoltaic Modules**

Keiko Kizawa<sup>1)</sup>, Shigenori Shimizu<sup>1)</sup>, Naotaka Tanaka<sup>1)</sup>,

Takeshi Horiuchi<sup>2)</sup>, Yuka Ito<sup>2)</sup> and Atsushi Masuda<sup>3)</sup>

<sup>1)</sup>Hitachi Chemical Co., Ltd., Japan, <sup>2)</sup>Hitachi Chemical Co., Ltd., Japan, <sup>3)</sup>National Institute of Advanced Industrial Science and Technology, Japan

#### 4TuPo.7.32

#### **Laser Doping of Boron-Doped Si Paste for High Efficiency Si Solar Cells**

Yuka Tomizawa<sup>1)</sup>, Tetsuya Imamura<sup>1)</sup>, Masaya Soeda<sup>1,2)</sup>, Yoshinori Ikeda<sup>1)</sup> and Takashi Shiro<sup>1,2)</sup>

<sup>1)</sup>Electronics Materials Development Project, New Business Development Business Unit, Teijin Limited, Japan, <sup>2)</sup>NanoGram Corporation, USA

#### 4TuPo.7.33

#### **The Influence of Blistering Defect on Aluminum Oxide Passivation on Interdigitated Back Contact Solar Cell**

Yun-Kuo Tsao, Kuang-Chieh Lai and Richard Pai

Motech Industries, Inc., Taiwan

#### 4TuPo.7.34

#### **Rapid Optimal Process Development Coupled with Optical Emission Spectroscopy on Intrinsic Hydrogenated Amorphous Silicon as a Passivation Layer Prepared by PECVD for Solar Cell**

Yu-Lin Hsieh<sup>1)</sup>, Chien-Chieh Lee<sup>2)</sup>, Tomi T. Li<sup>1)</sup>, Chia-Cheng Lu<sup>1)</sup>, Jenq-Yang Chang<sup>3)</sup>, I-Chen Chen<sup>4)</sup> and Ju-Yi Lee<sup>1)</sup>

<sup>1)</sup>Department of Mechanical Engineering, National Central University, Taiwan, <sup>2)</sup>Optical Science Center, National Central University, Taiwan,

<sup>3)</sup>Department of Optics and Photonics, National Central University, Taiwan, <sup>4)</sup>Institutes of Materials Science and Engineering, National Central University, Taiwan

**4TuPo.7.35****Co-Diffusion of Locally Patterned N<sup>+</sup> and P<sup>+</sup> Doped Layers for Interdigitated Back Contact Solar Cells by Ultrasonic Spray Technique**

S. Y. Wei<sup>1)</sup>, W. C. Sun<sup>1)</sup>, J. W. Liao<sup>2)</sup>, T. I. Lin<sup>1)</sup>, C. Y. Kuo<sup>2)</sup>, S. M. Yu<sup>1)</sup>, C. H. Wu<sup>3)</sup>, K. B. Chen<sup>3)</sup>, H. H. Wu<sup>3)</sup>, H. C. Lin<sup>3)</sup>, N. T. Ou<sup>3)</sup>, K. W. Huang<sup>3)</sup>, K. Y. Wu<sup>4)</sup>, C. H. Yu<sup>5)</sup>, C. C. Cho<sup>5)</sup>, J. C. Lee<sup>5)</sup> and J. H. Tsai<sup>5)</sup>

<sup>1)</sup>Material and Chemical Research Laboratories, Industrial Technology Research Institute, Taiwan,

<sup>2)</sup>Engineering and System Science department, National Tsing Hua University, Taiwan, <sup>3)</sup>Gintech Energy Corporation, Taiwan, <sup>4)</sup>China Steel Corporation,

<sup>5)</sup>Thintech Materials Technology Corporation, Taiwan

**4TuPo.7.36****Formation and Evaluation of N-type Emitter by Phosphorus Thermal Diffusion For Crystalline Silicon Solar Cells**

H. Imaeda<sup>1,3)</sup>, K. Urushibata<sup>1,3)</sup>, Y. Miki<sup>1)</sup>, I. Nakagoshi<sup>1)</sup>, S. Miki<sup>1)</sup>, A. Ogura<sup>2,3)</sup>, H. Yoshida<sup>1,3)</sup>, S. Sata<sup>1,3)</sup> and K. Arafune<sup>1,3)</sup>

<sup>1)</sup>University of Hyogo, Japan, <sup>2)</sup>University of Meiji, Japan, <sup>3)</sup>JST-CREST, Japan

**4TuPo.7.37****Impact of Growth Rate on Multicrystalline Silicon Grown from Small Randomly Oriented Seeds**

R. R. Prakash<sup>1,2)</sup>, K. Jiptner<sup>1)</sup>, Y. Miyamura<sup>1)</sup>, J. Chen<sup>1)</sup>, H. Harada<sup>1)</sup> and T. Sekiguchi<sup>1,2)</sup>

<sup>1)</sup>National Institute for Materials Science, Japan,

<sup>2)</sup>Graduate School of Pure and Applied Science, University of Tsukuba, Japan

**4TuPo.7.38****High-sensitivity Infrared Imaging Polariscope for Prompt Characterization of Residual Strain in Large Cast-grown Silicon**

K. Fuchuya, M. Yamada and M. Fukuzawa

Graduate School of Science and Technology, Kyoto Institute of Technology, Japan

#### 4TuPo.7.39

### **Polysilazane Based Solution-derived Diffusion Barrier Layer for Back Contact Crystalline Si Solar Cell**

Y. Jiang, Y. Ishikawa, S. Yoshinaga, T. Honda, M. Horita and Y. Uraoka

NARA INSTITUTE of SCIENCE and TECHNOLOGY,  
JAPAN

#### 4TuPo.7.40

### **Impact of N<sub>2</sub>O Plasma Pretreatment Prior to Silicon Nitride Deposition on Silicon Solar Cells with Ni-Cu Based Front Metallization**

M. Raval<sup>1,2)</sup>, S. Saseendran<sup>1,3)</sup>, S. Saravanan<sup>1)</sup>, B. Arunachalam<sup>1)</sup>, S. Mallikarjunchary<sup>1)</sup>, H. Singh<sup>1,2)</sup>, K. Murukesan<sup>1,3)</sup>, S. Kumbhar<sup>1)</sup>, A. Kottanthalayil<sup>1,3)</sup> and C. Solanki<sup>1,2)</sup>

<sup>1)</sup>National Centre for Photovoltaic Research and Education, India, <sup>2)</sup>Department of Energy Science and Engineering, India, <sup>3)</sup>Department of Electrical Engineering, India

#### 4TuPo.7.41

### **Enhancement of PN Si Solar Cells by Graphene Oxide**

Guan-Yu Chen, Liang-Jun Chen and Chu-Hsuan Lin

Department of Opto-electronic Engineering, National Dong Hwa University, Taiwan

#### 4TuPo.7.42

### **Passivation Quality of Cat-CVD SiN<sub>x</sub> and SiN<sub>x</sub>/P Cat-doped Layers on Textured C-si Wafers**

Trinh Cham Thi<sup>1,2)</sup>, Koichi Koyama<sup>1,2)</sup>, Keisuke Ohdaira<sup>1,2)</sup> and Hideki Matsumura<sup>1,2)</sup>

<sup>1)</sup>Japan Advanced Institute of Science and Technology (JAIST), Japan, <sup>2)</sup>CREST, Japan Science and

Technology Agency (JST), Japan

#### 4TuPo.7.43

### **High Growth-Rate Sputter-Epitaxy of Low Thread-Dislocation-Density Ge Film on Si (100) Substrate for Solar-Cell Application**

Wenchang Yeh, Akihiro Matsumoto, Keisuke Sugihara and Hisataka Hayase

Interdisciplinary Graduate School of Science and Engineering, Shimane University, Japan

#### 4TuPo.7.44

### **Antireflective Effect of Wide-gap Heterojunction Emitter for Crystalline Silicon Heterojunction Solar Cell**

E. O. Ateto<sup>1)</sup>, Kazuki Shimizu<sup>1)</sup>, Makoto Konagai<sup>1,2)</sup> and Shinsuke Miyajima<sup>1)</sup>

<sup>1)</sup>Graduate School of Science and Engineering, Tokyo Tech, Japan, <sup>2)</sup>PVREC, Tokyo Tech, Japan

#### 4TuPo.7.45

### **Application of c-Si Surface Oxidation to a-Si/c-Si Heterojunction Solar Cells**

T. Oikawa<sup>1)</sup>, K. Ohdaira<sup>1,2)</sup> and H. Matsumura<sup>1,2)</sup>

<sup>1)</sup>Japan Advanced Institute of Science and Technology, Japan, <sup>2)</sup>CREST, Japan Science and Technology Agency

#### 4TuPo.7.46

### **Correlation Between PL Intensity and Dislocation Density in Silicon Crystal Using High Spatial Resolution PL Measurement**

S. Ninomiya<sup>1)</sup>, K. Kutsukake<sup>1,2)</sup>, M. Deura<sup>1)</sup>, Y. Ohno<sup>1)</sup>, N. Usami<sup>3)</sup> and I. Yonenaga<sup>1)</sup>

<sup>1)</sup>Tohoku University, Japan, <sup>2)</sup>JST PRESTO, Japan,

<sup>3)</sup>Nagoya University, Japan

**4TuPo.7.47**

**R&D Activities of C-Si Solar Cells and Modules in AIST(FREA)**

K. Shirasawa, Y. Kida, T. Fukuda and H. Takato

National Institute of Advanced Industrial Science Technology, Japan

**4TuPo.7.48**

**Studies of Diamond Wire Sawn Wafers among Different Tension Setting in Processe**

Cheng-Fung Yeh, Yen-Chun Chou, Shang-wei Yang, Yu-Chung Chen and Jian-Jiun Wang

Motech Industries, Inc., Taiwan

**4TuPo.7.49**

**Emission-Free Fabrication of mono-Crystalline Si Solar Cells with 16.7% Efficiency**

Wenchang Yeh and Takuya Wasa

Interdisciplinary Graduate School of Science and Engineering, Shimane University, Japan

**4TuPo.7.50**

**Void Analysis Using Ultrasonic Mapping Technique for PERC Solar Cell Evaluation**

M. Dhamrin, S. Suzuki, M. Matsubara, Y. Nishio and H. Tada

Toyo Aluminium K.K., Japan

**4TuPo.7.51**

**Withdrawn**

**4TuPo.7.52**

**A Novel Process for Solar-grade Silicon Production via Electrolysis of SiO<sub>2</sub> Granules in Molten Salt**

X. Yang<sup>1,2)</sup>, K. Yasuda<sup>1,3)</sup>, T. Nohira<sup>1,2)</sup>, R. Hagiwara<sup>1)</sup>, K. Ichitsubo<sup>4)</sup>, K. Masuda<sup>4)</sup> and T. Homma<sup>2,5)</sup>

<sup>1)</sup>Graduate School of Energy Science, Kyoto University, Japan, <sup>2)</sup>CREST, Japan Science and Technology

Agency, Japan, <sup>3)</sup>Environment, Safety and Health Organization, Kyoto University, Japan, <sup>4)</sup>R&D Center, Taiheiyo Cement Corporation, Japan, <sup>5)</sup>Faculty of Science and Engineering, Waseda University, Japan

#### 4TuPo.7.53

#### **Investigation on Rear Surface Passivation of Floating Junction Bifacial Solar Cell**

Suhaila Sepeai<sup>1)</sup>, M. K. M. Khairunaz<sup>1)</sup>, A. W. Azhari<sup>1,2)</sup>, N. A. Ludin<sup>1)</sup>, K. Sopian<sup>1)</sup> and Saleem H. Zaidi<sup>1)</sup>

<sup>1)</sup>Solar Energy Research Institute (SERI), Universiti Kebangsaan Malaysia, Malaysia, <sup>2)</sup>School of Environmental Engineering, Universiti Malaysia Perlis, Malaysia

#### 4TuPo.7.54

#### **Influence of Spin-on Doping Process on Surface Passivation Properties of Bulk Si**

K. B. Lin<sup>1)</sup>, J. W. Hu<sup>1)</sup>, K. Y. Fong<sup>1)</sup>, T. M. Kuan<sup>2)</sup>, C. W. Kuo<sup>2)</sup>, C. Y. Yu<sup>2)</sup>, C. C. Lee<sup>3)</sup>, J. Y. Chang<sup>3)</sup>, T. Li<sup>4)</sup> and I. C. Chen<sup>1)</sup>

<sup>1)</sup>Institute of Materials Science and Engineering, National Central University, Taiwan, <sup>2)</sup>TSEC Corporation, Taiwan, <sup>3)</sup>Optical Sciences Center, National Central University, Taiwan, <sup>4)</sup>Department of Mechanical Engineering, National Central University, Taiwan

#### 4TuPo.7.55

#### **Surface Passivation by Sol-Gel Processed MgO for c-Si Solar Cell Applications**

N. Balaji<sup>1)</sup>, C. Park<sup>1)</sup>, J. Raja<sup>2)</sup>, M. Ju<sup>2)</sup>, S. Lee<sup>2)</sup>, S. Chung<sup>1)</sup> and J. Yi.<sup>1,2)</sup>

<sup>1)</sup>Department of Energy Science, Sungkyunkwan University, Korea <sup>2)</sup>College of Information and Communication Engineering, Sungkyunkwan University, Korea

**4TuPo.7.56****Relationship Between Passivation Property and Band Alignment on O<sub>3</sub>-Based ALD AlOx Surface Passivated Crystalline Si for Photovoltaic Applications**

N. Ikeno<sup>1)</sup>, Y. Yamashita<sup>1)</sup>, H. Oji<sup>2)</sup>, T. Katsumata<sup>1,5)</sup>, S. Miki<sup>3)</sup>, Y. Miki<sup>3)</sup>, S. Kitano<sup>3)</sup>, K. Arafune<sup>3,5)</sup>, H. Yoshida<sup>3,5)</sup>, S. Satoh<sup>3,5)</sup>, T. Chikyow<sup>4)</sup>, I. Hirosawa<sup>2)</sup> and A. Ogura<sup>1,5)</sup>

<sup>1)</sup>Meiji Univ., Japan, <sup>2)</sup>JASRI, Japan, <sup>3)</sup>Univ. of Hyogo, Japan, <sup>4)</sup>NIMS, Japan, <sup>5)</sup>JST-CREST, Japan

**4TuPo.7.57****Annealing Behavior of Electrically Active Nitrogen-Oxygen Complexes in Cast-grown Silicon Crystal**

K. Sato<sup>1,2)</sup>, A. Ogura<sup>1)</sup> and H. Ono<sup>1,2)</sup>

<sup>1)</sup>Meiji University, Japan, <sup>2)</sup>Kanagawa Industrial Technology Center, Japan

**4TuPo.7.58****Study of Carrier Recombination at Crystalline Defects Induced by SiN<sub>x</sub> Plasma CVD**

T. Tachibana<sup>1)</sup>, D. Takai<sup>1)</sup>, T. Kojima<sup>1)</sup>, A. Ogura<sup>2)</sup> and Y. Ohshita<sup>1)</sup>

<sup>1)</sup>Toyota Tech. Inst., Japan, <sup>2)</sup>Meiji Univ. Japan

**4TuPo.7.59****Decrease of Effective Lifetime in Si(100) and Si(111) Crystal with SiN<sub>x</sub>:H Layer by Light Irradiation**

D. Takai, T. Kojima, T. Tachibana, N. Kojima, Y. Ohshita and M. Yamaguchi

Toyota Technological Institute, Japan

**4TuPo.7.60****A Modified Metallurgical Refining Process for Multicrystalline Silicon Ingot using a Seed in Directional Solidification**

J. K. Lee<sup>1, 3)</sup>, J. S. Lee<sup>1)</sup>, B. Y. Jang<sup>1)</sup>, J. S. Kim<sup>1)</sup>, Y. S. Ahn<sup>1)</sup>, G. H. Kang<sup>2)</sup> and C. H. Cho<sup>3)</sup>

<sup>1)</sup>Advanced Materials and Devices Laboratory, Korea Institute of Energy Research, Republic of Korea,

<sup>2)</sup>Photovoltaic Laboratory, Korea Institute of Energy Research, Republic of Korea, <sup>3)</sup>Graduate School of Energy Science and Technology, Chungnam National University, Republic of Korea

#### 4TuPo.7.61

#### **Understanding the Uniqueness of the Inkjet Metallization of Multicrystalline Silicon Solar Cell**

Nian Chen, A. Ebong

Energy Production and Infrastructure Center (EPIC), Department of Electrical and Computer Engineering, University of North Carolina, Charlotte

#### 4TuPo.7.62

#### **HF-free Texturing of Si Wafer for Photo Voltaic Cells**

Seung Hyun Ha, Ji Hyeon Kim, In Sang Yoo and Sang Joon Park

Department of Chemical and Biological Engineering, Gachon University, Korea

#### 4TuPo.7.63

#### **Generalized Analysis of the Impact of Emitter Sheet Resistance on Silicon Solar Cell Performance**

Nian Chen<sup>1)</sup>, Keith Tate<sup>2)</sup>, Ahrar Ahmed Chowdhury<sup>1)</sup> and Abasifreke Ebong<sup>1)</sup>

<sup>1)</sup>Department of Electrical and Computer Engineering, University of North Carolina at Charlotte, United States,

<sup>2)</sup>School of Electrical and Computer Engineering, Georgia Institute of Technology, United States

#### 4TuPo.7.64

#### **Surface Damage Removal Techniques on Laser Texturization of c-Si Wafers to Achieved High Efficiency**

Nurul Huda Abdul Razak<sup>1)</sup> and Nowshad Amin<sup>1,2)</sup>

<sup>1)</sup>Department of Electrical, Electronic and Systems Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, Malaysia, <sup>2)</sup>Solar Energy Research Institute (SERI), Universiti Kebangsaan Malaysia, Malaysia

**4TuPo.7.65**

**Recycling Technology of Precious Metals**

T. Yanagisawa

Tanaka Holdings Co., Ltd., Japan

**4TuPo.7.66LN**

**Dual-Junction Perovskite/Silicon Tandem Solar Cell**

I. Al Mansouri, A. Ho-Baillie and M. A. Green

University of New South Wales, Australia

**4TuPo.7.67LN**

**High Efficiency Large Area IBC Solar Cells: Processing and Characterization**

B.J. O'Sullivan<sup>1)</sup>, S. Singh<sup>1)</sup>, K. Manabu<sup>2)</sup>, M Debucquoy<sup>1)</sup> and J. Szlufcik<sup>1)</sup>

<sup>1)</sup>imec, Belgium, <sup>2)</sup>Kyocera Corporation, Japan

**4TuPo.7.68LN**

**Efficient Light Management for Crystalline Silicon Solar Cells**

Yahui Liu<sup>1)</sup>, Shell He<sup>2)</sup>, Shengzhong Liu<sup>1,3)</sup>

<sup>1)</sup>Key Laboratory of Applied Surface and Colloid Chemistry, National Ministry of Education, School of Materials Science and Engineering, Shaanxi Normal University, China, <sup>2)</sup>Huanghe Hydropower Solar Industry Technology Co.,Ltd, China, <sup>3)</sup>Dalian Institute of Chemical Physics, Dalian National Laboratory for Clean Energy, Chinese Academy of Sciences, China

**4TuPo.7.69LN**

**Room Temperature Boron Doping Using UV Pulse Laser with Boron-doped Silicon Nano Ink**

M. Manabe<sup>1)</sup>, H. Nishimura<sup>1)</sup>, T. Fuyuki<sup>1)</sup>, Y. Tomizawa<sup>2)</sup>  
and Y. Ikeda<sup>2)</sup>

<sup>1)</sup>Graduate School of Materials Science, Nara Institute  
of Science and Technology (NAIST), Japan, <sup>2)</sup>Teijin Co.,  
Ltd., Japan

#### 4TuPo.7.70LN

##### **Relation Between Misorientation Angle and Recombination Activity of Small Angle Grain Boundaries Induced by Multi-seed Casting**

T. Kojima<sup>1)</sup>, T. Tachibana<sup>1)</sup>, Y. Ohshita<sup>1)</sup>, R. R. Prakash<sup>2,3)</sup>,  
T. Sekiguchi<sup>2,3)</sup> and M. Yamaguchi<sup>1)</sup>

<sup>1)</sup>Toyota Technological Institute, Japan, <sup>2)</sup>National  
Institute for Materials Science, Japan, <sup>3)</sup>Tsukuba  
University, Japan

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#### Tuesday, November 25

#### 14:45 - 16:10 Annex

**Area 5**

#### 5TuPo.8 III-V Cell & CPV 1

Chairpersons:

Takeyoshi Sugaya (AIST, Japan)

Taishi Sumita (Japan Aerospace Exploration Agency,  
Japan)

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#### 5TuPo.8.1

##### **Evaluation of Conversion Efficiency for Multi- junction Solar Cell with Luminescent Coupling Considering Series and Shunt Resistance Effects**

A. Ogura, T. Sogabe and Y. Okada

Research Center for Advanced Science and  
Technology (RCAST), The University of Tokyo, Japan

#### 5TuPo.8.2

##### **Silicon Heterojunction Solar Cells with Plated Contacts for Low Concentration Photovoltaics**

M. Despeisse, C. Alleb   , J. Champliaud, J. Levrat,  
A. Descoeuilles, A. Faes, L. Barraud, F. Debrot, A.

Lachowicz, N. Badel and C. Ballif

CSEM SA, PV-center, Switzerland

### 5TuPo.8.3

#### **Characteristics of *InGaP/Ga(In)As/Ge* Solar Cells Fabricated with Wet Chemical Etching Final Process**

V. S. Kalinovsky, E. A. Grebenschikova, P. A. Dmitriev, N. D. Il'inskaya, E. B. Kontrosh, N. M. Lebedeva and A. B. Malevskaya

Ioffe Physical-Technical Institute, Russia

### 5TuPo.8.4

#### **I-V Curves of Superlattice Solar Cells at High Temperatures**

J. Nishinaga<sup>1)</sup>, A. Kawaharazuka<sup>2,3)</sup> and Y. Horikoshi<sup>2,3)</sup>

<sup>1)</sup>Research Center for Photovoltaic Technology, AIST, Japan,

<sup>2)</sup>Faculty of Science and Engineering, Waseda University, Japan, <sup>3)</sup>CREST, JST, Japan

### 5TuPo.8.5

#### **Withdrawn**

### 5TuPo.8.6

#### **Growth and Advanced Characterization of *InGaP/InGaAs/Ge* Triple-Junction Solar Cells**

I. A. Alhomoudi<sup>1)</sup>, Z. Pulwin<sup>2)</sup>, J. A. Ott<sup>3)</sup>, M. Hopstaken<sup>3)</sup> and C. Ebert<sup>2)</sup>

<sup>1)</sup>King Abdulaziz City for Science and Technology (KACST), Saudi Arabia, <sup>2)</sup>Veeco Instruments

Corporation, USA, <sup>3)</sup>IBM Thomas J. Watson Research Center, USA

### 5TuPo.8.7

#### **Demonstration of the Mini-band Investigation in Strain-Balanced *InGaAs/GaAsP* Quantum Well Solar Cells by Combination of a Piezoelectric Photothermal and Photoreflectance Spectroscopies**

T. Aihara<sup>1)</sup>, T. Murakami<sup>1)</sup>, H. Kuradome<sup>1)</sup>, T. Sugimoto<sup>1)</sup>, H. Suzuki<sup>1)</sup>, A. Fukuyama<sup>1)</sup>, T. Ikari<sup>1)</sup>, K. Toprasertpong<sup>2)</sup>, M. Sugiyama<sup>2)</sup> and Y. Nakano<sup>2)</sup>

<sup>1)</sup>Faculty of Engineering, University of Miyazaki, Japan,

<sup>2)</sup>Faculty of Engineering, The University of Tokyo,  
Japan

### 5TuPo.8.8

#### **Minimized Reduction in Open-circuit Voltage for Quantum Well Solar Cell with Bandgap-Engineered Graded Quantum Well Depths**

Xiaohan Li, Vaishno Dasika, Ping-Chun Li, Li Ji, Seth R. Bank and Edward T. Yu

Microelectronics Research Center, The University of Texas at Austin, USA

### 5TuPo.8.9

#### **Investigation on the Origin of N-H Complex in GaAsN Grown by Chemical Beam Epitaxy Using Deuterated Trisdimethylaminoarsenic**

K. Demizu<sup>1)</sup>, K. Ikeda<sup>1)</sup>, N. Kojima<sup>1)</sup>, Y. Ohshita<sup>1)</sup>, E. Omar<sup>1)</sup>, H. Machida<sup>2)</sup>, M. Ishikawa<sup>2)</sup>, H. Sudoh<sup>2)</sup> and M. Yamaguchi<sup>1)</sup>

<sup>1)</sup>Toyota Technological Institute, Japan, <sup>2)</sup>Gas-phase Growth Ltd., Japan

### 5TuPo.8.10

#### **Structural and Optical Characterization of MBE Grown ( $In_xGa_{1-x})_2Se_3$ on GaAs(111)**

H. Nakamura, N. Kojima, Y. Ohshita and M. Yamaguchi  
Toyota Technological Institute, Japan

### 5TuPo.8.11

#### ***In situ* X-ray Diffraction Study of Strain Relaxation Process of Lattice-mismatched InGaAs / GaAs**

Daisuke Kodera<sup>1)</sup>, Toshiaki Nishi<sup>1)</sup>, Kazuma Ikeda<sup>1)</sup>, Takuo Sasaki<sup>2)</sup>, Masamitu Takahashi<sup>2)</sup>, Hidetoshi Suzuki<sup>3)</sup>, Hiroya Nakamura<sup>1)</sup>, Yoshio Ohshita<sup>1)</sup>, Nobuaki Kojima, Itaru Kamiya<sup>1)</sup> and Masafumi Yamaguchi<sup>1)</sup>

<sup>1)</sup>Toyota Technological Institute, Japan, <sup>2)</sup>Japan Atomic Energy Agency, Japan, <sup>3)</sup>University of Miyazaki, Japan

### 5TuPo.8.12

#### **Numerical Study of InGaN-based Solar Cell with Direction of Piezoelectric Field**

S. Lee, Y. Honda and H. Amano

Department of Electrical Engineering and Computer Science, Graduate School of Engineering, Nagoya University, Japan

### 5TuPo.8.13

#### **GaN-based Solar Cell as Grown by the MOCVD and MBE - techniques**

J. A. Espinoza-Figueroa<sup>1)</sup>, V. H. Mendez-Garcia<sup>1)</sup>, M. Lopez-Lopez<sup>2)</sup>, Y. Casallas-Moreno<sup>2)</sup>, S. Gallardo-Hernandez<sup>2)</sup>, Víctor Sanchez-Resendiz<sup>2)</sup>, G. Contreras-Puente<sup>3)</sup>, M. Ramirez-Lopez<sup>4)</sup> and F. de Moure-Flores<sup>5)</sup>

<sup>1)</sup>Universidad Autónoma de San Luis Potos , Mexico,

<sup>2)</sup>Centro de Investigación y de Estudios Avanzados del I.P.N., Mexico, <sup>3)</sup>Escuela Superior de Fisica y Matematicas del I.P.N., Mexico, <sup>4)</sup>Unidad Profesional Interdisciplinaria en Ingeniería y Tecnologías

Avanzadas del I.P.N., Mexico, <sup>5)</sup>Facultad de Química de la Universidad Autónoma de Querétaro, Mexico

### 5TuPo.8.14

#### **Evaluation of Misalignments within a CPV Module by the Module Optical Analyzer (MOA): A Case of Study Concerning Temperature Effects on the Module Performance**

R. Herrero, S. Askins, I. Antón and G. Sala

Instituto de Energía Solar IES-UPM, Spain

### 5TuPo.8.15

#### **A Consideration of Cooperative Solar Tracking of An Array of Compact Solar-pumped Lasers Combined with PV Cells for Electricity Generation**

T. Motohiro<sup>1,2,3)</sup>, A. Ichiki<sup>3)</sup>, T. Ichikawa<sup>2)</sup>, H. Ito<sup>2)</sup>, K.

Hasegawa<sup>2)</sup>, S. Mizuno<sup>2)</sup>, T. Ito<sup>2)</sup>, T. Kajino<sup>2)</sup>, Y. Takeda<sup>2)</sup> and K. Higuchi<sup>2,3)</sup>

<sup>1)</sup>Department of Material Sciences and Engineering, Nagoya University, <sup>2)</sup>Toyota Central Research and Development Laboratories, Inc., Japan, <sup>3)</sup>Green Mobility Collaborative Research Center, Nagoya University, Japan

#### 5TuPo.8.16

#### **Influence of Aerosol on Performance of Concentrator Photovoltaics**

K. Nomura<sup>1)</sup>, K. Imai<sup>1)</sup>, Y. Ota<sup>1)</sup>, T. Minemoto<sup>2)</sup> and K. Nishioka<sup>1)</sup>

<sup>1)</sup>University of Miyazaki, Japan, <sup>2)</sup>College of Science and Engineering, Ritsumeikan University

#### 5TuPo.8.17

#### **Solar Cell Size Influence on Actual Concentrator Photovoltaic Module Operation Estimated Using Finite Element Method**

Y. Ota and K. Nishioka

University of Miyazaki, Japan

#### 5TuPo.8.18

#### **The Effects of Circumsolar and Diffuse Solar Radiation on Cell-in-Cell-Structured CPV Module**

D. Hirai, K. Okamoto and N. Yamada

Department of Mechanical Engineering, Nagaoka University of Technology

#### 5TuPo.8.19

#### **Design of Shaped Fresnel Lens by Integration of Pentagon Prisms**

K. Araki and H. Nagai

Daido Steel, Japan

**5TuPo.8.20****Heat Transfer Analysis of Hybrid Photovoltaic Module for the Conversion of Sunlight into Microwave in Solar Power Satellite**

D. Sato<sup>1)</sup>, N. Yamada<sup>1)</sup> and K. Tanaka<sup>2)</sup>

<sup>1)</sup>Department of Mechanical Engineering, Nagaoka University of Technology, Japan, <sup>2)</sup>Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency (JAXA), Japan

**5TuPo.8.21LN****Structural and PL Investigations of MBE-grown InGaAs and GaAsSb Compounds with Low Lattice-Mismatch to GaAs**

A. Maros, N. Faleev and C. Honsberg

Arizona State University, USA

**5TuPo.8.22LN****Anti-soiling Coating Based on Silica for Fresnel Lens of Concentrator Photovoltaic**

T. Hirohata, Y. Ota and K. Nishioka

Faculty of Engineering, University of Miyazaki, Japan

**5TuPo.8.23LN****Characterization and Solar Cell Application of GaSb/AIGaAs Quantum Dots**

Martin Elborg<sup>1)</sup>, Takeshi Noda<sup>1)</sup>, Arthur Bowman III<sup>1)</sup>, Takuwa Kawazu<sup>1)</sup>, Takaaki Mano<sup>1)</sup>, Liyuan Han<sup>1)</sup> and Hiroyuki Sakaki<sup>1,2)</sup>

<sup>1)</sup>National Institute for Materials Science, Japan,

<sup>2)</sup>Toyota Technological Institute, Japan

**5TuPo.8.24LN****High<sup>LIGHT</sup> SAT (Solar Array Tester): Development of New Generation Large Area Tester for Space Application**

Corinne Droz<sup>1)</sup>, Nicolas Bassi<sup>1)</sup>, Jonas Hiller<sup>1)</sup>, Yanik Pelet<sup>1)</sup> and Emilio Fernandez Lisbona<sup>2)</sup>

<sup>1)</sup>Pasan SA (Meyer Burger Group), Switzerland, <sup>2)</sup>ESA - ESTEC, The Netherlands

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**Tuesday, November 25**

**16:30 - 17:55 Annex**

**Area 5**

**5TuPo.9 III-V Cell & CPV 2**

Chairpersons:

Kenji Araki (Daido Steel, Japan)

Tatsuya Takamoto (Sharp Corporation, Japan)

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**5TuPo.9.1**

**Broadband, Omnidirectional, Flexible Integrated Antireflection Nanostructures for Epitaxial Lift-Off GaAs Solar Cells**

Xiaohan Li<sup>1)</sup>, Ping-Chun Li<sup>1)</sup>, Li Ji<sup>1)</sup>, Christopher Stender<sup>2)</sup>, Rao Tatavarti<sup>2)</sup>, Kimberly Sablon<sup>3)</sup> and Edward T. Yu<sup>1)</sup>

<sup>1)</sup>Microelectronics Research Center, The University of Texas at Austin, USA, <sup>2)</sup>Microlink Devices, Inc., USA, <sup>3)</sup>U. S. Army Research Laboratory, USA

**5TuPo.9.2**

**Towards III-V Multi-junction Solar Cells on Si Substrate: Epitaxial GaAs-on-Si Characterization & Performance Modeling**

N. Jain, Y. Zhu, P. Goley and M. K. Hudait

Virginia Tech, USA

**5TuPo.9.3**

**MBE-grown 1.0 eV Bandgap InGaAsP Solar Cells on InP(001) Substrates for Application to Multi-junction Solar Cells**

Ryuji Oshima<sup>1)</sup>, Kikuo Makita<sup>1)</sup>, Hidenori Mizuno<sup>2)</sup>, Hidetaka Takato<sup>2)</sup>, Koji Matsubara<sup>1)</sup> and Takeyoshi Sugaya<sup>1)</sup>

<sup>1)</sup>Research Center for Photovoltaic Technologies, National Institute of Advanced Industrial Science

and Technology (AIST), Japan, <sup>2)</sup>Renewable Energy Research Center, National Institute of Advanced Industrial Science and Technology (AIST), Japan

#### 5TuPo.9.4

#### **Evaluation of Concentrator Photovoltaic Properties of GaInNAsSb Solar Cells**

N. Miyashita, N. Ahsan and Y. Okada

Research Center for Advanced Science and Technology (RCAST), The University of Tokyo, Japan

#### 5TuPo.9.5

#### **Numerical Analysis and Evaluation of Triple Junction Photovoltaic Cells Bonded with Expanded Area of Bottom Cell**

Jonggon Heo<sup>1)</sup>, Jung Woo Leem<sup>2)</sup>, Jongmin Kim<sup>1)</sup>, Jae Su Yu<sup>2)</sup> and Won-Kyu Park<sup>1)</sup>

<sup>1)</sup>Korea Advanced Nano Fab Center, South Korea, <sup>2)</sup>Department of Electronics and Radio Engineering, Kyung Hee University, South Korea

#### 5TuPo.9.6

#### **Toward GaAs/Si Tandem Solar Cell on Si Substrate**

T. Molière<sup>1,2)</sup>, C. Renard<sup>1)</sup>, N. Cherkashin<sup>3)</sup>, A. Jaffré<sup>2)</sup>, L. Vincent<sup>1)</sup>, D. Bouchier<sup>1)</sup>, J. Alvarez<sup>2)</sup>, J. P. Kleider<sup>2)</sup>, D. Mencaraglia<sup>2)</sup>, A. Michel<sup>3)</sup>, A. Claverie<sup>3)</sup> and J. Connolly<sup>4)</sup>

<sup>1)</sup>IEF, France, <sup>2)</sup>LGEP, <sup>3)</sup>CEMES-CNRS, France,

<sup>4)</sup>Universidad Politecnica de Valencia, Spain

#### 5TuPo.9.7

#### **Calculation and Optimisation of the Absorption Coefficients of Highly Strained, Arbitrary Profile Quantum Wells to Enable 50% Efficient CPV Solar Cells**

M. Führer<sup>1)</sup>, D. Alonso-Álvarez<sup>1)</sup>, N. J. Ekins-Daukes<sup>1)</sup>, D. Farrell<sup>2)</sup>, H. Fujii<sup>2)</sup>, K. Toprasertpong<sup>2)</sup> and M. Sugiyama<sup>2)</sup>

<sup>1)</sup>Department of Physics, Imperial College London, U.K., <sup>2)</sup>Research Center for Advanced Science and

Technology, University of Tokyo, Japan

**5TuPo.9.8****Hole Trap Acting as Acceptor in P-type GaAsN Grown by Chemical Beam Epitaxy**

O. Elleuch, L. Wang, K. Demizu, K. Ikeda, N. Kojima, Y. Ohshita and M. Yamaguchi

Toyota Technological Institute, Japan

**5TuPo.9.9****Si Doping in Atomic Layer Epitaxy of GaAsN Thin Films For Multi-Junction Solar Cells**

H. Suzuki, T. Yamauchi, T. Haraguchi, A. Fukuyama and T. Ikari

Faculty of Engineering, University of Miyazaki, Japan

**5TuPo.9.10****Non-Destructive Investigation of Photovoltaic Performance of GaAs p-n Junction Grown on Si Substrate Using Surface Photo-voltage Spectroscopy**

W. Ding<sup>1)</sup>, K. Kawano<sup>1)</sup>, Y. Li<sup>1)</sup>, H. Suzuki<sup>1)</sup>, A. Fukuyama<sup>1)</sup>, T. Ikari<sup>1)</sup>, O. Morohara<sup>2)</sup>, H. Geka<sup>2)</sup>, Y. Moriyasu<sup>2)</sup>, K. Ikeda<sup>3)</sup>, N. Kojima<sup>3)</sup> and M. Yamaguchi<sup>3)</sup>

<sup>1)</sup>Faculty of Engineering, University of Miyazaki, Japan,

<sup>2)</sup>AsahiKASEI Co. Ltd, Japan, <sup>3)</sup>Toyota Technological Institute, Japan

**5TuPo.9.11****GaP/Si Selective Contact Heterojunction Solar Cells: Analytical and Experimental Approaches Towards Improved Efficiency**

R. Saine, C. T. Chen, H. S. Emmer and H. A. Atwater

Thomas J. Watson Laboratory of Applied Physics  
California Institute of Technology, USA

**5TuPo.9.12****Simulated Study of GaAsN Solar Cells as Functions of the Doping Level in Front Surface Field (FSF) And Back Surface Field (BSF) Layers**

L. Wang, O. Elleuch, N. Kojima, Y. Ohshita and M. Yamaguchi

Toyota Technological Institute, Jap

#### 5TuPo.9.13

**Estimating of Cell Temperature in Concentrator Photovoltaic Module Using Direct Normal Irradiance and Ambient Temperature**

K. Imai, K. Nomura, Y. Ota and K. Nishioka

Faculty of Engineering, University of Miyazaki, Japan

#### 5TuPo.9.14

**Design and Test of Cell-in-cell-structured CPV Modules for Better Solar Energy Conversion**

K. Okamoto, D. Hirai and N. Yamada

Department of Mechanical Engineering, Nagaoka University of Technology

#### 5TuPo.9.15

**Optical Design and Testing of a Multi-focus Solar Dish CPV System Based on Elliptical Pneumatic Membrane Facets**

M. Schmitz<sup>1)</sup>, G. Ambrosetti<sup>2)</sup> and A. Steinfeld<sup>1,3)</sup>

<sup>1)</sup>ETH Zurich, Dept. of Mechanical and Process Engineering, Switzerland, <sup>2)</sup>Airlight Energy Manufacturing SA, Switzerland, <sup>3)</sup>Solar Technology Laboratory, Paul Scherrer Institute, Switzerland

#### 5TuPo.9.16

**Field Test Analysis of Concentrator Photovoltaic System Focusing on Average Photon Energy and Temperature**

Husyira Al Husna<sup>1)</sup>, Yasuyuki Ota<sup>1)</sup>, Takashi Minemoto<sup>2)</sup> and Kensuke Nishioka<sup>1)</sup>

<sup>1)</sup>Faculty of Engineering, University of Miyazaki, Japan,

<sup>2)</sup>Faculty of Science and Engineering, Ritsumeikan University, Japan

**5TuPo.9.17****Consideration of Current Mismatch in Multi-junction Solar Cells for Concentrator Photovoltaic Using Field Test Results of Lens Transmittance**

K. Nomura, T. Hirohata, Y. Ota and K. Nishioka

University of Miyazaki, Japan

**5TuPo.9.18****A 3D Photovoltaic Simulation Tool for Low Concentration and Sun Tracking**

I. D. S. Miranda<sup>1)</sup>, R. N. Guimarães<sup>2)</sup> and A. P. D. Lima<sup>2)</sup>

<sup>1)</sup>Universidade Federal do Recôncavo da Bahia, Brazil,

<sup>2)</sup>União Metropolitana de Educação e Cultura, Brazil

**5TuPo.9.19****Nature Inspired Solar PV Panel Tracking Using Sunflower Based Heliotropism for Higher Efficiency of Solar PV Power System**

D. K. Sharma and G. Purohit

School of Engineering, Sir Padampat Singhania University, India

**5TuPo.9.20****Step Stress Accelerated Life Tests: An Useful Tool for The Evaluation of Reliability of Advanced Concentrator Multijunction Solar Cells**

Vincenzo Orlando, Pilar Espinet, Neftali Nuñez, Luis Cifuentes, Jesús Bautista, Manuel Vázquez and Carlos Algara

Instituto de Energía Solar, Universidad Politécnica de Madrid, Spain

**5TuPo.9.21****Temperatures Dependence of Solar Performance in Poly-silicon and GaAs Solar Cells**

Zih-Yang Chen, Ming-Jer Jeng and Liann-Be Chang

Department of Electronic Engineering, Chang Gung University, Taiwan

## **5TuPo.9.22LN**

### **Polarization of N-H Bond in Growth Process of GaAsN by Chemical Beam Epitaxy**

K. Ikeda, K. Demizu, N. Kojima, Y. Ohshita and M. Yamaguchi

Toyota Technological Institute, Japan

## **5TuPo.9.23LN**

### **Costs of III-nitride Solar Cells**

W.A Doolittle<sup>1)</sup>, F. Ponce<sup>2)</sup>, S.M. Goodnick<sup>2)</sup> and C.B. Honsberg<sup>2)</sup>

<sup>1)</sup>Georgia Institute of Technology, Atlanta GA, USA,

<sup>2)</sup>Arizona State University, Tempe, AZ, USA

## **5TuPo.9.24LN**

### **Design and Analysis of a Novel CPV-T Receiver Concept**

Robert Höller<sup>1)</sup>, Manfred Hangweirer<sup>1)</sup> and Hartmut Schneider<sup>2)</sup>

<sup>1)</sup>University of Applied Sciences Upper Austria, Austria,

<sup>2)</sup>Fresnex GmbH, Austria

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## **Tuesday, November 25**

**14:45 - 16:10 Annex**

**Area 7**

## **7TuPo.10 Characterization and Modules Reliability 1**

Chairperson:

Yoshihito Eguchi (MITSUI CHEMICALS, Inc., Japan)

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## **7TuPo.10.1**

### **Accelerated Degradation in Commercial PV Modules by Using Extension and Repetition of Damp Heat and Thermal Cycling**

Shinji Kawai<sup>1)</sup>, Yutaka Fukumoto<sup>1)</sup>, Fujio Tamai<sup>1)</sup>, Koji Masuda<sup>2)</sup>, Yasunori Uchida<sup>2)</sup>, Hiroshi Kato<sup>2)</sup>, Tadashi Obayashi<sup>2)</sup>, Eiji Yamada<sup>2)</sup>, Takuya Doi<sup>3)</sup>, Atsushi

Masuda<sup>3)</sup> and Michio Kondo<sup>3)</sup>

<sup>1)</sup>Industrial Technology Center of SAGA (SAGA-ITC), Japan, <sup>2)</sup>Japan Electrical Safety & Environment Technology Laboratories (JET), Japan, <sup>3)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan

#### 7TuPo.10.2

#### **Optical Characterization of Different Module Technologies**

Rita Ebner, Bernhard Kubicek, Gusztav Ujvari and Karl Berger

AIT Austrian Institute of Technology, Energy Department, Austria

#### 7TuPo.10.3

#### **Study on the Weathering Degradation Rate of PET Film**

M. Tanaka, T. Amioka and M. Terada

Toray Industries, Inc. Environment & Energy Development Center, Japan

#### 7TuPo.10.4

#### **Correlative Evaluation of Current-induced Magnetic Flux Distribution and Electroluminescence Image in Crystalline Silicon Photovoltaic Modules**

S. Kawamoto<sup>1)</sup>, K. Tada<sup>1)</sup>, N. Yamada<sup>1)</sup>, T. Tadaumi<sup>2)</sup> and K. Kato<sup>3)</sup>

<sup>1)</sup>Department of Mechanical Engineering, Nagaoka University of Technology, Japan, <sup>2)</sup>ATOX Co., Ltd, Japan, <sup>3)</sup>Research Center for Photovoltaic Technologies, National Institute of Advanced Industrial Science and Technology (AIST), Japan

#### 7TuPo.10.5

#### **Withdrawn**

## 7TuPo.10.6

### Solder Joint Failure Modes in Crystalline Si PV Modules Operated in Tsukuba, Japan for 10 Years - Voids and Cracks

Uichi Itoh, Tetsuro Nishimura<sup>2)</sup>, Takuro Fukami<sup>2)</sup>, Kenji Takamura<sup>2)</sup>, Akira Kita<sup>2)</sup>, Ryosuke Miyabayashi<sup>3)</sup>, Hideo Ohkuma<sup>4)</sup>

<sup>1)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan, <sup>2)</sup>Nihon Superior Co. LTD., Suita, Osaka, Japan, <sup>3)</sup>NPC Incorporated, Japan, <sup>4)</sup>HTO Inc., Japan

## 7TuPo.10.7

### Accurate and Rapid Measurement of High-Capacitance PV Cells and Modules Using Dark and Light I-V Characteristics

Hisashi Kojima<sup>1)</sup>, Kazutaka Iwamoto<sup>1)</sup>, Akio Shimono<sup>1)</sup>, Junichiro Abe<sup>1)</sup> and Yoshihiro Hishikawa<sup>2)</sup>

<sup>1)</sup>Kyoshin Electric Co., Ltd. (KOPEL), Japan, <sup>2)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Research Center for Photovoltaic Technologies, Japan

## 7TuPo.10.8

### Results of the Fourth International Spectral Measurement Intercomparison of a Steady-state AM0 Solar Simulator and a FEL-type Standard Lamp

M. Pravettoni<sup>1)</sup>, R. Galleano<sup>2)</sup>, G. Jungst<sup>3)</sup>, S. Bartocci<sup>4)</sup>, J. A. Bogaat Sánchez-Piqueras<sup>5)</sup>, J. F. Fabero<sup>6)</sup>, R. Fucci<sup>7)</sup>, J. Gadermaier<sup>8)</sup>, K. Hoogendijk<sup>9)</sup>, C. Lanconelli<sup>10)</sup>, A. Minuto<sup>11)</sup> and A. Serrano Perez<sup>12)</sup>

<sup>1)</sup>University of Applied Sciences and Arts of Southern Switzerland, Switzerland, <sup>2)</sup>European Commission, Joint Research Centre, Institute of Energy and Transport, Italy, <sup>3)</sup>Instituto Nacional de Técnica Aeroespacial (INTA), Spain, <sup>4)</sup>University of Rome "Tor Vergata", Department of Enterprise Engineering, Italy, <sup>5)</sup>Instituto Nacional de Técnica Aeroespacial (INTA),

Dpto. de Observación de la Tierra, Mazagón, Huelva, Spain, <sup>6)</sup>CIEMAT, Departamento de Energía, Madrid, Spain, <sup>7)</sup>ENEA, UTTP FOTO, Portici, Italy, <sup>8)</sup>Austrian Institute of Technology, Photovoltaic Systems, Vienna, Austria; <sup>9)</sup>EKO Instruments Europe, Den Haag, Netherlands, <sup>10)</sup>National Research Council, Institute of Atmospheric Science and Climate (ISAC), Bologna, Italy, <sup>11)</sup>RSE Spa, Milan, Italy, <sup>12)</sup>University of Extremadura, Departament of Physics, Badajoz, Spain

#### 7TuPo.10.9

#### **Innovative System for High Precision Measurements of PV Module Temperature Coefficients and Energy Rating**

A. Metz, S. Schenk, M. Meixner, K. Ramspeck, S. Dauwe and A. Laux

h.a.l.m. elektronik GmbH, Germany

#### 7TuPo.10.10

#### **Experimentally Measured Light Distribution from Metal Nanoparticles**

Y. Yang, N. Kao, S. Pillai and M. Green

Australian Centre for Advanced Photovoltaics, School of Photovoltaic and Renewable Energy Engineering, University of New South Wales, Australia

#### 7TuPo.10.11

#### **Influence of Cross-Linking Conditions of EVA on Long-Term Stability for Crystalline Silicon Photovoltaic Modules**

S. Jonai<sup>1)</sup>, K. Hara<sup>1)</sup>, Y. Tsutsui<sup>2)</sup>, H. Nakahama<sup>2)</sup> and A. Masuda<sup>1)</sup>

<sup>1)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan, <sup>2)</sup>Nisshinbo Holdings Inc., Japan

#### 7TuPo.10.12

#### **Fault Diagnostic Method of PV Module Using An Induction Coil**

T. Yamaguchi<sup>1)</sup>, T. Ikegami<sup>1)</sup>, R. Hayashida<sup>1)</sup>, F. Mitsugi<sup>1)</sup>  
and A. Tanaka<sup>2)</sup>

<sup>1)</sup>Graduate School of Science and Technology, CSEE,  
Kumamoto University, <sup>2)</sup>Graduate School of Science  
and Technology, GeIK, Kumamoto University, JAPAN

#### **7TuPo.10.13**

##### **Modeling and Testing the Effect of Soiling on PV Modules**

Jan Herrmann, Timo Lorenz, Karolina Slamova,  
Elisabeth Klimm, Karl-Anders Weiss and Michael Koehl

Fraunhofer-Institut für Solare Energiesysteme (ISE),  
Germany

#### **7TuPo.10.14**

##### **Measurement of the Magnetic Flux Density Distribution in PV Cells for Fault Detection**

R. Hayashida<sup>1)</sup>, T. Ikegami<sup>1)</sup>, T. Yamaguchi<sup>1)</sup>, F. Mitsugi<sup>1)</sup>  
and A. Tanaka<sup>2)</sup>

<sup>1)</sup>Graduate School of Science and Technology, CSEE,  
Kumamoto University, JAPAN, <sup>2)</sup>Graduate School of  
Science and Technology, GeIK, Kumamoto University,  
JAPAN

#### **7TuPo.10.15**

##### **Development of Cost-competitive Solutions for Back-contact Modules**

M. J. A. A. Goris, I. J. Bennett and V. Rosca  
ECN Solar Energy, The Netherlands

#### **7TuPo.10.16**

##### **Accurate Performance Evaluation of Conventional and Bifacial Crystalline Silicon Solar Cells**

Y. Hishikawa, A. Sasaki and H. Shimura

National Institute of Advanced Industrial Science and  
Technology (AIST), RCPVT

**7TuPo.10.17****New Process Monitoring Methodologies Based on Multiwavelength Excitation Raman Scattering and Photoluminescence Techniques: Advanced Characterization of  $\text{CuIn}_{1-x}\text{Ga}_x\text{Se}_2$  Based Solar Cells and Large Area Modules**

V. Izquierdo-Roca<sup>1)</sup>, C. Insignares<sup>1)</sup>, Y. Sanchez<sup>1)</sup>, X. Fontané<sup>1)</sup>, E. Saucedo<sup>1)</sup>, T. Goislard de Monsabert<sup>2)</sup>, V. Bermúdez<sup>2)</sup> and Al. Pérez-Rodríguez<sup>1,3)</sup>

<sup>1)</sup>IREC: Institut de Recerca en Energia de Catalunya, Spain, <sup>2)</sup>NEXCIS Photovoltaic Technology, France,

<sup>3)</sup>IN<sup>2</sup>UB i Departament d'Electrònica, Universitat de Barcelona, Spain

**7TuPo.10.18****Durability of Adhesion of Polymeric Encapsulation Materials within PV Modules in Dependence of Lamination Conditions**

D. Wu, J. Zhu, D. Montiel-Chicharro, J. Frese, T. R. Betts and R. Gottschalg

Centre for Renewable Energy Systems Technology (CREST), UK

**7TuPo.10.19****Field Measurements of PV Power Generation from Thin Film Solar Cells Installed on Walls in a Snowy Cold Region**

Y. Abe<sup>1)</sup>, T. Tsukidate<sup>1)</sup>, T. Tsutsumi<sup>1)</sup>, Y. Inoue<sup>2)</sup>, K. Iwaki<sup>2)</sup>, K. Hayashi<sup>3)</sup>, Y. Yokoyama<sup>3)</sup> and Y. Tsukahara<sup>3)</sup>

<sup>1)</sup>Hokkaido Research Organization, Northern Regional Building Research Institute, Japan, <sup>2)</sup>Yodogawa Steel Works, Ltd., Japan, <sup>3)</sup>Fuji Electric Co., Ltd., Japan

**7TuPo.10.20****Development of Mathematical Equation for Photovoltaic Array Internal Resistance Analysis Under Operating Condition**

N. Ketjoy, N. Khaosaad, C. Sirisamphanwong, K. Mansiri and M. Konyu

School of Renewable Energy Technology (SERT),  
Naresuan University, Thailand

**7TuPo.10.21**

**Comparison of PV Systems Yield with Poly Crystalline and Amorphous/Microcrystalline and Solar Spectral Effect**

Y. Sangpongsanont, C. Limsakul, M. Seapan, D. Chenvidhya, B. Muenpinij, T. Chenvidhya and K. Kirtikara

CES Solar Cell Testing Center (CSSC), Pilot Plant Development and Training Institute (PDTI), King Mongkut's University of Technology Thonburi (KMUTT), Thailand

**7TuPo.10.22**

**Study on Connection Poor Detection Technology of PV Module Connector**

C. Nagao, N. Yamanaka and S. Nishikawa

Nihon University, Japan

**7TuPo.10.23**

**Measurement of Photovoltaic Devices at JET and Intercomparison with AIST**

Hiromi Tobita<sup>1)</sup>, Ryo Urabe<sup>1)</sup>, Takamitsu Inoue<sup>1)</sup>, Eiji Yamada<sup>1)</sup> and Yoshihiro Hishikawa<sup>2)</sup>

<sup>1)</sup>Japan Electrical Safety & Environment Technology Laboratories (JET), Japan, <sup>2)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Research Center for Photovoltaic Technologies (RCPVT), Japan

**7TuPo.10.24LN**

**The Study of Dynamic Mechanical Loads on Novel Heat Cap and Traditional PV Modules**

Chen-Wei Chen<sup>1)</sup>, Hung-Sen Wu<sup>1)</sup>, Wen-Yao Chou<sup>2)</sup>, Chien-Chun Hsieh<sup>2)</sup> and Chen-Lieh Wang<sup>2)</sup>

<sup>1)</sup>Industrial Technology Research Institute, Photovoltaic Metrology Laboratory, Taiwan, <sup>2)</sup>Win Win Precision

Technology Co.,Ltd(WINAICO) , Taiwan

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**Tuesday, November 25**

**16:30 - 17:55 Annex**

**Area 7**

**7TuPo.11 Characterization and Modules Reliability  
2**

Chairperson:

Atsushi Masuda (AIST, Japan)

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**7TuPo.11.1**

**Identification and Elimination of Potential Induced  
Degradation (PID) at Photovoltaic Power Plants**

S. Krauter

University of Paderborn, Department of Electrical  
Energy Technology - Sustainable Energy Concepts,  
Germany

**7TuPo.11.2**

**Development of PV Measurement Cooperative  
Research Consortium of PV Industries and AIST**

Y. Hishikawa<sup>1)</sup>, A. Sasaki<sup>1)</sup>, K. Yamagoe<sup>1)</sup>, H. Shimura<sup>1)</sup>,  
A. Nakajima<sup>2)</sup>, S. Sugawara<sup>3)</sup>, T. Sato<sup>4)</sup>, M. Taguchi<sup>5)</sup>,  
T. Asano<sup>6)</sup>, E. Takeuchi<sup>7)</sup>, H. Kojima<sup>8)</sup>, H. Muraoka<sup>9)</sup>, A.  
Ura<sup>10)</sup> and N. Watanabe<sup>11)</sup>

<sup>1)</sup>National Institute of Advanced Industrial Science  
and Technology (AIST), RCPVT, <sup>2)</sup>Kaneka corporation,  
<sup>3)</sup>Kyocera Corporation, Solar Energy R&D Div., <sup>4)</sup>  
Mitsubishi Electric Corp., Advanced Technology R  
& D Center, <sup>5)</sup>Panasonic Corporation, Eco Solutions  
company, <sup>6)</sup>Bunkoukeiki Co., Ltd., <sup>7)</sup>EKO Instruments  
Co., Ltd., <sup>8)</sup>Kyoshin Electric Corporation, <sup>9)</sup>Opto  
Research Corporation, <sup>10)</sup>Soma Optics, Ltd., <sup>11)</sup>Wacom  
Electric Co.,Ltd.

### **7TuPo.11.3**

#### **Infrared Camera Based Verification of Hottest PV Cells Arising from Hot Spot Phenomena and the IEC 61215 Standards**

S. Munggonrit, P. Parinya, T. Srisaksomboon, N. Jirarungsatian, T. Chenvidhya, M. Seapan, B. Muenpinij, Y. Sangpongsanon, D. Chenvidhya and K. Kirtikara

CES Solar Cells Testing Center, King Mongkut's University of Technology Thonburi, Thailand

### **7TuPo.11.4**

#### **Challenges and Solutions for Performance Measurement of High Efficiency PV Cells and Modules in Production Environment**

Corinne Droz, Vahid Fakhouri, Yanik Pelet, Nicolas Bassi and Jonas Hiller

Pasan SA (Meyer Burger Group), Switzerland

### **7TuPo.11.5**

#### **Actual Performance and Degradation Rate of Different Types of Photovoltaic Modules: A Case Study in Thailand**

A. Limmanee<sup>1)</sup>, K. Chumpolrat<sup>1)</sup>, N. Udomdachanut<sup>1)</sup>, S. Keawniyompanit<sup>2)</sup>, Y. Sato<sup>3)</sup>, M. Nakaishi<sup>3)</sup>, S. Kittisontirak<sup>1)</sup>, K. Sriprapha<sup>1)</sup> and Y. Sakamoto<sup>3)</sup>

<sup>1)</sup>Solar Energy Technology Laboratory, National Electronics and Computer Technology Center, Thailand, <sup>2)</sup>Thai Tabuchi Electric Co., Ltd., Thailand, <sup>3)</sup>Tabuchi Electric Co., Ltd, Japan

### **7TuPo.11.6**

#### **A Correction Method for Outdoor Thermography Performed from Slanted Angles**

Bernhard Kubicek<sup>1)</sup>, Horst Sonnleitner<sup>2)</sup>, Peter Steirer<sup>1)</sup>, Rita Ebner<sup>1)</sup> and Karl A. Berger<sup>1)</sup>

<sup>1)</sup>AIT Austrian Institute of Technology, Austria, <sup>2)</sup>Encome, Austria

**7TuPo.11.7****Characterization of Shadowing on c-Si PV-modules and Irradiation Sensors by the Serial Resistance Using Artificial Neural Networks**

J. A. Weicht, J. Zielinski, A. Domnik, F. U. Hamelmann and G. Behrens

University of Applied Sciences Bielefeld, Germany

**7TuPo.11.8****Low-temperature Conductive Film Bonded Crystalline Silicon PV Modules**

Su-Wung Baek, Kwang-II Choi, Suk-Ho Lee and Cheol-Hyun Lim

Green Energy Institute, Korea

**7TuPo.11.9****Accurate Performance Measurement of High Capacitance Modules**

H. Song, M. Wang, H. Chen and D. Hu

National Center of Supervision and Inspection on Solar Photovoltaic Product Quality (CPVT), P.R.China

**7TuPo.11.10****Diagnosis Method for Detriorated PV Modules String**

Youichi Hirata

Tokyo University of Science, Japan

**7TuPo.11.11****Performance Improvement by Reducing NOCT and the Temperature Coefficient of Crystalline Si PV Modules**

Indeok Chung, Nari Yoon, Hoon Oh, Hyun-Young Son, Un-il Baek, Won-jae Lee, Eun-Chel Cho and In-Sik Moon

PV Research Dep't, Green Energy Business Division, Hyundai Heavy Industries, Co., Ltd., Korea

**7TuPo.11.12**

**Effects of Lamination Temperature on Durability of EVA Encapsulated PV Modules**

J. Zhu, D. Wu, D. Montiel-Chicharro, T. R. Betts and R. Gottschalg

Centre for Renewable Energy Systems Technology,  
Loughborough University, UK

**7TuPo.11.13**

**On Determination of Parameters Dynamic Resistances of Photovoltaic Panels under the Shading Effects**

J. Thongpron<sup>1)</sup>, C. naracha<sup>1)</sup>, W. Muangjai<sup>2)</sup> and S. Teerasak<sup>2)</sup>

<sup>1)</sup>Department of Electrical Engineering, Faculty of Engineering, Rajamangala University of Technology Lanna, Thailand, <sup>2)</sup>College of Integrated Science and Technology Rajamangala University of Technology Lanna, Thailand

**7TuPo.11.14**

**Optimal Diode Ideality Factors and Resistances Size in the Photovoltaic Cell by Shuffled Frog Leaping Algorithm**

W. Prommee and U. Wongtragoon

Faculty of Engineering, Rajamangala University of Technology Lanna, Thailand

**7TuPo.11.15**

**Outdoor Testing of Field-aged Bp Saturn Modules with Nickel-copper Plated Contacts**

N. Nampalli<sup>1)</sup>, D. Jordan<sup>1)</sup>, A. Lennon<sup>1)</sup>, R. Evans<sup>1,2)</sup>, S. Wenham<sup>1)</sup> and M. Edwards<sup>1)</sup>

<sup>1)</sup>School of Photovoltaic and Renewable Energy Engineering, University of New South Wales, Australia,  
<sup>2)</sup>Suntech R&D Australia Pty Ltd, Australia

**7TuPo.11.16****Improvement of PV Module Temperature Estimation Using Derivative Ambient Temperature and Irradiation**

N. Jirarungsatian<sup>1,2)</sup>, P. Parinya<sup>2)</sup>, T. Chenvidhya<sup>2)</sup>, K. Kirtikara<sup>2)</sup>, T. Srisaksomboon<sup>2)</sup> and D. Chenvidhya<sup>2)</sup>

<sup>1)</sup>Division of Energy Technology, School of Energy, Environment and Materials, <sup>2)</sup>CES Solar Cells Testing Center, Pilot Plant Development and Training Institute, King Mongkut's University of Technology Thonburi, Thailand

**7TuPo.11.17****Outdoor Performance Analysis of Multi-crystalline Solar Cell and Its Module**

S. Parthasarathy, P. Kasirajan and Periyasamy Thilakan

Photon Energy Technology Laboratory, Centre for Green Energy Technology, Madanjeet School of Green Energy Technologies, Pondicherry University, SASTRA University, India

**7TuPo.11.18****Preparation of Solar Spectral Database in Japan**

A. Itagaki<sup>1)</sup>, K. Utsunomiya<sup>1)</sup>, T. Aoshima<sup>2)</sup> and I. Harada<sup>3)</sup>

<sup>1)</sup>Japan Weather Association, Japan, <sup>2)</sup>EKO INSTRUMENTS CO., LTD, Japan, <sup>3)</sup>new planning co., ltd., Japan

**7TuPo.11.19****Study of Multiple Effects on Solar Irradiance Measurement by Wavelet Transform**

N. Silsirivanich, C. Limsakul, Y. Sangpongsanont, T. Srisaksomboon, W. Ketren, M. Seapan, D. Chenvidhya, C. Jivacate and K. Kirtikara

CES Solar Cell Testing Center (CSSC), Pilot Plant Development and Training Institute (PDTI) King Mongkut's University of Technology Thonburi (KMUTT),

Thailand

**7TuPo.11.20**

**Leakage Current Analysis of Components in Photovoltaic Modules Under Potential Induced Degradation Conditions**

S. Bae<sup>1)</sup>, W. Oh<sup>1)</sup>, S. M. Kim<sup>1)</sup>, S. Park<sup>1)</sup>, Y. Kang<sup>2)</sup>, H. Lee<sup>1)</sup> and D. Kim<sup>1)</sup>

<sup>1)</sup>Department of Materials Science and Engineering, Solar Energy Research Center of Korea University, Korea, <sup>2)</sup>KU KIST Green School Graduate School of Energy and Environment, Korea

**7TuPo.11.21**

**NICE Bifacial Module Technology**

F. Madon<sup>1)</sup>, O. Nichiporuk<sup>1)</sup>, R. Einhaus<sup>1)</sup>, T. Klaus<sup>2)</sup>, L. Popescu<sup>2)</sup>, C. Comparotto<sup>2)</sup>, G. Galbiati<sup>2)</sup> and A. Edler<sup>2)</sup>

<sup>1)</sup>Apollon Solar, France, <sup>2)</sup>ISC Konstanz, Germany

**7TuPo.11.22**

**Investigations on Temporal Output Power Fluctuations in Solar Photovoltaic Power System**

P. Kasirajan, S. Parthasarathy and Periyasamy Thilakan

Photon Energy Technology Laboratory, Centre for Green Energy Technology, Madanjeet School of Green Energy Technologies, Pondicherry University, SASTRA University, India

**7TuPo.11.23**

**Environment Friendly Design of Backsheets**

M. Wielpuetz<sup>1)</sup>, D. Demicoli<sup>2)</sup> and W. Du<sup>3)</sup>

<sup>1)</sup>Director Business Management Solar, EVONIK Industries AG, Germany, <sup>2)</sup>Manager Business Management Resource Efficiency, EVONIK Industries AG, Germany, <sup>3)</sup>Business Manager, EVONIK Degussa (China) Co. Ltd., China

**7TuPo.11.24****Finding Degraded PV Modules in a PV Power Plant with Non-parametric Monitoring Data Analysis**

K. Shibahara<sup>1)</sup>, K. Fujimoto<sup>1)</sup>, Y. Inatomi<sup>2)</sup> and T. Shioda<sup>2)</sup>

<sup>1)</sup>Tensor consulting, Japan, <sup>2)</sup>Mitsui Chemicals, Inc., Japan

**7TuPo.11.25LN****A Simple On-line Method of Characterizing PV Cells/Modules Using Supercapacitor**

S. Basu Pal<sup>1)</sup>, T. Belel<sup>2)</sup>, K. Das (Bhattacharya)<sup>1)</sup> and D. Mukherjee<sup>2)</sup>

<sup>1)</sup>Department of Electrical Engineering, IEST, Shibpur, West Bengal, India, <sup>2)</sup>Department of Electronics Engineering, IEST, Shibpur, West Bengal, India

**7TuPo.11.26LN****Study of Highly Accurate Outdoor Characterization Technique for PV Modules**

A. Fukabori<sup>1)</sup>, T. Takenouchi<sup>1)</sup>, Y. Matsuda<sup>1)</sup>, Y. Tsuno<sup>1,2)</sup> and Y. Hishikawa<sup>1)</sup>

<sup>1)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan, <sup>2)</sup>(present address) TÜV Rheinland, Japan

**7TuPo.11.27LN****A Method for Measuring Spectral Responsivity for Slow Response Solar Cells**

T. Okura<sup>1)</sup>, Y. Matsumoto<sup>1)</sup> and Y. Hishikawa<sup>2)</sup>

<sup>1)</sup>Soma Optics, LTD., Japan, <sup>2)</sup>National Institute of Advanced Industrial Science and technology, Japan

**7TuPo.11.28LN****Accelerated Degradation by Light Illumination or Current Injection during Heat Tests on Flexible Thin Film Modules**

Keiichiro Sakurai<sup>1,2)</sup>, Akihiro Takano<sup>2)</sup>, Hironori Yanase<sup>2)</sup>, Toshiaki Sakai<sup>2)</sup>, Hironori Nishihara<sup>2)</sup>, Tetsuro

Nakamura<sup>2)</sup>, Shinji Fujikake<sup>2)</sup>, Masayoshi Takani<sup>2)</sup>

<sup>1)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan, <sup>2)</sup>Photovoltaic Power Generation Technology Research Association (PVTEC), Japan

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**Wednesday, November 26****16:30 - 17:55 Annex****Area 1****1WePo.1 Quantum Structured Solar Cells****Chairpersons:**

Dirk König (University of New South Wales, Australia)

Shuhei Yagi (Saitama University, Japan)

**1WePo.1.1****Intermediate-Band Formation of Ultrahigh-Density InAs/GaAsSb Quantum Dots**S. Uchida, K. Uchida, K. Sakamoto and K. YamaguchiDepartment of Engineering Science, University of  
Electro-Communications, Japan**1WePo.1.2****Withdrawn****1WePo.1.3****Efficient Two-step Photon Absorption in InAs/GaAs Quantum Dot Solar Cells**T. Kada<sup>1)</sup>, S. Asahi<sup>1)</sup>, T. Kaizu<sup>1)</sup>, T. Kita<sup>1)</sup>, R. Tamaki<sup>2)</sup>, Y. Okada<sup>2)</sup> and K. Miyano<sup>2)</sup><sup>1)</sup>Department of Electrical and Electronic Engineering,  
Graduate School of Engineering, Kobe University,  
Japan, <sup>2)</sup>RCAST, The University of Tokyo, Japan**1WePo.1.4****Changed to 1TuO.8.5****1WePo.1.5****Theory Of Quantum Coupling And Efficiency In QD Array Based Intermediate Band Solar Cells**S. Tomić<sup>1)</sup>, T. Sogabe<sup>2)</sup> and Y. Okada<sup>2)</sup><sup>1)</sup>University of Salford, UK, <sup>2)</sup>University of Tokyo, Japan**1WePo.1.6****Withdrawn**

**1WePo.1.7****Hot Carrier Intermediate Band Solar Cell Using Low-dimensioned Quantum Structures**

D. Watanabe, N. Kasamatsu, T. Kada, S. Asahi, Y. Harada and T. Kita

Department of Electrical and Electronic Engineering,  
Graduate School of Engineering, Kobe University,  
Japan

**1WePo.1.8****Slowed Cooling of Hot Carriers in Silicon Nanocrystals**

Xiaoming Wen<sup>1)</sup>, Penfei Zhang<sup>1)</sup>, Yu Feng<sup>1)</sup>, Santosh Shrestha<sup>1)</sup>, Gavin Conibeer<sup>1)</sup>, Shujuan Huang<sup>1)</sup>, Rebecca J. Anthony<sup>2)</sup> and Uwe R. Kortshagen<sup>2)</sup>

<sup>1)</sup>Australian Centre for Advanced Photovoltaics,  
University of New South Wales, Australia, <sup>2)</sup>Department  
of Mechanical Engineering, University of Minnesota,  
United States

**1WePo.1.9****Control of Intermediate Band Configuration in GaAs:N δ-doped Superlattice**

K. Osada<sup>1)</sup>, T. Suzuki<sup>1</sup>, S. Yagi<sup>1)</sup>, S. Naito<sup>2)</sup>, Y. Shoji<sup>2)</sup>, Y. Okada<sup>2)</sup>, Y. Hijikata<sup>1)</sup> and H. Yaguchi<sup>1)</sup>

<sup>1)</sup>Graduate School of Science and Engineering, Saitama University, Japan, <sup>2)</sup>Research Center for Advanced Science and Technology (RCAST), The University of Tokyo, Japan

**1WePo.1.10****GeN<sub>x</sub>/Ge/GeN<sub>x</sub> Resonant Tunnelling Structure as Energy Selective Contacts for Hot Carrier Solar Cells**

X. Dai, Y. Liao, S. Huang, S. Shrestha and G. Conibeer

Australian Centre for Advanced Photovoltaics, School of Photovoltaic and Renewable Energy Engineering, Australia

**1WePo.1.11****Effect of Field Damping Layer on Two Step Absorption of Quantum Dots Solar Cells**

Y. Shoji<sup>1)</sup>, R. Tamaki<sup>1)</sup>, A. Datas<sup>2)</sup>, A. Mart<sup>2)</sup>, A. Luque<sup>2)</sup> and Y. Okada<sup>1)</sup>

<sup>1)</sup>Research Center for Advanced Science and Technology (RCAST), Japan, The University of Tokyo,

<sup>2)</sup>Instituto de Energía Solar - Universidad Politécnica de Madrid ETSI Telecomunicación, Ciudad Universitaria sn, Spain-EU

**1WePo.1.12****Formation of Single Crystalline Silicon Nanowires Using Indium Nano-droplets**

I. Kita<sup>1)</sup>, K. Fukunaga<sup>1)</sup>, H. Yano<sup>1)</sup>, A. Tani<sup>1)</sup>, Y. Ishikawa<sup>1)</sup>, N. Okamoto<sup>1)</sup>, M. Ajmal Khan<sup>2)</sup> and T. Fuyuki<sup>1)</sup>

<sup>1)</sup>Nara Institute of Science and Technology, Japan, <sup>2)</sup>Japan Science and Technology Agency, Japan

**1WePo.1.13****Influence of Trapping Processes on Photocurrent Generation Efficiencies in Quantum-dot Intermediate-band Solar Cells**

D. M. Tex<sup>1,2)</sup>, T. Ihara<sup>1)</sup>, I. Kamiya<sup>3)</sup> and Y. Kanemitsu<sup>1,2)</sup>

<sup>1)</sup>Institute for Chemical Research, Kyoto University,

Japan, <sup>2)</sup>Japan Science and Technology Agency,

CREST, Japan, <sup>3)</sup>Toyota Technological Institute, Japan

**1WePo.1.14****Effect of Sequential Tunneling in Quantum Dot Intermediate Band Solar Cells**

K. Yoshida<sup>1)</sup>, Y. Okada<sup>2)</sup> and N. Sano<sup>1)</sup>

<sup>1)</sup>Institute of Applied Physics, University of Tsukuba,

JAPAN, <sup>2)</sup>Research Center for Advanced Science and

Technology, The University of Tokyo, JAPAN

**1WePo.1.15**

**Withdrawn**

### 1WePo.1.16

#### **Band Edge Alignment at the Back Electrode of a ZnO/PbS Depleted Heterojunction Quantum Dot Photovoltaic Cell**

M. Philip<sup>1)</sup> and N. Cowern<sup>2)</sup>

<sup>1)</sup>Ngee Ann Polytechnic, Singapore, <sup>2)</sup>Newcastle University, UK

### 1WePo.1.17

#### **GaNAs/GaAs Quantum Well Intermediate Band Solar Cell with Zero Valance Band Offset**

Martin Elborg<sup>1)</sup>, Takeshi Noda<sup>1)</sup>, Takaaki Mano<sup>2)</sup>, Kazuaki Sakoda<sup>2,3)</sup> and Liyuan Han<sup>1)</sup>

<sup>1)</sup>Photovoltaic Materials Unit, National Institute for Materials Science Tsukuba, Japan, <sup>2)</sup>Applied Photonic Materials Unit, National Institute for Materials Science Tsukuba, Japan, <sup>3)</sup>Graduate School of Pure and Applied Sciences, University of Tsukuba, Japan

### 1WePo.1.18

#### **InGaP-based Multiple-quantum-well Solar Cell Fabricated Using Metal-organic-vapor -phase-epitaxy**

Yunpeng Wang<sup>1)</sup>, Hassanet Sodabanlu<sup>1)</sup>, Hiromasa Fujii<sup>2)</sup>, Kasidit Toprasertpong<sup>2)</sup>, Kentaroh Watanabe<sup>1)</sup>, Masakazu Sugiyama<sup>2)</sup> and Yoshiaki Nakano<sup>1,2)</sup>

<sup>1)</sup>Research Center for Advanced Science and Technology, the University of Tokyo, Japan,

<sup>2)</sup>Department of Electrical Engineering & Information System, School of Engineering, the University of Tokyo, Japan

### 1WePo.1.19

#### **Device Simulations of Si/SiO<sub>2</sub> Superlattice Solar Cells Using Bohm Quantum Potential Method**

S. Yamada<sup>1)</sup>, R. Ishikawa<sup>2)</sup>, T. Higa<sup>3)</sup>, M. Konagai<sup>1,3)</sup> and S. Miyajima<sup>3)</sup>

<sup>1)</sup>Japan Science and Technology Agency, Japan,

<sup>2)</sup>Faculty of Engineering, Niigata University, Japan,  
<sup>3)</sup>Department of Physical Electronics, Tokyo Institute of Technology, Japan

### 1WePo.1.20

#### **Two-Color Spectroscopy of PbS Quantum Dot Coupled NaYF<sub>4</sub>:Er<sup>3+</sup> Layers for Up-Conversion Solar Cells**

Sanghun Woo<sup>1)</sup>, Craig M. Johnson<sup>1)</sup>, John A. Stride<sup>2)</sup>, Peter J. Reece<sup>3)</sup>, Shujuan Huang<sup>1)</sup>, Richard P. Corkish<sup>1)</sup> and Gavin J. Conibeer<sup>1)</sup>

<sup>1)</sup>School of Photovoltaic and Renewable Energy Engineering, University of New South Wales, Australia,

<sup>2)</sup>School of Chemistry, University of New South Wales, Australia, <sup>3)</sup>School of Physics, University of New South Wales, Australia

### 1WePo.1.21

#### **Size-Dependent Effect of Boron-Doped Si Quantum Dot Thin Films Utilizing a Gradient Si-Rich Oxide Multilayer Structure**

P. R. Huang, Y. J. Chen, K. Y. Kuo and P. T. Lee

Department of Photonics & Institute of Electro-Optical Engineering, National Chiao Tung University, Taiwan

### 1WePo.1.22

#### **Improved Efficiency of Hybrid PEDOT:PSS/Silicon-Nanowire Heterojunction Solar Cell via Back Surface Treatment**

Yi-Chun Lai<sup>1)</sup>, Yu-Fan Chang<sup>1)</sup>, Shu-Cheng Yu<sup>1)</sup>, Wei-Sheng Weng<sup>1)</sup>, Hsin-Fei Meng<sup>2)</sup>, Gou-Chung Chi<sup>1)</sup> and Peichen Yu<sup>1)</sup>

<sup>1)</sup>Department of Photonics and Institute of Electro-Optical Engineering, National Chiao-Tung University, Taiwan, <sup>2)</sup>Institute of Physics, National Chiao-Tung University, Taiwan

### 1WePo.1.23

#### **Fabrication of Wire-structure Crystalline Silicon Solar Cells Using Doping Paste as a Doping Source**

Y. Yashiki<sup>1)</sup>, S. Hiza<sup>1)</sup>, Y. Shirayanagi<sup>1)</sup>, T. Hakamata<sup>1)</sup> and M. Konagai<sup>2)</sup>

<sup>1)</sup>Japan Science and Technology Agency, Japan,

<sup>2)</sup>Tokyo Institute of technology, Japan

#### 1WePo.1.24

#### **Fabrication of Hybrid ErAs:InAs Quantum Dots for Solar Cell Application**

ChaoYu Hung, Tomah Sogabe, Naoya Miyashita, Shunya Naitoh and Yoshitaka Okada

Research Center for Advanced Science and Technology (RCAST), The University of Tokyo, Japan

#### 1WePo.1.25

#### **Assembled Quantum Dots for Photovoltaic Applications**

Sungjee Kim

Department of Chemistry, Pohang University of Science and Technology, South Korea

#### 1WePo.1.26

#### **PLD of Cu<sub>2</sub>O for Intermediate Band Solar Cells**

S. Polyakov and T. W. Reenaas

Norwegian University of Science and Technology (NTNU), Department of Physics, Norway

#### 1WePo.1.27LN

#### **Withdrawn**

#### 1WePo.1.28LN

#### **Synthesize of ZnO-based Semiconductor with Tunable Band Gap and Its Application in Multi-Quantum-Well Solar Cells**

N. Itagaki<sup>1,2)</sup>, K. Matsushima<sup>1)</sup>, T. Ide<sup>1)</sup>, D. Yamashita<sup>1)</sup>, H. Seo<sup>1)</sup>, K. Koga<sup>1)</sup> and M. Shiratani<sup>1)</sup>

<sup>1)</sup>Kyushu University, Japan, <sup>2)</sup>JST PRESTO, Japan

**1WePo.1.29LN****Optical Properties of Si Nano-Walls for Solar Cell Application**

S. Yoshioka<sup>1)</sup>, M. Hirai<sup>1)</sup>, H. Tomizawa<sup>1)</sup>, Y. Ichikawa<sup>1)</sup> and M. Konagai<sup>1,2)</sup>

<sup>1)</sup>Japan Science and Technology Agency, Japan,

<sup>2)</sup>Tokyo Institute of Technology, Japan

**1WePo.1.30LN****Advanced Concept of Hybrid Solar Cells for Third Generation Photovoltaic Devices**

Jongwon Lee and Christiana B. Honsberg

School of Electrical, Computer and Energy Engineering, Arizona State University, USA

**1WePo.1.31LN****Generalized Detailed Balance Solver for Solar Energy Conversion**

Elizabeth LeBeau, Matthias Karow and Christiana Honsberg

Arizona State University, Solar Power Laboratory, Tempe, AZ, USA

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**Wednesday, November 26****10:15 - 11:30 Annex****Area 3**

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**3WePo.5 Thin Film Compound Semiconductor Based PV 3**

Chairpersons:

Takashi Minemoto (Ritsumeikan University, Japan)  
Shigeru Niki (AIST, Japan)

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**3WePo.5.1****The Correlation of the Efficiency of CIGS Solar Cells to Its Defect Activation Energy**

Ming-Jer Jeng<sup>1)</sup>, Konstantin Bocharov<sup>2)</sup>, Gennady Novikov<sup>2)</sup>, Liann-Be Chang<sup>1)</sup>, Jian-Ping Ao<sup>3)</sup> and Yun

Sun<sup>3)</sup>

<sup>1)</sup>Department of Electronic Engineering, Chang Gung University, Taiwan, <sup>2)</sup>Institute of Problems of Chemical Physics, RAS, Russia, <sup>3)</sup>Institute of Photoelectronic Thin Film Device and Technology, Nankai University, PR China

### **3WePo.5.2**

#### **Study on Synthesized Temperature for Cu-In-Ga-Se Nano-powders of CIGS Film Formations**

Dong-seob Jeong, Hyungmin Lee, Hyosang Lee and Chinho Park

School of Chemical Engineering, Yeungnam University, Korea

### **3WePo.5.3**

#### **P3 Laser Scribing of CIGSe Solar Cells with Different Gallium Gradients**

C. Schultz<sup>1)</sup>, M. Schüle<sup>1)</sup>, K. Stelmaszczyk<sup>2)</sup>, M. Weizman<sup>1)</sup>, C. Wolf<sup>2)</sup>, S. Merdes<sup>2)</sup>, F. Ziem<sup>2)</sup>, C. A. Kaufmann<sup>2)</sup>, B. Rau<sup>2)</sup>, R. Schlatmann<sup>1,2)</sup>, V. Quaschning<sup>1)</sup>, B. Stegemann<sup>1)</sup> and F. Fink<sup>1)</sup>

<sup>1)</sup>PVcomB / HTW Berlin - University of Applied Sciences, Germany, <sup>2)</sup>PVcomB / Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Germany

### **3WePo.5.4**

#### **Changed to 3WeO.15.2**

### **3WePo.5.5**

#### **Excitonic Photoluminescence of CuInS2 Films by Pulse Laser Deposition**

Ryo Yoshida<sup>1)</sup>, Tseng Po-Han<sup>1)</sup>, Yong-Gu Shim<sup>2)</sup> and Kazuki Wakita<sup>1)</sup>

<sup>1)</sup>Chiba Institute of Technology, Japan, <sup>2)</sup>Osaka Prefecture University, Japan

### **3WePo.5.6**

#### **Optical and Electrical Properties of Electrospun**

## CIS Nanofibers of 3D Network

H. Yoon, S. An, M. W. Kim, H. Y. Kim, and S. S. Yoon  
Korea University, Republic of Korea

### 3WePo.5.7

#### Fabrication of CIGS Solar Cell by Non-Toxic Solution Used Spray Deposition

Jae Hyun Kim, Firoz Khan, Hyun-Jung Lee and Misol Oh

Energy Research Division, Daegu Gyeongbuk Institute of Science & Technology (DGIST), Republic of Korea

### 3WePo.5.8

#### $\text{Cu}_2\text{ZnSnSe}_4$ Thin Films Prepared by Annealing from Precursor Using $\text{Cu}_2\text{ZnSnSe}_4$ Compound in Selenium and Tin Mixing Atmosphere

Mitsuki Nakashima<sup>1)</sup>, Toshiyuki Yamaguchi<sup>1)</sup>, Kengo Kusumoto<sup>1)</sup>, Shohei Yukawa<sup>1)</sup>, Junji Sasano<sup>2)</sup> and Masanobu Izaki<sup>2)</sup>

<sup>1)</sup>Wakayama National College of Technology, Japan,

<sup>2)</sup>Toyohashi University of Technology, Japan

### 3WePo.5.9

#### Influence of Zinc/Tin Composition Ratio on the performance of CZTSe Solar Cells

Guk-jin Jeon<sup>1)</sup>, Hojung Jeong<sup>2)</sup>, Ye-chan Kim<sup>1)</sup> and Jaehyung Jang<sup>1,2,3)</sup>

<sup>1)</sup>School of Information and Communications, GIST, Republic of Korea, <sup>2)</sup>WCU Department of Nanobio Materials and Electronics, GIST, Republic of Korea,

<sup>3)</sup>Research Institute for Solar and Sustainable Energies(RISE), GIST, Republic of Korea

### 3WePo.5.10

#### Optoelectronic Properties of Undoped and Na-doped $\text{Cu}_2\text{ZnSnS}_4$ Single Crystals

Le Quang Phuong<sup>1,2)</sup>, Makoto Okano<sup>1)</sup>, Yasuhiro Yamada<sup>1)</sup>, Akira Nagaoka<sup>3)</sup>, Kenji Yoshino<sup>3)</sup> and

Yoshihiko Kanemitsu<sup>1,2)</sup>

<sup>1)</sup>Institute for Chemical Research, Kyoto University, Japan, <sup>2)</sup>Japan Science and Technology Agency, CREST, Japan, <sup>3)</sup>Department of Applied Physics and Electronic Engineering, University of Miyazaki, Japan

### 3WePo.5.11

#### **Characteristics of Cu<sub>2</sub>ZnSnS<sub>4</sub> Thin Films Fabricated through the Sulfurization of Two Types of Metal Precursors**

S. Hong<sup>1)</sup> and C. Kim<sup>2)</sup>

<sup>1)</sup>Division of Science Education, Daegu University, Korea, <sup>2)</sup>Department of Physics, Kyungpook National University, Korea

### 3WePo.5.12

#### **Effects of Sulfur Contents on Sulfurization Using Single-layered Cu-Zn-Sn Metal Precursors Deposited by Co-sputtering Method**

C. Kim<sup>1)</sup> and S. Hong<sup>2)</sup>

<sup>1)</sup>Department of Physics, Kyungpook National University, Korea, <sup>2)</sup>Division of Science Education, Daegu University, Korea

### 3WePo.5.13

#### **Effect of Cu/Sn Ratio on Defect Properties of Cu<sub>2</sub>ZnSn(S,Se)<sub>4</sub> Thin Film**

X. Luo<sup>1)</sup>, M. Halim<sup>1)</sup>, T. Sakurai<sup>1)</sup>, N. Sakai<sup>2)</sup>, T. Kato<sup>2)</sup>, H. Sugimoto<sup>2)</sup>, H. Tampo<sup>3)</sup>, H. Shibata<sup>3)</sup>, S. Niki<sup>3)</sup> and K. Akimoto<sup>1)</sup>

<sup>1)</sup>Institute of Applied Physics, University of Tsukuba, Japan, <sup>2)</sup>Energy Solution Business Center, Showa Shell Sekiyu K.K., Japan, <sup>3)</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan

### 3WePo.5.14

#### **The Effects of Surface Oxygen on Cu<sub>2</sub>ZnSnS<sub>4</sub> Thin Films**

Hisashi Miyazaki<sup>1)</sup>, Masami Aono<sup>1)</sup>, Hiroaki Kishimura<sup>1)</sup>

and Hironori Katagiri<sup>2)</sup>

<sup>1)</sup>National Defense Academy, Japan, <sup>2)</sup>Nagaoka National College of Technology, Japan

### 3WePo.5.15

#### **Surface Treatment of CZTS Thin Films by Ammonia Solution**

Hisashi Miyazaki<sup>1)</sup>, Masami Aono<sup>1)</sup>, Hiroaki Kishimura<sup>1)</sup> and Hironori Katagiri<sup>2)</sup>

<sup>1)</sup>National Defense Academy, Japan, <sup>2)</sup>Nagaoka National College of Technology, Japan

### 3WePo.5.16

#### **Properties of Cu<sub>2</sub>Sn<sub>1-x</sub>Ge<sub>x</sub>S<sub>3</sub> Based Thin-film Photovoltaic Absorber**

Myo Than Htay<sup>1)</sup>, T. Mandokoro<sup>1)</sup>, H. Seki<sup>1)</sup>, N. Momose<sup>2)</sup>, T. Taishi<sup>1)</sup>, Y. Hashimoto<sup>1)</sup> and K. Ito<sup>1)</sup>

<sup>1)</sup>Department of Electrical and Electronic Engineering, Faculty of Engineering, Shinshu University, Japan, <sup>2)</sup>Department of Electrical and Electronic Engineering, Nagano National College of Technology, Japan

### 3WePo.5.17

#### **Growth and Characterization of Tin Sulphide (SnS) Thin Films for Potential Photovoltaic Absorber Layer Application**

P. Chelvanathan<sup>1)</sup>, Z. Zakaria<sup>1)</sup>, N. Asim<sup>1)</sup>, M. M. Alam<sup>3)</sup>, K. Sopian<sup>1)</sup> and N. Amin<sup>1,2,3)</sup>

<sup>1)</sup>Solar Energy Research Institute, The National University of Malaysia, Malaysia, <sup>2)</sup>Department of Electrical, Electronic and System Engineering, Faculty of Engineering and Built Environment, The National University of Malaysia, Malaysia, <sup>3)</sup>Advanced Materials Research Chair, Chemistry Department, College of Sciences, King Saud University, Saudi Arabia

### 3WePo.5.18

#### **Pulsed Laser Deposition of Cu-Sn-S Thin Films for Solar Cell Absorber Layers**

R. B. Ettlinger<sup>1)</sup>, A. Crovetto<sup>2)</sup>, A. Cazzaniga<sup>1)</sup>, Stela Canulescu<sup>1)</sup>, O. Hansen<sup>2)</sup> and J. Schou<sup>1)</sup>

<sup>1)</sup>DTU Fotonik, Technical University of Denmark, Denmark, <sup>2)</sup>DTU Nanotech, Technical University of Denmark, Denmark

### 3WePo.5.19

#### **Infrared Solar Cell by: PbSe Film as An Absorption Layer**

J. A. Heredia Cancino<sup>1)</sup>, K. J. Mendoza Peña<sup>1)</sup>, R. Ochoa Landín<sup>2)</sup> and S. J. Castillo<sup>1)</sup>

<sup>1)</sup>Departamento de Investigación en Física, Universidad de Sonora, México, <sup>2)</sup>Departamento de Física, Universidad de Sonora, México

### 3WePo.5.20

#### **Defect Levels in N-basi2 Epitaxial Films Measured on Metal/n-BaSi<sub>2</sub> Schottky-junction and n-BaSi<sub>2</sub>/p-Si Heterojunction Diodes by Deep Level Transient Spectroscopy**

H. Takeuchi<sup>1)</sup>, W. Du<sup>1)</sup>, M. Baba<sup>1)</sup>, R. Takabe<sup>1)</sup>, K. Toko<sup>1)</sup> and T. Suemasu<sup>1,2)</sup>

<sup>1)</sup>University of Tsukuba, Institute of Applied Physics, Japan, <sup>2)</sup>JST-CREST, Japan

### 3WePo.5.21

#### **Fabrication of Single-phase BaSi<sub>2</sub> Thin Films on Silicon Substrates by Vacuum Evaporation for Solar Cell Applications**

Y. Nakagawa<sup>1)</sup>, K. O. Hara<sup>1,2)</sup>, T. Suemasu<sup>2,3)</sup> and N. Usami<sup>1,2)</sup>

<sup>1)</sup>Graduate School of Engineering, Nagoya University, Japan, <sup>2)</sup>JST-CREST, Japan, <sup>3)</sup>Institute of Applied Physics, University of Tsukuba, Japan

### 3WePo.5.22

#### **Si-based New Material for High Efficiency Thin Film Solar Cell Applications**

W. Du<sup>1)</sup>, K. Toko<sup>1)</sup>, M. Baba<sup>1)</sup>, R. Takabe<sup>1)</sup>, N. Usami<sup>2,3)</sup>

and T. Suemasu<sup>1,3)</sup>

<sup>1)</sup>Institute of Applied Physics, University of Tsukuba, Japan, <sup>2)</sup>Graduate School of Engineering, Nagoya University, Japan, <sup>3)</sup>Core Research for Evolutional Science and Technology, Japan Science and Technology agency, Japan

### 3WePo.5.23

#### **Thermodynamic Analysis on ZnSnP<sub>2</sub> Fabrication Process Using Chemical Potential Diagrams**

S. Nakatsuka, Y. Nose, T. Uda and Y. Shirai

Department of Materials Science and Engineering, Japan

### 3WePo.5.24

#### **Growth of Low Resistivity Sprayed Ga-doped ZnO Films for CuInGaSe<sub>2</sub> Solar Cells**

Kenta Hamachi<sup>1)</sup>, Akiko Mochihara<sup>1)</sup>, Kenji Yoshino<sup>1)</sup>, Shigeru Ikeda<sup>2)</sup> and Takashi Minemoto<sup>3)</sup>

<sup>1)</sup>Department of Electronics and Applied Physics, University of Miyazaki, Japan, <sup>2)</sup>Research Center for Solar Energy Chemistry, Osaka University, Japan, <sup>3)</sup>Department of Electrical and Electronic Engineering, Ritsumeikan University, Japan

### 3WePo.5.25

#### **Growth of Zn(O,S) Films Deposited by CBD on the Different Substrates**

Takeshi Maki, Chie Honda, Tetsuhito Okamoto and Masanobu Izaki

Toyohashi University of Technology, Graduate School of Engineering, Japan

### 3WePo.5.26

#### **Low-Cost Growth of Aluminum Doped Zinc Oxide Films for Photovoltaic Applications**

Donguk Kim<sup>1)</sup>, Sooho Lee<sup>1)</sup>, Minha Kim<sup>1)</sup>, Dohyun Baek<sup>1)</sup>, Yongseob Park<sup>2)</sup> and Jaehyeong Lee<sup>1)</sup>

<sup>1)</sup>School of Electronic and Electrical Engineering,  
Sungkyunkwan University, Republic of Korea, <sup>2)</sup>  
Department of Photoelectronics Information, Chosun  
College of Science and Technology, Republic of Korea

**3WePo.5.27**

**Ag-embedded Wide-band Gap ZnMgO for  
Transparent Conductive Oxide**

Kwanwoo Nam<sup>1)</sup>, Hojung Jung<sup>2)</sup>, T. Prem kumar<sup>1)</sup> and  
Jaehyung Jang<sup>1,2)</sup>

<sup>1)</sup>Research Institute of Solar and Sustainable Energy,  
Gwangju Institute of Science and Technology, Korea  
Republic, <sup>2)</sup>WCU Department of Nanobio Materials  
and Electronics, Gwangju Institute of Science and  
Technology, Korea Republic

**3WePo.5.28LN**

**Optical, Structural and Morphological Properties  
of CuInSe<sub>2</sub> Nanoparticles Synthesized by Wet  
Chemical and Hydrothermal Processes**

J. Ramkumar<sup>1)</sup>, S. Ananthakumar<sup>1)</sup>, S. Moorthy Babu<sup>1)</sup>  
and Y.Hayakawa<sup>2)</sup>

<sup>1)</sup>Crystal Growth Centre, Anna University, India,

<sup>2)</sup>Research Institute of Electronics, Shizuoka University,  
Japan

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**Wednesday, November 26**

**13:00 - 14:25 Annex**

**Area 3**

**3WePo.6 Thin Film Compound Semiconductor  
Based PV 4**

Chairpersons:

Hironori Katagiri (Nagaoka National College of  
Technology, Japan)

Takahiro Wada (Ryukoku University, Japan)

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**3WePo.6.1**

**Self-organization of Nano-structures in Solar  
Cell Materials and Its Effects on the Conversion**

## Efficiency

K. Sato<sup>1,2)</sup>, H. Tanaka<sup>3)</sup>, T. Fukushima<sup>3)</sup> and H. Katayama-Yoshida<sup>3)</sup>

<sup>1)</sup>Division of Materials and Manufacturing Science, Graduate School of Engineering, Osaka University, Japan, <sup>2)</sup>PRESTO, Japan Science and Technology Agency (JST), Japan, <sup>3)</sup>Department of Materials Engineering Science, Graduate School of Engineering Science, Osaka University, Japan

### 3WePo.6.2

**Withdrawn**

### 3WePo.6.3

#### **Influence of Cd-Free Buffer Layer and Window Layer on the High Efficiency Cu(In,Ga)Se<sub>2</sub> Thin Film Solar Cells**

Minha Kim<sup>1)</sup>, Wonkyu Chae<sup>1)</sup>, Donguk Kim<sup>1)</sup>, Dohyun Baek<sup>1)</sup>, Yongseob Park<sup>2)</sup>, Junsin Yi<sup>1)</sup>, Jaehyeong Lee<sup>1)</sup>

<sup>1)</sup>School of Electronic and Electrical Engineering, Sungkyunkwan University, South Korea, <sup>2)</sup>Department of Photoelectronics Information, Chosun College of Sci. & Tech, South Korea

### 3WePo.6.4

#### **Using Photoluminescence to Investigating Optical Properties of Different Cu/In Ratio of CuInSe<sub>2</sub> Film**

Siang-Yi Hu<sup>1)</sup>, Fang-I Lai<sup>1</sup>, Pei-Jhe Liou<sup>1)</sup>, Jui-Fu Yang<sup>1,2)</sup> and Shou-Yi Kuo<sup>2)</sup>

<sup>1)</sup>Department of Photonics Engineering, Yuan-Ze University Taiwan <sup>2)</sup>Department of Electronic Engineering, Chang Gung University, Taiwan

### 3WePo.6.5

#### **Precise Control of Se Flux for High Quality Cu(In,Ga)Se<sub>2</sub> Absorber Layer Deposition at Low Substrate Temperature by UV Light Absorption in Vapor Phase**

S. Niihaki<sup>1)</sup>, F. Pianezzi<sup>1)</sup>, B. Bissig<sup>1)</sup>, P. Reinhard<sup>1)</sup>, S. Buecheler<sup>1)</sup>, C. Eisele<sup>2)</sup> and A. N. Tiwari<sup>1)</sup>

<sup>1)</sup>Laboratory for Thin Films and Photovoltaics, Empa - Swiss Federal Laboratories for Materials Science and Technology, Switzerland, <sup>2)</sup>Dr. Eberl MBE-Komponenten GmbH, Germany

### 3WePo.6.6

#### **Performance Dependence of Graded CIGS Solar Cells on Effects of Defect Density and Carrier Density Distribution Studied by Device Simulation**

Chia-Hua Huang and Wen-Jie Chuang

Department of Electrical Engineering, National Dong Hwa University, Taiwan

### 3WePo.6.7

#### **Comparative Study of CBD ZnS-based Buffers Prepared in Acid or Alkaline Solutions for CIGS Solar Cells**

Chia-Hua Huang and Yueh-Lin Jan

Department of Electrical Engineering, National Dong Hwa University, Taiwan

### 3WePo.6.8

#### **Spray Pyrolyzed Copper Indium Sulfide Thin Film Solar Cells Using Sandwich Structured TCO Layer**

Erkan Aydin, Esma Ugur, Mehmet Sankir and Nurdan Demirci Sankir

Department of Materials Science and Nanotechnology Engineering, TOBB University of Economics and Technology, Turkey

**3WePo.6.9****Cu<sub>2</sub>ZnSnS<sub>4</sub> Thin Film Deposited by the PLD Method**

Hiroki Miura<sup>1)</sup>, Yusuke Watanabe<sup>1)</sup>, Yong-Gu Shim<sup>2)</sup> and Kazuki Wakita<sup>1)</sup>

<sup>1)</sup>Chiba Institute of Technology, Japan, <sup>2)</sup>Osaka Prefecture University, Japan

**3WePo.6.10****Fabrication of a New CdZnS buffer Layer for CZTS Solar Cells by a Chemical Bath Deposition Method**

XF. Zhang, S. Takahashi and M. Kobayashi

Waseda University, Japan

**3WePo.6.11****Characterization of Cu<sub>2</sub>ZnSn(S,Se)<sub>4</sub> Solar Cells Fabricated by Coating and Sintering Process**

M. Morihama, K. Nakamura, T. Maeda and T. Wada

Department of Materials Chemistry, Ryukoku University, Japan

**3WePo.6.12****First-principles Study on Interface Between Cu<sub>2</sub>ZnSn(S,Se)<sub>4</sub> and Back Electrode, Mo and Other Metals**

A. Shigemi and T. Wada

Department of Materials Chemistry, Ryukoku University, Japan

**3WePo.6.13****High Short-circuit Current Density of Cu<sub>2</sub>ZnSnSe<sub>4</sub> Solar Cells Prepared by Se Vapour Selenization of Sputtered Metallic Precursors**

Shou-Yi Kuo<sup>1)</sup>, Jui-Fu Yang<sup>2)</sup> and Fang-I Lai<sup>2)</sup>

<sup>1)</sup>Department of Electronic Engineering, Chang Gung University, Taiwan, <sup>2)</sup>Department of Photonics Engineering, Yuan-Ze University, Taiwan

**3WePo.6.14****Secondary Phases Formation and Its Influence on Cu-poor Zn-rich Cu<sub>2</sub>ZnSn(S<sub>1-y</sub>Se<sub>y</sub>)<sub>4</sub> Based Solar Cells**

H. Xie<sup>1)</sup>, M. Dimitrievska<sup>1)</sup>, Y. Sánchez<sup>1)</sup>, X. Fontané<sup>1)</sup>, S. López-Marino<sup>1)</sup>, V. Izquierdo-Roca<sup>1)</sup>, A. Pérez-Rodríguez<sup>1,2)</sup> and E. Saucedo<sup>1)</sup>

<sup>1)</sup>Catalonia Institute for Energy Research, IREC., Spain,

<sup>2)</sup>IN2UB, Departament d'Electrònica, Universitat de Barcelona, Spain

**3WePo.6.15****Cu<sub>2</sub>ZnSn(S,Se)<sub>4</sub> Thin-Film Solar Cells Prepared by Two-step Annealing**

M. Goto<sup>1)</sup>, J. Kuwana<sup>1)</sup>, N. Suyama<sup>1)</sup>, Y. Zhang<sup>2)</sup>, Y. Kurokawa<sup>1)</sup> and A. Yamada<sup>1,3)</sup>

<sup>1)</sup>Department of Physical Electronics, Tokyo Institute of Technology, Japan, <sup>2)</sup>Technical Research Institute, Toppan Printing Co. Ltd., Japan, <sup>3)</sup>Photovoltaics Research Center, Tokyo Institute of Technology, Japan

**3WePo.6.16****Effect of Sulphurization on Cu<sub>2</sub>ZnSnS<sub>4</sub> Thin Films Deposited by Single Source Thermal Evaporation Method**

Z. Zakaria<sup>1,2)</sup>, P. Chelvanathan<sup>1)</sup>, M. J. Rashid<sup>1)</sup>, M. Akhtaruzzaman<sup>1)</sup>, M. M. Alam<sup>3)</sup>, K. Sopian<sup>1)</sup> and N. Amin<sup>1,3)</sup>

<sup>1)</sup>Solar Energy Research Institute (SERI), The National University of Malaysia, Malaysia, <sup>2)</sup>Faculty of Electrical Engineering, Universiti Teknikal Malaysia Melaka, Malaysia, <sup>3)</sup>Advanced Materials Research Chair, Chemistry Department, College of Sciences, King Saud University, Saudi Arabia

**3WePo.6.17****Preparation of Copper Tin Sulfide Thin Films for Solar Cell Application**

T. Korechika<sup>1)</sup>, Y. Mizui<sup>2)</sup>, S. Yukawa<sup>2)</sup>, T. Yamaguchi<sup>2)</sup>, S.

Kunitsugu<sup>3)</sup> and S. Nakamura<sup>1)</sup>

<sup>1)</sup>Tsuyama National College of Technology, Japan,<sup>2)</sup>  
Wakayama National College of Technology, Japan,<sup>3)</sup>  
Industrial Technology Center of Okayama Prefecture,  
Japan

### 3WePo.6.18

#### **Preparation of Cu<sub>2</sub>SnS<sub>3</sub> Thin Films Using Chemical Bath Deposition for Photovoltaic Application**

Lin-Ya Yeh and Kong-Wei Cheng

Department of Chemical and Materials Engineering,  
Chang Gung University, Taiwan

### 3WePo.6.19

#### **Reaction Paths for Formation of Cu<sub>2</sub>SnSe<sub>3</sub> Films by Selenization of Cu-Sn Precursors**

Z. Tang<sup>1)</sup>, J. Chantana<sup>2)</sup>, Y. Nukui<sup>2)</sup>, K. Kosaka<sup>2)</sup>, H. Uegaki<sup>2)</sup> and T. Minemoto<sup>2)</sup>

<sup>1)</sup>Ritsumeikan Global Innovation Research Organization,  
Ritsumeikan University, Japan, <sup>2)</sup>College of Science  
and Engineering, Ritsumeikan University, Japan

### 3WePo.6.20

#### **Performance of Zn<sub>3</sub>P<sub>2</sub> Solar Cells Using Bulk Crystals Grown by Solution Growth**

R. Katsume<sup>1)</sup>, A. Nagaoka<sup>1)</sup>, Y. Nose<sup>1)</sup>, K. Yoshino<sup>2)</sup> and Y. Shirai<sup>1)</sup>

<sup>1)</sup>Kyoto University, Japan, <sup>2)</sup>University of Miyazaki,  
Japan

### 3WePo.6.21

#### **Conversion Efficiency of Sustainable Photovoltaic Materials Calculated with *ab initio* Optical Absorption Coefficient**

D. Deguchi<sup>1)</sup>, K. Sato<sup>1,2)</sup>, T. Kotani<sup>3)</sup>, H. Katayama-Yoshida<sup>4)</sup> and T. Kakeshita<sup>1)</sup>

<sup>1)</sup>Division of Materials and Manufacturing Science,  
Graduate School of Engineering, Osaka University,

Japan, <sup>2)</sup>PRESTO, Japan Science and Technology Agency (JST), Japan, <sup>3)</sup>Department of Applied Mathematics and Physics, Tottori University, Japan, <sup>4)</sup>Department of Materials Engineering Science, Graduate School of Engineering Science, Osaka University, Japan

### 3WePo.6.22

#### **Study of Nano-crystals in CdS:O Thin Films by Kelvin Probe Force Microscopy**

Masahiro Nakajima<sup>1)</sup>, Ryo Asaba<sup>1)</sup>, Akinori Suzuki<sup>1)</sup>, Nobuo Sato<sup>1)</sup>, Yong-Gu Shim<sup>2)</sup>, Kazuki Wakita<sup>1)</sup>, Kh. Khalilova<sup>3)</sup>, Nazim Mamedov<sup>3)</sup>, Ayaz Bayramov<sup>3)</sup> and Emil Huseynov<sup>3)</sup>

<sup>1)</sup>Chiba Institute of Technology, Japan, <sup>2)</sup>Osaka Prefecture University, Japan, <sup>3)</sup>Institute of Physics, Azerbaijan

### 3WePo.6.23

#### **Control of Conductivity Type in Co-evaporated CuFeS<sub>2</sub> Thin Films**

K. M. Kim, H. Tampo, H. Shibata and S. Niki

Research Center for Photovoltaic Technologies, National Institute of Advanced Industrial Science and Technology (AIST), Japan

### 3WePo.6.24

#### **Characteristics of p-type Cu<sub>2</sub>O Absorber Layer for Heterojunction Solar Cell**

Y. S. Jung<sup>1)</sup>, S. J. Park<sup>2)</sup> and K. H. Kim<sup>1)</sup>

<sup>1)</sup>Department of Electrical Engineering, Gachon University, Republic of Korea, <sup>2)</sup>Department of Chemical Engineering, Gachon University, Republic of Korea

### 3WePo.6.25

#### **Efficient Light Harvesting Using ZnO Nanorod as an Anti-reflection Layer on Cu(In,Ga)Se<sub>2</sub> Solar Cells**

Fang-I Lai<sup>1)</sup>, Ming-Yang Hsieh<sup>2)</sup> and Shou-Yi Kuo<sup>2)</sup>

<sup>1)</sup>Department of Photonics Engineering, Yuan-Ze University, Taiwan, <sup>2)</sup>Department of Electronic Engineering, Chang Gung University, Taiwan

### 3WePo.6.26

#### **Thickness Dependent Properties of Molybdenum Thin Films Induced by Growth Parameters in Magnetron Sputtering**

P. Chelvanathan<sup>1)</sup>, F. Arith<sup>2)</sup>, M. M. Alam<sup>3)</sup>, Z. A. AlOthman<sup>3)</sup>, K. Sopian<sup>1)</sup> and N. Amin<sup>1,2,3)</sup>

<sup>1)</sup>Solar Energy Research Institute, The National University of Malaysia, Malaysia, <sup>2)</sup>Department of Electrical, Electronic and System Engineering, Faculty of Engineering and Built Environment, The National University of Malaysia, Malaysia, <sup>3)</sup>Advanced Materials Research Chair, Chemistry Department, College of Sciences, King Saud University, Saudi Arabia

### 3WePo.6.27

#### **Properties of Sn-S Thin Films Prepared by Sulfurization**

K. Iwasaki<sup>1)</sup>, S. Nakamura<sup>2)</sup> and Y. Akaki<sup>1)</sup>

<sup>1)</sup>Miyakonojo Coll. Tech., Japan , <sup>2)</sup>Tsuyama Coll. Tech., Japan

### 3WePo.6.28LN

#### **Disorder Induced Phase Change in Cu<sub>2</sub>ZnSnS<sub>4</sub>**

Sunil Kumar Samji, Brajesh Tiwari, M. Krishna Surendra, and M.S. Ramachandra Rao

Department of Physics and Nano Functional Materials Technology Centre, Indian Institute of Technology Madras, India

### 3WePo.6.29

#### **Fabrication and Properties of CuGaSe<sub>2</sub>/CdS Solar Cell**

Seung-Hee Yu, Gye-Choon Park

Dept. of Electrical Engineering, Mokpo National University, Korea

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**Wednesday, November 26**

**10:15 - 11:30 Annex**

**Area 4**

**4WePo.7 Wafer-Based Crystalline Silicon 2**

Chairperson:

Atsushi Ogura (Meiji University, Japan)

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**4WePo.7.1**

**High Electron Mobility Indium Tin Oxide Films  
for Heterojunction Silicon Wafer Solar Cell  
Applications**

M. Huang<sup>1)</sup>, Z. Hameiri<sup>1,2)</sup>, A. G. Aberle<sup>1)</sup> and T. Mueller<sup>1)</sup>

<sup>1)</sup>Solar Energy Research Institute of Singapore,  
National University of Singapore, Singapore, <sup>2)</sup>Now  
with: School of Photovoltaic and Renewable Energy  
Engineering, University of New South Wales, Australia

**4WePo.7.2**

**Withdrawn**

**4WePo.7.3**

**Impact of Rear Internal Reflectance on  
Photocurrent in Silicon Wafer Solar Cells**

Z. Liu<sup>1,2)</sup>, C. Ke<sup>1,2)</sup>, R. Stangl<sup>1)</sup>, B. Hoex<sup>1)</sup> and I. M. Peters<sup>1)</sup>

<sup>1)</sup>Solar Energy Research Institute of Singapore,  
Singapore, <sup>2)</sup>Department of Electrical and Computer  
Engineering, National University of Singapore,  
Singapore

**4WePo.7.4**

**Ultra-shallow Hydrogen-like Donors Formed in  
Carbon- and Hydrogen-doped Oxygen-rich Silicon  
Crystals**

A. Hara and T. Awano

Tohoku Gakuin University, Japan

#### 4WePo.7.5

### Silicon Photovoltaic Cells Designed for Intense Monochromatic Illumination

Y. Takeda<sup>1)</sup>, H. Iizuka<sup>1)</sup>, T. Ito<sup>1)</sup>, S. Mizuno<sup>1)</sup>, K. Hasegawa<sup>1)</sup>, T. Ichikawa<sup>1)</sup>, H. Ito<sup>1)</sup>, T. Kajino<sup>1)</sup>, K. Higuchi<sup>1,2)</sup>, A. Ichiki<sup>2)</sup> and T. Motohiro<sup>2)</sup>

<sup>1)</sup>Toyota Central Research and Development Laboratories, Inc., Japan, <sup>2)</sup>Green Mobility Collaborative Research Center, Nagoya University, Japan

#### 4WePo.7.6

### PC2D Simulation of the Effects of Gridline and Heavily Doped Region Parameters on the Performance of Crystalline Silicon Selective Emitter Solar Cells

B. Ai, X. Jia, Y. Deng and H. Shen

Guangdong Provincial Key Laboratory of Photovoltaic Technologies, State Key Laboratory of Optoelectronic Materials and Technologies, Sun Yat-sen University, China

#### 4WePo.7.7

### A Novel Low Temperature Doping Technology, Cat-Doping, and Its Application to Solar Cells

Hideki Matsumura, Shogo Tsuzaki, Trinh Thi Cham, Koichi Koyama and Keisuke Ohdaira

JAIST (Japan Advanced Inst. Sci. & Tech.), JAPAN

#### 4WePo.7.8

### Optical Anisotropy of Conductive Polymer PEDOT:PSS -Its Effect on the Photovoltaic Performance of Crystalline-Si/PEDOT:PSS Heterojunction Solar Cells-

H. Shirai, K. Ueno and R. Ishikawa

Graduate School of Science and Engineering, Saitama University, Japan

#### 4WePo.7.9

#### **High Efficiency Rear Emitter Si Heterojunction Solar Cell With Cu Plating**

T. Watahiki, T. Furuhata, T. Matsuura, T. Shinagawa, Y. Shirayanagi, T. Morioka, T. Hayashida, Y. Yuda, Y. Sakai, H. Tokioka and H. Fuchigami

Advanced Technology R&D Center, Mitsubishi Electric Corporation, Japan

#### 4WePo.7.10

#### **Competition of Emitter Recombination and Surface Passivation Effects in the Oxidation of $\text{POCl}_3$ Emitters of Silicon Solar Cells**

Yoonseok Choi, Jongchul Lee, Jong-Keun Lim, Kyumin Lee, Won-jae Lee and Eun-Chel Cho

Hyundai Heavy Industries, Co., Ltd, South Korea

#### 4WePo.7.11

#### **Low Temperature Fabrication Technologies of Si Solar Cell with Sputter Epitaxy Method**

S. Fujimura, S. Yoshioka, T. Tsukamoto, K. Kamisako and Y. Suda

Graduate School of Engineering, Tokyo University of Agriculture and Technology, Japan

#### 4WePo.7.12

#### **Numerical Analysis of N-type Crystalline Silicon Heterojunction Solar Cells with P-type Hydrogenated Nanocrystalline Cubic Silicon Carbide Emitter**

D. Hamashita<sup>1)</sup>, S. Miyajima<sup>1)</sup> and M. Konagai<sup>1,2)</sup>

<sup>1)</sup>Department of Physical Electronics, Tokyo Institute of Technology, Japan, <sup>2)</sup>Photovoltaic Research Center (PVSEC), Tokyo Institute of Technology, Japan

#### 4WePo.7.13

#### **Interdigitated Back Contact Heterojunction Solar Cells Fabricated by Inkjet-Printing Patterning**

K. Saito<sup>1)</sup>, H. Noge<sup>1)</sup>, A. Sato<sup>1)</sup>, T. Kaneko<sup>2)</sup> and M. Kondo<sup>1,3)</sup>

<sup>1)</sup>Fukushima University, Japan, <sup>2)</sup>Tokai University, Japan, <sup>3)</sup>National Institute of Advanced Industrial Science and Technology, Fukushima Renewable Energy Institute, Japan

#### 4WePo.7.14

#### **Spin Coating ZrO<sub>2</sub> Based Anti-Reflection Film For Crystalline Silicon Solar Cells**

Masashi Kuriyama<sup>1)</sup>, Norihisa Harano<sup>1)</sup>, Abdullah Uzum<sup>1)</sup>, Yutaka Kimura<sup>2)</sup>, Kenji Tanimoto<sup>2)</sup>, Hidehito Fukui<sup>3)</sup>, Taichiro Izumi<sup>3)</sup>, Tomitaro Harada<sup>3)</sup> and Seigo Ito<sup>1)</sup>

<sup>1)</sup>University of Hyogo, Japan, <sup>2)</sup>Nissan Chemical Industries Ltd., Japan, <sup>3)</sup>Daiwa Sangyo, Japan

#### 4WePo.7.15

#### **Impedance Carrier-Lifetime Analysis for Crystalline Silicon Solar Cells with μ-PCD Measurements**

Hiroyuki Kanda, Abdullah Uzum and Seigo Ito

Department of Electrical Engineering and Computer Sciences University of Hyogo, Japan

#### 4WePo.7.16

#### **Comparison of P-type PERT and PERL Solar Cells**

H. C. Lin<sup>1)</sup>, K. B. Chen<sup>1)</sup>, H. H. Wu<sup>1)</sup>, N. T. Ou<sup>1)</sup>, K. W. Huang<sup>1)</sup>, C. H. Wu<sup>1)</sup>, S. Y. Wei<sup>2)</sup>, S. M. Yu<sup>2)</sup>, W. C. Sun<sup>2)</sup>, K. Y. Wu<sup>3)</sup>, C. C. Cho<sup>4)</sup>, J. C. Lee<sup>4)</sup>, J. H. Tsai<sup>4)</sup> and C. H. Yu<sup>4)</sup>

<sup>1)</sup>Gintech Energy Corporation, Taiwan, <sup>2)</sup>Material and Chemical Research Laboratories, Industrial Technology Research Institute, Taiwan, <sup>3)</sup>China Steel Corporation, Taiwan, <sup>4)</sup>Thintech Materials Technology Corporation, Taiwan

#### 4WePo.7.17

#### **A Novel Spin Coating Phosphorus Diffusion Source for High Efficiency Crystalline Silicon Solar Cells**

Shuhei Mochizuki<sup>1)</sup>, Hiroyuki Kanda<sup>1)</sup>, Abdullah Uzum<sup>1)</sup>, Hidehito Fukui<sup>2)</sup>, Taichiro Izumi<sup>2)</sup>, Tomitaro Harada<sup>2)</sup>, Ken Fukatsu<sup>1)</sup> and Seigo Ito<sup>1)</sup>

<sup>1)</sup>Department of Electrical Engineering and Computer Sciences University of Hyogo, Japan, <sup>2)</sup>Daiwa Sangyo, Japan

#### 4WePo.7.18

#### **The Influence of Aluminum Oxide Passivation on Back Contact Back Junction Solar Cell**

Yun-Kuo Tsao, Kuang-Chieh Lai and Richard Pai

Motech Industries, Inc., Taiwan

#### 4WePo.7.19

#### **Fabrication of Rear-Emitter Heterojunction Solar Cells with a-SiO:H Passivation Layer**

K. Nakada<sup>1)</sup>, J. Irikawa<sup>1)</sup>, S. Miyajima<sup>1)</sup> and M. Konagai<sup>1,2)</sup>

<sup>1)</sup>Department of Physical Electronics, Tokyo Institute of Technology, Japan, <sup>2)</sup>MEXT/FUTURE-PV Innovation Research, JST, Japan

#### 4WePo.7.20

#### **Boron Laser Doping Using Spin-on Dopant for Textured Crystalline Silicon**

H. Nishimura, M. Manabe, Y. Kudamatsu and T. Fuyuki

Nara Institute of Science and Technology (NAIST), Japan

#### 4WePo.7.21

#### **Impact of Back Surface Morphology on Ag-Si Contact and Back-contact Back-junction Solar Cells Performance**

Chenming Jiang<sup>1)</sup>, Dianlei Wang<sup>1)</sup> and Hui Shen<sup>1,2)</sup>

<sup>1)</sup>Institute for Solar Energy Systems, Sun Yat-sen University, China, <sup>2)</sup>Shunde SYSU Institute for Solar Energy, China

**4WePo.7.22****Spin-Coatable Passivation Films Prepared by Using ZrO<sub>2</sub>-SiO<sub>2</sub> Composite Solution**

S. Yoshioka<sup>1)</sup>, K. Tanitsu<sup>2)</sup>, Y. Suda<sup>1)</sup> and K. Kamisako<sup>1)</sup>

<sup>1)</sup>Tokyo University of Agriculture and Technology, Japan, <sup>2)</sup>TOKYO OHKA KOGYO CO., LTD., Japan

**4WePo.7.23****Simulation of Interdigitated Back Contact Silicon Heterojunction Solar Cells Having Overlapped p/i and n/i a-Si:H Layers**

H. Noge<sup>1)</sup>, K. Saito<sup>1)</sup>, A. Sato<sup>1)</sup>, T. Kaneko<sup>2)</sup> and M. Kondo<sup>1,3)</sup>

<sup>1)</sup>Fukushima University, Japan, <sup>2)</sup>Tokai University, Japan, <sup>3)</sup>National Institute of Advanced Industrial Science and Technology, Fukushima Renewable Energy Institute, Japan

**4WePo.7.24****Optical Properties of Encapsulated Silicon Solar Cells with Silicon Nitride Film of Varying Refractive Indices**

Jieun Lee, Indeok Chung, Kyumin Lee, Hae-Na-Ra Shin, In-Sik Moon, Won-jae Lee and Eun-Chel Cho

Hyundai Heavy Industries Co. Ltd., South Korea

**4WePo.7.25****Spatially Resolved Lifetime Spectroscopy from Temperature-Dependent Photoluminescence Imaging**

Z. Hameiri, M. K. Juhl and T. Trupke

The School of Photovoltaic and Renewable Energy Engineering, The University of New South Wales, Australia

**4WePo.7.26****CO<sub>2</sub> Laser Doping to Fabricate Crystalline Silicon Solar Cell**

**T. Honda<sup>1)</sup>, Y. Ishikawa<sup>1)</sup>, H. Ikenoue<sup>2)</sup>, Y. Watanabe<sup>2)</sup>, S. Yoshinaga<sup>1)</sup>, Y. Jiang<sup>1)</sup> and Y. Uraoka<sup>1)</sup>**

<sup>1)</sup>Graduate School of Material Science, Nara Institute of Science and Technology (NAIST), Japan, <sup>2)</sup>Graduate School of Information Science and Electrical Engineering, Kyushu University, Japan

#### **4WePo.7.27**

##### **Effective Low Cost SiO<sub>2</sub> Passivation Using Perhydromethylsilazane**

C. Hagiwara and H. Nagayoshi

Tokyo National College of Technology, Japan

#### **4WePo.7.28**

##### **How Can We Control Adjacent Dendrite Crystals in Parallel Direction to Realize High-quality Multicrystalline Si Ingot for Solar Cells?**

T. Hiramatsu, I. Takahashi and N. Usami

Nagoya University, Japan

#### **4WePo.7.29**

##### **Novel Carbon Based Screen-Printing Front Contact Paste for Crystalline Silicon Solar Cells**

Taiki Ashikaga, Abdullah Uzum and Seigo Ito

Department Of Electrical Engineering and Computer Sciences, University of Hyogo

#### **4WePo.7.30**

##### **Photonic Nanostructures for Light-management in IBC Solar Cells:Device Integration and Performance Benchmarking**

F. Lenzmann<sup>1)</sup>, L. Duval<sup>1)</sup>, P. Spinelli<sup>1,2)</sup>, M. Koppes<sup>1)</sup>, A. Polman<sup>2)</sup> and A. Weeber<sup>1)</sup>

<sup>1)</sup>ECN, Solar Energy, The Netherlands, <sup>2)</sup>Center for Nanophotonics, FOM Institute AMOLF, The Netherlands

**4WePo.7.31****Oxygen Precipitation around Grain Boundaries in Multicrystalline Silicon for Solar Cells**

T. Uno<sup>1,2)</sup>, K. Sato<sup>1,2)</sup>, A. Ogura<sup>1)</sup> and H. Ono<sup>1,2)</sup>

<sup>1)</sup>Meiji University, Japan, <sup>2)</sup>Kanagawa Industrial Technology Center, Japan

**4WePo.7.32****Surface Reflectance of Nanoimprinted-Texture on Crystalline Silicon Solar Cells**

S. Yoshinaga, Y. Ishikawa, S. Araki, T. Honda, Y. Jiang, M. Horita and Y. Uraoka

Nara Institute of Science and Technology, Japan

**4WePo.7.33****Experimental and First-principles Study of the Suppression of Boron-oxygen Defects in C-doped CZ-Si**

Deren Yang, Yichao Wu and Xuegong Yu

State Key Laboratory of Silicon Materials and Department of Materials Science and Engineering, Zhejiang University, China

**4WePo.7.34****Influence of Coating on the Quality of Si Ingots Grown by Directional Solidification**

K. Jiptner, J. Li, H. Harada, T. Kimura, Y. Miyamura and T. Sekiguchi

National Institute for Materials Science, Japan

**4WePo.7.35****Re-solidification and Evaluation of Retrieved Silicon Swarf from Waste Coolant of Fixed-Abrasive Multi-Wire-Sawing**

S. Miki, T. Tokuzawa, H. Satone, K. Maeda and K. Arafune

University of Hyogo, Japan

#### 4WePo.7.36

### Mössbauer Spectroscopic Investigation of a $^{57}\text{Fe}$ Doped Si Wafer Containing Voids and Interstitial Defects Clusters

Y. Ino, K. Tanaka and Y. Yoshida

Shizuoka Institute of Science and Technology, Japan

#### 4WePo.7.37

### Effects of Mirror Position with Tilted Condition on the Solid-liquid Interface Shape of Silicon Molten Zone by Floating Zone Method Under Infrared Convergent Heating

Md. Mukter Hossain<sup>1)</sup>, S. Watauchi<sup>1,2)</sup>, M. Nagao<sup>1)</sup> and I. Tanaka<sup>1)</sup>

<sup>1)</sup>Center for crystal science and technology, University of Yamanashi, Japan, <sup>2)</sup>Precursory Research for Embryonic Science and Technology (PRESTO), Japan Science and Technology Agency (JST), Japan

#### 4WePo.7.38

### Optimization of Boron Spin on Dopant (BSOD) Diffusion for Emitter Formation In $n$ - type c-Si Solar Cells

Bandana Singha and Chetan Singh Solanki

Department of Energy Science nd Engineering, Indian Institute of Technology Bombay, India

#### 4WePo.7.39

### Improvement of 50cm Square Mono Cast Si Ingot for Solar Cell Application

Y. Miyamura<sup>1)</sup>, H. Harada<sup>1)</sup>, K. Jiptner<sup>1)</sup>, T. Sekiguchi<sup>1)</sup>, S. Nakano<sup>2)</sup> and K. Kakimoto<sup>2)</sup>

<sup>1)</sup>National Institute for Materials Science, Japan,

<sup>2)</sup>Kyushu University, Japan

#### 4WePo.7.40

### Direct Observation of FeB Pairs in B-Highly Doped Si Wafers by Mössbauer Spectroscopy

K. Tanaka<sup>1)</sup>, T. Watanabe<sup>2)</sup>, Y. Ino<sup>1)</sup> and Y. Yoshida<sup>2)</sup>

<sup>1)</sup>Center for Advanced Technology, Shizuoka Institute of Science and Technology (SIST), Japan, <sup>2)</sup>Faculty of Science and Technology, SIST, Japan

#### 4WePo.7.41

#### **A Study on the Emitter Diffusion Process Using the Oxide Barrier for Crystalline Silicon Solar Cells**

Si-Cheol Roh, Jeong-Ho Choi and Hwa-II Seo

Korea University of Technology and Education (KOREATECH), Republic of Korea

#### 4WePo.7.42

#### **Microcrystalline Silicon (-oxide) Emitters for Hit Solar Cells**

L. Mazzarella, S. Kirner, L. Korte, B. Stannowski, R. Schlatmann and B. Rech

Helmholtz-Zentrum, Germany

#### 4WePo.7.43

#### **Effect of Amorphous Silicon Oxide Layer on p-Type Microcrystalline Silicon Oxide/n-Type Crystalline Silicon Heterojunction Solar Cells and Their Temperature Dependence**

Taweewat Krajangsang<sup>1)</sup>, Apichan Moollakorn<sup>1)</sup>, Sorapong Inthisang<sup>1)</sup>, Amornrat Limmanee<sup>1)</sup>, Aswin Hongsingthong<sup>1)</sup>, Perawut Chinnavornrungsee<sup>1)</sup>, Kobsak Sriprapha<sup>1)</sup>, Nattaphong Boriraksantikul<sup>2)</sup> and Jaran Sritharathikhun<sup>1)</sup>

<sup>1)</sup>Solar Energy Technology Laboratory (STL), National Electronics and Computer Technology Center (NECTEC), Thailand, <sup>2)</sup>PTT Research & Technology Institute, PTT Public Company Limited, Thailand

#### 4WePo.7.44

#### **TCO Work Function Engineering for the a-Si:H/TCO-contact in SHJ Solar Cells**

Kurt-Ulrich Ritzau, Martin Bivour, Heiko Steinkemper, Sebastian Schröer, Patrick Reinecke, Florian Wagner

and Martin Hermle  
Fraunhofer ISE, Germany

#### 4WePo.7.45

#### **Insight on Rear Emitter Silicon Heterojunction Solar Cells and Transfer to Industrial Production**

P. J. Ribeyron, D. Muñoz, R. Varache, A. Danel, S. Harrison, C. Roux and D. Heslinga

CEA, LITEN, Department of Solar Technologies,  
France

#### 4WePo.7.46

#### **Analysis on Low Fill Factor of Amorphous/ Crystalline Silicon Heterojunction Solar Cell**

Lei Zhao, Hongwei Diao, Guanghong Wang, Chunlan Zhou and Wenjing Wang

Key Laboratory of Solar Thermal Energy and Photovoltaic Systems of Chinese Academy of Sciences, Institute of Electrical Engineering, The Chinese Academy of Sciences, China

#### 4WePo.7.47

#### **Surface Investigation of Photovoltaic Mono-crystalline Silicon Wafers**

Tetsuo Fukuda, Nobutaka Suzuki Katsuhiko Shirasawa and Hidetaka Takato

Fukushima Renewable Energy Institute, AIST (FREA), National Institute of Advanced Industrial Science and Technology (AIST), Japan

#### 4WePo.7.48

**Withdrawn**

#### 4WePo.7.49

#### **Electrode Formation Using Electroless Plating in the Crystalline Silicon Solar Cells with Various Anti-reflection Layers**

M. S. Jeong<sup>1)</sup>, M. G. Kang<sup>2)</sup>, S. J. Choi<sup>3)</sup>, J. I. Lee<sup>2)</sup> and H.-e. Song<sup>2)</sup>

<sup>1)</sup>Graduate School of Energy Science and Technology, Chungnam National University, South Korea, <sup>2)</sup>Photovoltaic Laboratory, Korea Institute of Energy Research, South Korea, <sup>3)</sup>Department of Energy Environment Policy and Technology, Green School, Graduate School of Energy and Environment, Korea University, South Korea

#### 4WePo.7.50

### **Low Cost Potential of Micro-grooved Back-contact Back-junction Silicon Solar Cell: A Theoretical Evaluation**

B. Zhang<sup>1)</sup>, J. F. Yang<sup>1)</sup> and J. P. Long<sup>2)</sup>

<sup>1)</sup>School of Energy Science and Engineering, University of Electronic Science and Technology of China, China,  
<sup>2)</sup>College of Materials and Chemistry & Chemical Engineering, Chengdu University of Technology, China

#### 4WePo.7.51

### **Withdrawn**

#### 4WePo.7.52

### **Electrolytic Reduction of SiO<sub>2</sub> on Liquid Zn Cathode in Molten Salt for Solar-grade Silicon Production**

T. Shimao<sup>1)</sup>, X. Yang<sup>1,2)</sup>, K. Yasuda<sup>1,3)</sup>, T. Nohira<sup>1,2)</sup>, R. Hagiwara<sup>1)</sup>, K. Ichitsubo<sup>4)</sup>, K. Masuda<sup>4)</sup> and T. Homma<sup>2,5)</sup>

<sup>1)</sup>Graduate School of Energy Science, Kyoto University, Japan, <sup>2)</sup>CREST, Japan Science and Technology Agency, Japan, <sup>3)</sup>Environment, Safety, and Health Organization, Kyoto University, Japan, <sup>4)</sup>R&D Center, Taiheiyo Cement Corporation, Japan, <sup>5)</sup>Faculty of Science and Engineering, Waseda University, Japan

#### 4WePo.7.53

### **Plasma Texturing for Improving High Efficiency Mono-Like Crystalline Silicon Solar Cells**

Cheng-Wen Kuo, Ta-Ming Kuan, Cheng-Chi Liu, Chih-Chiang Huang, Li-Guo Wu and Cheng-Yeh Yu  
TSEC Corporation, Taiwan

**4WePo.7.54****The Electrical Properties of Boron Emitter with Various Etching Times of Boron Rich Layer (BRL)**

Sungjin Choi<sup>1,3)</sup>, Se Young Song<sup>2),3)</sup>, Min Gu Kang<sup>3)</sup>, Jeong In Lee<sup>3)</sup>, Donghwan Kim<sup>4)</sup> and Hee-eun Song<sup>3)</sup>

<sup>1)</sup>Department of Energy Environment Policy and Technology, Green School, Graduate School of Energy and Environment, Korea University, South Korea, <sup>2)</sup>Graduate School of Energy Science and Technology, Chungnam National University, South Korea, <sup>3)</sup>Photovoltaic Laboratory, Korea Institute of Energy Research, South Korea, <sup>4)</sup>Department of Materials Science and Engineering, Korea University, South Korea

**4WePo.7.55****Local Workfunction Mapping of Interface on Heterojunction Si Solar Cell Using KFM**

F. Yamada, T. Kamioka, T. Tachibana, K. Nakamura, Y. Ohshita and I. Kamiya

Toyota Technological Institute, Japan

**4WePo.7.56****Investigation of Electronic Chemical Properties in SiN Passivation Layer on Crystalline Si by X-ray Photoelectron Spectroscopy**

Y. Yamashita<sup>1)</sup>, N. Ikeno<sup>1)</sup>, T. Tachibana<sup>2)</sup>, Y. Ohshita<sup>2)</sup> and A. Ogura<sup>1)</sup>

<sup>1)</sup>Meiji Univ., Japan <sup>2)</sup>Toyota Tech. Inst., Japan

**4WePo.7.57****Development of Novel Local Self-Contacting Al Paste for Cost-Effective Bifacial Solar Cells**

K. Y. Wu<sup>1)</sup>, H. S. Chung<sup>1)</sup>, C. L. Huang<sup>1)</sup>, C. L. Liu<sup>2)</sup>, W. C. Sun<sup>3)</sup> and S. M. Yu<sup>3)</sup>

<sup>1)</sup>New Materials Research & Development Department, China Steel Corporation, Taiwan, <sup>2)</sup>Thintech Materials Technology Corporation, Taiwan, <sup>3)</sup>Material and

Chemical Research Laboratories, Industrial Technology Research Institute, Taiwan

#### 4WePo.7.58

### Production of Si in Thermite Reaction of Silica Using Alkaline Earth Metals

K. Yasuda<sup>1,2)</sup>, D. Itakura<sup>1)</sup>, Y. Mizutani<sup>1)</sup>, T. Nohira<sup>1,3)</sup>, R. Hagiwara<sup>1)</sup> and T. Homma<sup>3,4)</sup>

<sup>1)</sup>Graduate School of Energy Science, Kyoto University, Japan, <sup>2)</sup>Environment, Safety and Health Organization, Kyoto University, Japan, <sup>3)</sup>CREST, Japan Science and Technology Agency, Japan, <sup>4)</sup>Faculty of Science and Engineering, Waseda University, Japan

#### 4WePo.7.59

### TCAD Modeling of Rear Surface Passivation in Monocrystalline Silicon Solar Cells

Ramachandran Vijayan, Dr V. Muthubalan and Dr R. Bairava Ganesh

School of Electrical and Electronics Engineering,  
Sastra University, India

#### 4WePo.7.60

### High-speed Fabrication of Electroplated Diamond Wire for Slicing a Crystal Silicon

T. Suzuki, J. Muraoka and M. Kato

Yamagata research institute of technology, Japan

#### 4WePo.7.61

### How Good Are Random Pyramids at Light Trapping?

S. Manzoor and Z. C. Holman

Arizona State University, School of Electrical, Computer, and Energy Engineering, USA

#### 4WePo.7.62

### **Comprehensive Assessment of the p-n Junction Formation Technologies for Solar Cell Emitter Uniformity, Contact Formation and Performance**

Nian Chen, Ahrar Chowdury, Veysel Unsur and Abasifreke Ebong

Department of Electrical and Computer Engineering,  
University of North Carolina at Charlotte, United States

#### 4WePo.7.63

### **Correspondence between Sheet Resistances and Emitter Profiles of Homogeneously and Selectively Emitters Formed by Screen-Printing Phosphorus Diffusion**

Ali Hamdi<sup>1)</sup>, Abdullah Uzum<sup>2)</sup>, Mohammed Al-Matwakel<sup>1)</sup>, Hatem Al-Ndhari<sup>1)</sup>, Marwan Dhamrin<sup>2)</sup> and Koichi Kamisako<sup>2)</sup>

<sup>1)</sup>Sana'a University, Science Faculty, Physics Department, Yemen, <sup>2)</sup>Tokyo University of Agriculture and Technology, Japan

#### 4WePo.7.64

### **Investigating the Effect of Phosphorous Vacancy Complexes on the Majority Carrier Mobility in Compensated Cz Silicon**

Song Zhang<sup>1)</sup>, Eivind Johannes Øvreliid<sup>2)</sup>, Mari Juel<sup>2)</sup> and Gabriella Tranell<sup>1)</sup>

<sup>1)</sup>Department of Materials Science and Engineering, NTNU, Norway, <sup>2)</sup>SINTEF Materials Technology, Norway

#### 4WePo.7.65LN

### **Synthesis and Imprint of Antireflection Layer on Top of a Crystalline Silicon Solar Cell to Improve Light Trapping**

Yu-Shun Cheng, Yu-Cheng Hong and Chie Gau

Institute of Aeronautics and Astronautics/Research Center for Energy Technology and Strategy, National

Cheng Kung University, Taiwan

#### 4WePo.7.66LN

### GQD Films for Down-conversion Layer on Photovoltaics by Kinetic Spray

K. D. Lee<sup>1)</sup>, M. J. Park<sup>2)</sup>, D. Kim<sup>3)</sup>, B. Kang<sup>1)</sup>, S. Kim<sup>1)</sup>, H. Kim<sup>1)</sup>, H.-S Lee<sup>1)</sup>, Y. Kang<sup>4)</sup>, S. S. Yoon<sup>3)</sup>, B. H. Hong<sup>2)</sup> and D. Kim<sup>1)</sup>

<sup>1)</sup>Department of Materials Science and Engineering, Solar Energy Research Center of Korea University, Korea, <sup>2)</sup>Department of Chemistry, College of Natural Sciences, Seoul National University, Korea,

<sup>3)</sup>Department of Mechanical Engineering, Korea University, Korea, <sup>4)</sup>KU·KIST Green School Graduate School of Energy and Environment, Korea University, Korea

#### 4WePo.7.67LN

### Surface Mount Technology for Hetero-junction Back Contact Si Solar Cells

T. Hieda<sup>1)</sup>, N. Asano<sup>1)</sup>, C. Okamoto<sup>1)</sup>, T. Ohnishi<sup>1)</sup>, M. Kobayashi<sup>1)</sup>, H. Tadokoro<sup>1)</sup>, R. Suganuma<sup>1)</sup>, Y. Matsumoto<sup>1)</sup>, J. Nakamura<sup>1)</sup>, H. Katayama<sup>1)</sup>, K. Higashi<sup>2)</sup>, T. Kamikawa<sup>2)</sup>, K. Kimoto<sup>2)</sup>, M. Harada<sup>2)</sup>, T. Sakai<sup>2)</sup>, H. Shigeta<sup>2)</sup>, T. Kuniyoshi<sup>2)</sup>, K. Tsujino<sup>2)</sup>, L. Zou<sup>2)</sup>, N. Koide<sup>2)</sup> and K. Nakamura<sup>3)</sup>

<sup>1)</sup>Energy System Solutions Division, SHARP Corporation, Japan, <sup>2)</sup>Corporate Research & Development Division, SHARP Corporation, Japan, <sup>3)</sup>Meiji University, Japan

#### 4WePo.7.68LN

### Investigation of High Performance Slicing Wafer Was Fabricated with Various Wire Cycle Time in Fixed Abrasive Wire Saw Technology

Ting-Chun Wang, Yen-Chun Chou, Shang-Wei Yang, Yu-Chung Chen and Chien-Chun Wang

Motech Industries, Inc., Taiwan

#### **4WePo.7.69LN**

##### **Metrology Strategy for Quality Control of Heterojunction Cell Concepts**

F. Korsós<sup>1)</sup>, M. Wilson<sup>2)</sup>, A. Findlay<sup>2)</sup>, A. Savtchouk<sup>2)</sup>, J. Lagowski<sup>2)</sup>, M. Tallián<sup>1)</sup>, M. Watanabe<sup>3)</sup>

<sup>1)</sup>Semilab Co. Ltd, Hungary, <sup>2)</sup>Semilab SDI LLC, FL, USA, <sup>3)</sup>Semilab Japan K.K., Japan

#### **4WePo.7.70LN**

##### **Enhanced Light Absorption of Optimal Subwavelength-scale Silicon Structure for Thin c-Si Solar Cell Application**

Jea-Young Choi, Christiana Honsberg

Arizona State University, USA

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#### **Wednesday, November 26**

**10:15 - 11:30 Annex**

**Area 6**

#### **6WePo.2 Organic, Dye Sensitized and Perovskite Solar Cells 1**

Chairpersons:

Itaru Osaka (RIKEN, Japan)

Ashraf Uddin (The University of New South Wales, Australia)

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#### **6WePo.2.1**

##### **Peptide Addition Effect of the Active Layer Precursor Solution Containing Poor Solvent on Photoelectrochemical Characteristics of the Thin Film Organic Photovoltaic Cells**

S. Shindo and H. Ymanane

Kitakyushu National College of Technology, Japan

#### **6WePo.2.2**

##### **Charge Generation in Highly Efficient All-Polymer Solar Cells Studied by Transient Absorption Spectroscopy**

S. Ishida<sup>1)</sup>, D. Mori<sup>1)</sup>, H. Benten<sup>1)</sup>, H. Ohkita<sup>1,2)</sup> and S. Ito<sup>1)</sup>

<sup>1)</sup>Department of Polymer Chemistry, Graduate School of Engineering, Kyoto University, Japan, <sup>2)</sup>Japan Science and Technology Agency (JST), PRESTO, Japan

### 6WePo.2.3

#### **Influence of Fullerene Aggregation on the Geminate Charge Recombination in Poly(3-alkylthiophene)/PCBM Blended Films**

D. Kawamura<sup>1)</sup>, H. Benten<sup>1)</sup>, H. Ohkita<sup>1,2)</sup> and S. Ito<sup>1)</sup>

<sup>1)</sup>Department of Polymer Chemistry, Graduate School of Engineering, Kyoto University, Japan, <sup>2)</sup>Japan Science and Technology Agency, PRESTO, Japan

### 6WePo.2.4

#### **The Enhancement of Performance and Stability in Inverted Solar Cells by Introducing Anthracene Derivative as the Electron Transporting Layer**

J. P. Han<sup>1)</sup>, E. J. Lee<sup>1)</sup>, S. W. Heo<sup>1)</sup>, H. J. Song<sup>2)</sup> and D. K. Moon<sup>1)</sup>

<sup>1)</sup>Konkuk University, Republic of Korea, <sup>2)</sup>Korea Institute of Industrial Technology, Republic of Korea

### 6WePo.2.5

#### **Stability Improvement of PTB7:PC<sub>7,1</sub>BM Bulk-Heterojunction Organic Solar Cells with an Inverted Structure**

A. Yoshida<sup>1)</sup>, K. Kiriishi<sup>1)</sup>, J. Qiu<sup>1)</sup>, K. Hashiba<sup>1)</sup>, S. Fujii<sup>2)</sup>, H. Kataura<sup>2)</sup> and Y. Nishioka<sup>1)</sup>

<sup>1)</sup>Department of Precision Machinery Engineering, College of Science and Technology, Nihon University, Japan, <sup>2)</sup>Nanosystem Research Institute, National Institute of Advanced Industrial Science and Technology, Japan

### 6WePo.2.6

#### **Withdrawn**

### 6WePo.2.7

#### **Insertion Effects of Interlayers for High Performance Polymer Based Organic Solar Cell**

J. Tanaka<sup>1)</sup>, T. Kuwabara<sup>1)</sup>, K. Takahashi<sup>1)</sup> and T. Taima<sup>1,2)</sup>

<sup>1)</sup>Kanazawa univ., Japan, <sup>2)</sup>JST-PRESTO, Japan

### 6WePo.2.8

#### **Synthesis and Characterization of Quinacridone-based Polymer for OPVs**

H. Y. Kim, M. H. Choi and D. K. Moon

Konkuk university, Republic of Korea

### 6WePo.2.9

#### **Synthesis and Characterization of Benzodithiophene Series Conjugated Polymers for Organic Photovoltaics**

T. H. Lee, S. J. Jeon, E. J. Lee and D. K. Moon

Konkuk University, Republic of Korea

### 6WePo.2.10

#### **Development of Solution-Processed Bilayer P3HT/O-Acetylgalactosylated Fulleropyrrolidine Heterojunction Organic Photovoltaics**

Y. Uemura<sup>1,2)</sup>, M. Yoshitake<sup>1)</sup>, K. Mizuki<sup>1,2)</sup>, Y. Nishihara<sup>3)</sup>, M. Chikamatsu<sup>3)</sup> and T. Hatta<sup>1,2)</sup>

<sup>1)</sup>Department of Nanoscience, Faculty of Engineering, Sojo University, Japan, <sup>2)</sup>Kumamoto Institute for Photo-Electro Organics (PHOENICS), Japan, <sup>3)</sup>Research Center for Photovoltaic Technologies (RCPVT), National Institute of Advanced Industrial Science and Technology (AIST), Japan

### 6WePo.2.11

#### **Novel Triphenylamine-based Oligothiophene Star-Shaped Molecules as Donor Materials for the Efficient Bulk Heterojunction Solar Cells**

Y. N. Luponosov<sup>1)</sup>, J. Min<sup>2)</sup>, C. J. Brabec<sup>2)</sup> and S. A. Ponomarenko<sup>1)</sup>

<sup>1)</sup>Enikolopov Institute of Synthetic Polymeric Materials of the Russian Academy of Sciences, Russia, <sup>2)</sup>Institute of Materials for Electronics and Energy Technology, Friedrich-Alexander-University Erlangen-Nuremberg, Germany

## 6WePo.2.12

### **A New Star-shaped Oligomer for Organic Photovoltaics**

A. N. Solodukhin<sup>1)</sup>, Y. N. Luponosov<sup>1)</sup>, J. Min<sup>2)</sup>, T. Ameri<sup>2)</sup>, N. Kausch-Busies<sup>3)</sup>, C. J. Brabec<sup>2)</sup> and S. A. Ponomarenko<sup>1)</sup>

<sup>1)</sup>Institute of Synthetic Polymeric Materials RAS, <sup>2)</sup>Institute of Materials for Electronics and Energy Technology, Friedrich-Alexander-University Erlangen-Nuremberg, <sup>3)</sup>Heraeus Precious Metals GmbH & Co. KG, Conductive Polymers Division (Clevios)

## 6WePo.2.13

### **Synthesis and Characterization of Two-Copolymer Solar Cells Containing Quinacridone-Quaterthiophene Units Effect of Side Chain Position**

D. H. Kim<sup>1)</sup>, K. H. Hwang<sup>1)</sup>, E. J. Lee<sup>1)</sup>, H. J. Song<sup>2)</sup> and D. K. Moon<sup>1)</sup>

<sup>1)</sup>Konkuk University, , Republic of Korea, <sup>2)</sup>Korea Institute of Industrial Technology, Republic of Korea

## 6WePo.2.14

### **Effect of Side-Chain Positions on Quinacridone and Quinoxaline Based Conjugated Polymers for Organic Photovoltaics**

K. H. Hwang, D. H. Kim and D. K. Moon

Konkuk University, Republic of Korea

## 6WePo.2.15

### **Fabrication of PCPDTBT:PCBM Solar Cells by Using Carbon Disulfide as Solvent and Its Effect on Polymer Solar Cell Performance**

Viet Thanh Hau Pham, Nguyen Tam Nguyen Truong,  
Kieu Thanh Trinh, Chang Duk Kim and Chinho Park

Department of Chemical Engineering and Technology,  
Yeungnam University, Korea

#### 6WePo.2.16

**Doping Effects of Fluorinated Organic Dyes on  
the Open-circuit Voltage of Bulk-heterojunction  
Photovoltaic Devices**

T. Watanabe and K. Yamashita

Department of Electronics, Graduate School of  
Science and Technology, Kyoto Institute of Technology,  
Japan

#### 6WePo.2.17

**OPV Characteristics of Novel Benzo- or Naphtho-  
dithiophene Based Copolymers**

S. J. Moon, S. K. Lee, J. C. Lee and W. S. Shin

Research Center for Energy Materials, Korea Research  
Institute of Chemical Technology, Korea

#### 6WePo.2.18

***pn*-Homojunction Organic Solar Cells Formed in  
the Co-deposited Films Using a Novel Push-Pull  
Type Organic Semiconductor**

M. Kikuchi<sup>1,3)</sup>, Y. Shinmura<sup>1,3)</sup>, T. Kaji<sup>1,3)</sup>, T. Kono<sup>2,3)</sup>, Y.  
Yoshida<sup>2,3)</sup> and M. Hiramoto<sup>1,3)</sup>

<sup>1)</sup>Institute for Molecular Science, Japan, <sup>2)</sup>Research  
Center for Photovoltaic Technology, Japan, AIST, <sup>3)</sup>  
CREST/JST, Japan

#### 6WePo.2.19

***pn*-homojunction Solar Cells Formed by Ppm-level  
Doping Technique**

Masayuki Kubo<sup>1,2)</sup>, Toshihiko Kaji<sup>1,2)</sup> and Masahiro  
Hiramoto<sup>1,2)</sup>

<sup>1)</sup>Institute for Molecular Science, Japan, <sup>2)</sup>CREST/JST,  
Japan

**6WePo.2.20****Sensitization of Doping in Organic Co-deposited Films**

Y. Shinmura<sup>1,2)</sup>, Y. Yamashina<sup>1,2)</sup>, T. Kaji<sup>1,2)</sup> and M. Hiramoto<sup>1,2)</sup>

<sup>1)</sup>Institute for Molecular Science, Japan, <sup>2)</sup>JST, CREST, Japan

**6WePo.2.21****Nanoscale Conductivity in Poly(3-hexylthiophene) Films Studied by Conductive Atomic Force Microscopy**

M. Osaka<sup>1)</sup>, H. Benten<sup>1)</sup>, H. Ohkita<sup>1,2)</sup> and S. Ito<sup>1)</sup>

<sup>1)</sup>Graduate School of Engineering, Kyoto University, Japan, <sup>2)</sup>Japan Science and Technology Agency, PREST, Japan

**6WePo.2.22****X-ray Photoelectron Spectroscopy Investigation of Photo-degraded Photoactive Layer of Organic Solar Cell Modules**

S. H Kim<sup>1,2)</sup>, S. H Park<sup>1,3)</sup>, H. J Shin<sup>1,4)</sup> and D. H Kim<sup>2,4)</sup>

<sup>1)</sup>Energy-Nano materials research center, KETI, South Korea, <sup>2)</sup>Graduate School of energy and environment, Korea University, South Korea, <sup>3)</sup>Department of Electrical and Computer Engineering, Korea University, South Korea, <sup>4)</sup>Department of Material Science and Engineering, Korea University, South Korea

**6WePo.2.23****Density Functional Theory (DFT) Study on the Reactions of Fullerene ( $C_{60}$ ) with Radicals**

Tetuji Iyama, Koichi Kato and Hiroto Tachikawa

Division of Materials Chemistry, Graduate School of Engineering, Hokkaido University, Japan

**6WePo.2.24****Interaction of Radicals and Atoms with C<sub>60</sub> and Graphene Surfaces: Density Functional Theory (DFT) Study**

Hiroto Tachikawa, Takahiro Fukuzumi and Tetuji Iyama

Division of Materials Chemistry, Graduate School of Engineering, Hokkaido University, Japan

**6WePo.2.25****Theoretical Limit of Power Conversion Efficiency for Organic Photovoltaics**

K. Seki<sup>1)</sup>, A. Furube<sup>2)</sup> and Y. Yoshida<sup>3)</sup>

<sup>1)</sup>NRI, National Institute of Advanced Industrial Science and Technology (AIST), Japan, <sup>2)</sup>RIIF, National Institute of Advanced Industrial Science and Technology (AIST), Japan, <sup>3)</sup>RCPVT, National Institute of Advanced Industrial Science and Technology (AIST), Japan

**6WePo.2.26****One-Dimensional Singlet Exciton Diffusion in Crystalline Poly(3-hexylthiophene) Films**

Y. Tamai<sup>1)</sup>, Y. Matsuura<sup>1)</sup>, H. Ohkita<sup>1,2)</sup>, H. Benten<sup>1)</sup> and S. Ito<sup>1)</sup>

<sup>1)</sup>Department of Polymer Chemistry, Graduate School of Engineering, Kyoto University, Japan, <sup>2)</sup>Japan Science and Technology Agency (JST), PRESTO, Japan

**6WePo.2.27****Hole-Transport Properties of Defect Fullerenes C<sub>69</sub>: A Theoretical Study on Singlet and Triplet States**

K. Tokunaga

Division of Liberal Arts, Kogakuin University, Japan

**6WePo.2.28****Surface Potential Measurement of Fullerene Derivative / Copper Phthalocyanine on Indium Tin Oxide Electrode by Kelvin Probe Force Microscopy**

N. Satoh<sup>1,2)</sup>, S. Katori<sup>1,3)</sup>, K. Kobayashi<sup>1)</sup>, K. Matsushige<sup>1)</sup> and H. Yamada<sup>1)</sup>

<sup>1)</sup>Kyoto University, Japan, <sup>2)</sup>Chiba Institute of Technology, Japan, <sup>3)</sup>Tsuyama National College of Technology, Japan

## 6WePo.2.29

### **Synthesis of ZnO Nanocrystals and Application in Hybrid Heterojunction Solar Cells**

J. J. Dong, H. Y. Hao and J. Xing

School of Science, China University of Geosciences (Beijing), China

## 6WePo.2.30LN

### **Withdrawn**

## 6WePo.2.31LN

### **Electronic Properties Enhancement with Graphene Oxide Blended PEDOT:PSS for Anode Buffer layer in Organic Photovoltaics**

P. Goutham Raj, Anil Kanwat and Jin Jang

Department of Information Display, Advanced Display Research Center, Kyung Hee University, South Korea

## 6WePo.2.32LN

### **Optical and Morphological Studies of Poly-3-hexylthiophene (P3HT) / CdTe nanoparticles (NPs)/ TiO<sub>2</sub> Nanorods (NRs) Blend for Hybrid Solar Cells**

S. Ananthakumar<sup>1)</sup>, J. Ramkumar<sup>1)</sup>, S. Moorthy Babu<sup>1)</sup> and Y.Hayakawa<sup>2)</sup>

<sup>1)</sup>Crystal Growth Centre, Anna University, India,

<sup>2)</sup>Research Institute of Electronics, Shizuoka University, Japan

## 6WePo.2.33LN

### **Interface Engineering for High Performance Organic Photovoltaic**

Hyeong Pil Kim, Dong Cheon Kim, Anil Kanwat, Abd. Rashid bin Mohd Yusoff and Jin Jang

Department of Information Display, Advanced Display Research Center, and Kyung Hee University, Korea

### 6WePo.2.34LN

#### **Flexible Transparent AgNWs/AZO Electrode for Thin Film Solar Cells**

Dongcheon Kim, Anil Kanwat, Taehun Kim, Jin Jang

Advanced Display Research Center, Department of Information Display, Kyung Hee University, Korea

### 6WePo.2.35LN

#### **Beyond Energy: A Comprehensive LCA Study of Organic Photovoltaic Solar Cells**

M. Tsang<sup>1)</sup>, G. Sonnemann<sup>2)</sup> and D. Bassani<sup>3)</sup>

<sup>1)</sup>University of Bordeaux, Institute of Molecular Sciences, France, <sup>2)</sup>CNRS (Le Centre National de la Recherche Scientifique), Institute of Molecular Sciences, France

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**Wednesday, November 26**

**13:00 - 14:25 Annex**

**Area 6**

### **6WePo.3 Organic, Dye Sensitized and Perovskite Solar Cells 2**

Chairpersons:

Takaya Kubo (The University of Tokyo, Japan)

Regan Wilks (Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Germany)

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### 6WePo.3.1

#### **Performance Improvement of Small Molecular Organic Solar Cells with Inverted Structure by Using an ITO Cathode Coated by Ultrathin Calcium Layer**

X. Hao, S. Wang, T. Sakurai and K. Akimoto

Institute of Applied Physics, University of Tsukuba, Japan

### 6WePo.3.2

#### **Inverted Type Polymer Solar Cells with Nanostructured Titanium Oxide Thin Film as Buffer Layer**

N. Kishi, N. Morito and T. Soga

Department of Frontier Materials, Nagoya Institute of Technology, Japan

### 6WePo.3.3

#### **Low Temperature Fabrication of Solution-Processed ZnO/Ag Nanowire Composite Electrodes for Flexible Device Application**

Won-Jung Shin, Chan-Su Moon, Wonki Cho, Bo Seok Kim and Seung Jae Baik

Department of Electrical, Electronic and Control Engineering, Hankyong National University, Korea

### 6WePo.3.4

#### **Nanostructured Electron Collector for Inverted Organic Solar Cell and Design toward Improved Module Efficiency**

Gyeong Seok Hwang, Seung Jae Go and Byung Doo Chin

Department of Polymer Science and Engineering, Dankook University, Korea

### 6WePo.3.5

#### **Hole Transit in P3HT:PCBM Solar Cells with Embedded Gold Nanoparticles**

C.-E. Cheng<sup>1,2)</sup>, Z. Pei<sup>3)</sup>, C.-C. Hsu<sup>4)</sup>, C.-S. Chang<sup>1)</sup> and F. S.-S. Chien<sup>2)</sup>

<sup>1)</sup>Department of Photonics and Institute of Electro-Optical Engineering, National Chiao Tung University, Taiwan, <sup>2)</sup>Department of Applied Physics, Tunghai University, Taiwan, <sup>3)</sup>Graduate Institute of Optoelectronic Engineering, Department of Electrical Engineering, National Chung Hsin University, Taiwan, <sup>4)</sup>Department of Physics, National Chung Cheng

University, Taiwan

### 6WePo.3.6

#### **Efficiency Improvement in Nano-structured Organic Solar Cells**

C. Wang<sup>1)</sup>, P. Ruankham<sup>2)</sup>, E. Kim<sup>2)</sup>, T. Sagawa<sup>2)</sup> and M J. Cryan<sup>1)</sup>

<sup>1)</sup>Department of Electronic & Electrical Engineering, University of Bristol, UK, <sup>2)</sup>Graduate School of Energy Science, Kyoto University, Japan

### 6WePo.3.7

#### **Ternary Hybrid Solar Cells with Wide and Narrow Bandgap Polymers**

Hyung Do Kim<sup>1)</sup>, Hideo Ohkita<sup>1,2)</sup>, Hiroaki Benten<sup>1)</sup> and Shinzaburo Ito<sup>1)</sup>

<sup>1)</sup>Department of Polymer Chemistry, Graduate School of Engineering, Kyoto University, Japan, <sup>2)</sup>Japan Science and Technology Agency (JST), PRESTO, Japan

### 6WePo.3.8

#### **A Highly Ordered Triple-tube-framed Nanostructure Formed in TiO<sub>2</sub> Nanotubes for Hybrid Solar Cells**

T. Ma<sup>1)</sup>, N. Yamada<sup>1)</sup>, D. Tadaki<sup>1)</sup>, Y. Kimura<sup>2)</sup> and M. Niwano<sup>1)</sup>

<sup>1)</sup>Laboratory for Nanoelectronics and Spintronics, Research Institute of Electrical Communication, Tohoku University, Japan, <sup>2)</sup>Department of the Computer Science, Tokyo University of Technology, Japan

### 6WePo.3.9

#### **Plasmonic Metallic Nanostructures for Enhanced Light Harvesting in Organic Photovoltaic Devices**

Chih -Yao Chen, Fang-Chu Lin and I-Chen Chen

Institute of Materials Science and Engineering, National Central University, Taiwan

### 6WePo.3.10

#### **Organic Solar Cells Efficiency Improvement by Addition of ZnO Nanopartilces in the Active Layer**

S. Saravanan<sup>1,3)</sup>, Yasser A. M. Ismail<sup>2)</sup>, M. Silambarasan<sup>1)</sup>, N. Kishi<sup>3)</sup> and T. Soga<sup>3)</sup>

<sup>1)</sup>Centre for Photonics and Nanotechnology, Sona College of Technology, INDIA, <sup>2)</sup>Department of Physics, Faculty of Science, Al-Azhar University, EGYPT,

<sup>3)</sup>Department of Frontier Materials, Nagoya Institute of Technology, JAPAN

### 6WePo.3.11

#### **Alloyed Silicon-Tin Nanocrystals with Quantum Confinement Effect for Hybrid Solar Cells**

M. Lozach<sup>1)</sup>, V. Svrcek<sup>1)</sup>, D. Mariotti<sup>2)</sup> and K. Matsubara<sup>1)</sup>

<sup>1)</sup>Research Center for Photovoltaic Technologies, National Institute for Advanced Industrial Science and Technology (AIST), Japan, <sup>2)</sup>Nanotechnology and Advanced Materials Research Institute (NAMRI), University of Ulster, UK

### 6WePo.3.12

#### **Efficient Organic/Poly Crystalline Silicon Heterojunction Solar Cells**

Q. Liu<sup>1)</sup>, T. Ohki<sup>1)</sup>, D. Liu<sup>2)</sup>, R. Ishikawa<sup>1)</sup>, K. Ueno<sup>1)</sup> and H. Shirai<sup>1)</sup>

<sup>1)</sup>Graduate School of Science and Engineering, Saitama University, Japan, <sup>2)</sup>International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science, Japan

### 6WePo.3.13

#### **Oxygen Passivation of Silicon Nanocrytals: Its Influences on Trap States, Carrier Mobility, and Hybrid Solar Cell Performance**

Yi Ding, Shu Zhou, Ryan Gresback, Michihiro Sugaya and Tomohiro nozaki

Department of Mechanical Sciences and Engineering,

Tokyo Institute of Technology, Japan

#### 6WePo.3.14

### **Analysis of Solution-Processed $\text{CH}_3\text{NH}_3\text{PbX}_3$ Perovskite for Organic-Inorganic Hybrid Solar Cells**

S. Kim<sup>1)</sup>, T. Chung<sup>1)</sup>, S. Lee<sup>1)</sup>, K. D. Lee<sup>1)</sup>, H. Kim<sup>1)</sup>, Y. Kang<sup>2)</sup>, H.-S. Lee<sup>1)</sup> and D. Kim<sup>1)</sup>

<sup>1)</sup>Department of Materials Science and Engineering, Korea University, Korea, <sup>2)</sup>KU-KIST Green School Graduate School of Energy and Environment, Korea University, Korea

#### 6WePo.3.15

### **The Light Stability of Perovskite Solar Cells**

Govindhasamy Murugadoss<sup>1)</sup>, Soichiro Tanaka<sup>1)</sup>, Gai Mizuta<sup>1)</sup>, Shusaku Kanaya<sup>1)</sup>, Hitoshi Nishino<sup>2)</sup> and Seigo Ito<sup>1)</sup>

<sup>1)</sup>Department of Electric Engineering and Computer Science, School of Engineering, University of Hyogo, Japan, <sup>2)</sup>Energy Technology Laboratories, Japan

#### 6WePo.3.16

### **Hole Transporting Materials Based on Sulfur-containing Donors for Efficient Perovskite Solar Cells**

Jian Liu and Liyuan Han

Photovoltaic Materials Unit, National Institute for Materials Science, Japan

#### 6WePo.3.17

### **Perovskite Solar Cells with Inverted Cell Structure Based on Novel Transparent, Conductive Hole Selective Layers**

Wei Chen<sup>1,2)</sup> and Liyuan Han<sup>1)</sup>

<sup>1)</sup>Photovoltaic Materials Unit, National Institute for Materials Science, Japan, <sup>2)</sup>Wuhan Michael Grätzel Center for Mesoscopic Solar Cells, Wuhan National Laboratory for Optoelectronics, Huazhong University

of Science and Technology, P. R. China

### 6WePo.3.18

#### **Crystal Variation of $\text{CH}_3\text{NH}_3\text{PbI}_3$ Perovskite by Deposition of Inorganic CuSCN Hole Conductor for Mesoscopic Solar Cell**

Shusaku Kanaya<sup>1)</sup>, Govindhasamy Murugadoss<sup>1)</sup>, Soichiro Tanaka<sup>1)</sup>, Gai Mizuta<sup>1)</sup>, Hitoshi Nishino<sup>2)</sup> and Seigo Ito<sup>1)</sup>

<sup>1)</sup>Department of Electric Engineering and Computer Science, School of Engineering, University of Hyogo, Japan, <sup>2)</sup>Energy Technology Laboratories, Osaka Gas Co., Ltd., Japan

### 6WePo.3.19

#### **Effects of $\text{CH}_3\text{NH}_3\text{PbI}_3$ Thickness and Structure and Flat and Porous $\text{TiO}_2$ Electrodes for the Perovskite Solar Cells**

Gai Mizuta<sup>1)</sup>, Govindhasamy Murugadoss<sup>1)</sup>, Shusaku Kanaya<sup>1)</sup>, Soichiro Tanaka<sup>1)</sup>, Hitoshi Nishino<sup>2)</sup> and Seigo Ito<sup>1)</sup>

<sup>1)</sup>Department of Electric Engineering and Computer Science, School of Engineering, University of Hyogo, Japan, <sup>2)</sup>Energy Technology Laboratories, Osaka Gas Co., Ltd., Japan

### 6WePo.3.20

#### **Morphology Controlling of Solution Processed Perovskite for Planar-structured Solar Cells**

Yongzhen Wu and Liyuan Han

Photovoltaic Materials Unit, National Institute for Materials Science, Japan

### 6WePo.3.21

#### **X-Ray Crystallographic Studies on the Formation of $\text{CH}_3\text{NH}_3\text{PbI}_3$ Layers**

N. Maruyama<sup>1)</sup>, M. Endo<sup>1)</sup>, Y. Nakaike<sup>1)</sup>, A. Wakamiya<sup>1,2)</sup>, T. Sasamori<sup>1)</sup>, N. Tokitoh<sup>1)</sup>, Y. Ogomi<sup>3)</sup>, S. Hayase<sup>3)</sup> and Y. Murata<sup>1)</sup>

<sup>1)</sup>Institute for Chemical Research, Kyoto University, Japan, <sup>2)</sup>JST-PRESTO, Japan, <sup>3)</sup>Graduate School of Life Sciences and Systems Engineering, Kyushu Institute of Technology, Japan

#### 6WePo.3.22

#### **Optical and Photoconductive Properties of Perovskite ( $\text{CH}_3\text{NH}_3\text{PbI}_3$ ) Thin Film for Thin-film Solar Cells**

R. Ishikawa, T. Yamanaka, Z. Honda, K. Ueno and H. Shirai

Graduate School of Science and Engineering, Saitama University, Japan

#### 6WePo.3.23

#### **Optical Analysis on Perovskite Films According to $\text{CH}_3\text{NH}_3\text{I}$ and $\text{PbI}_2$ Concentration**

H. Seo<sup>1)</sup>, S. Hashimoto<sup>1)</sup>, G. Uchida<sup>2)</sup>, N. Itagaki<sup>1)</sup>, K. Koga<sup>1)</sup> and M. Shiratani<sup>1)</sup>

<sup>1)</sup>Graduate School of Information Science and Electrical Engineering, Kyushu University, Japan, <sup>2)</sup>Joining and Welding Research Institute, Osaka University, Japan

#### 6WePo.3.24

#### **Effect of Surface Passivation and Modification of Perovskites Capping Layer on Photo-voltage Performance of Perovskite Solar Cells**

A. Islam, C. Qin, Y. Wu, X. Yang, J. Liu and L. Han

Photovoltaic Materials Unit, National Institute for Materials Science, Japan

#### 6WePo.3.25

#### **Study of Planar Heterojunction Perovskite Photovoltaic Cells Using Compact Titanium Oxide by Chemical Bath Deposition**

K. Yamamoto<sup>1)</sup>, T. Kuwabara<sup>1,2)</sup>, K. Takahashi<sup>1,2)</sup> and T. Taima<sup>1,2,3)</sup>

<sup>1)</sup>Graduate School Natural Science and Technology and <sup>2)</sup>Research Center for Sustainable Energy and

Technology, Kanazawa University, Japan, <sup>3)</sup>JST-PRESTO, Japan Science and Technology Agency (JST), Japan

### 6WePo.3.26

#### **Photovoltaic Properties of BiFeO<sub>3</sub>/BaTiO<sub>3</sub> Multilayered Thin Films Prepared by Sol-gel Method**

Savita Sharma<sup>1,3)</sup>, Monika Tomar<sup>2)</sup>, Ashok Kumar<sup>4)</sup>, Nitin K. Puri<sup>3)</sup> and Vinay Gupta<sup>1)</sup>

<sup>1)</sup>Department of Physics and Astrophysics, University of Delhi, India, <sup>2)</sup>Physics Department, Miranda House, University of Delhi, India, <sup>3)</sup>Department of Applied Physics, Delhi Technological University , India, <sup>4)</sup>CSIR-National Physical Laboratory, India

### 6WePo.3.27

#### **Ferroelectric PZT Thin Films for Photovoltaics Application**

Reema Gupta<sup>1)</sup>, Monika Tomar<sup>2)</sup> and Vinay Gupta<sup>1)</sup>

<sup>1)</sup>Department of Physics and Astrophysics, India, University of Delhi, <sup>2)</sup>Physics Department, Miranda House, University of Delhi, India

### 6WePo.3.28LN

#### **Withdrawn**

### 6WePo.3.29LN

#### **Novel Small-molecule Hole Transporting Materials(HTM) Based on a New Indolocarbazole Derivative for Perovskite Solar Cells**

I. Lim, S.-H. Han

Department of Chemistry, Hanyang University, Republic of Korea

### 6WePo.3.30LN

#### **Validation of TiO<sub>2</sub>/Sb<sub>2</sub>S<sub>3</sub>/CuI as a Photovoltaic Material by Using a Planar Cell Structure**

R. Suzuki, Y. Takeda, N. Kato, K. Higuchi and T.

Motohiro

Toyota Central R&D Labs., Japan

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**Wednesday, November 26**

**14:45 - 16:10 Annex**

**Area 6**

**6WePo.4 Organic, Dye Sensitized and Perovskite Solar Cells 3**

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Chairpersons:

Tae-Hyuk Kwon (Ulsan National Institute of Science and Technology, Korea)

Masatoshi Yanagida (National Institute for Materials Science(NIMS), Japan)

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**6WePo.4.1**

**Properties of DSSCs Affected by Accelerating UV Light Exposure**

Der-Ray Huang, Yi-An Chen, Run-Lin Liou and Chih-Hung Tsai

Department of Opto-Electronic s Engineering, National Dong Hwa University, Taiwan

**6WePo.4.2**

**A Novel Cossensitization Method Using the Lewis Acid Sites of a TiO<sub>2</sub> Photoelectrode for Dye-Sensitized Solar Cells**

N. Shibayama<sup>1,2)</sup>, H. Ozawa<sup>1)</sup>, Y. Ooyama<sup>3)</sup> and H. Arakawa<sup>1)</sup>

<sup>1)</sup>Department of Industrial Chemistry, Faculty of Engineering, Tokyo University of Science, Japan,

<sup>2)</sup>Technical Research Institute, Toppan Printing Co.,

Ltd., Japan, <sup>3)</sup>Department of Applied Chemistry, Graduate School of Engineering, Hiroshima University, Japan

## 6WePo.4.3

### **Enhance the Performance of Dye-sensitized Solar Cells Using Phosphor Co-doped TiO<sub>2</sub> Photoelectrode to Improve the Light Harvesting**

H. W. Choi, H. H. Yoon and Y. M. Kim

Department of Electrical Engineering, Gachon University, Korea

## 6WePo.4.4

### **Electron Donating Group Effects On Dithienothiophene-based Dyes For Dye-Sensitized Solar Cells**

Jeong Soo Kim<sup>1)</sup>, Byoung Man Kim<sup>2)</sup>, Hyun Kyu Han<sup>1)</sup>, Jung Seung Nam<sup>1)</sup>, Duck Ho No<sup>2)</sup>, Hyun Ho Shin<sup>1)</sup>, Andrew B Holmes<sup>3)</sup> and Tae-Hyuk Kwon<sup>1,2)</sup>

<sup>1)</sup>Department of Chemistry, School of Natural Sciences, Ulsan National Institute of Science and Technology (UNIST), Republic of Korea, <sup>2)</sup>School of Energy and Chemical Engineering, Ulsan National Institute of Science and Technology (UNIST), Republic of Korea, <sup>3)</sup>School of Chemistry, Bio 21 Institute, University of Melbourne, Australia

## 6WePo.4.5

### **Improved Conversion Efficiency of Dye-Sensitized Solar Cells due to Reduction in Ion Diffusion Resistance with Void Incorporation into Titanium Oxide Films**

H. Hamasaki, S. Ohkub, H. Tsurumaki, K. Yamada and S. Shiratsuchi

Graduate School of Engineering, Kyushu Institute of Technology, Japan

## 6WePo.4.6

### **Effect of Dye Anchoring Groups on Dye Adsorption Characteristics of Dye-Sensitized Solar Cells**

Galhenage A. Sewvandi, M. Kakimoto and Qi Feng

Department of Advanced Materials Science, Faculty of

Engineering, Kagawa University, Japan

**6WePo.4.7**

**A Novel Photoanode for Enhancement in Conversion Efficiency of Natural Dye Sensitized Solar Cell**

Mridula Tripathi and Priyanka Chawla

Department of Chemistry, C.M.P. Degree College  
University of Allahabad, India

**6WePo.4.8**

**Improving the Efficiency of DSSCs with Diatom Structure**

Der-Ray Huang, Run-Lin Liou, Yan-Jang Jiang and  
Chih-Hung Tsai

Department of Opto-Electronics Engineering, National  
Dong Hwa University, Taiwan

**6WePo.4.9**

**Synthesis of Anatase TiO<sub>2</sub> Nanoparticles by Using Liquid-liquid Method and Their Applications for Dye-sensitized Solar Cells**

T. Narabe, M. Hagiwara and S. Fujihara

Department of Applied Chemistry, Faculty of Science and Technology, Keio University, Japan

**6WePo.4.10**

**Synthesis of Dodecahedron ZnO Aggregates Using Metal-Organic Frameworks as Precursors and Their Application for Dye-sensitized Solar Cells**

T. Enomoto<sup>1)</sup>, E. Hosono<sup>2)</sup>, H. Zhou<sup>2)</sup>, M. Hagiwara<sup>1)</sup> and S. Fujihara<sup>1)</sup>

<sup>1)</sup>Department of Applied Chemistry, Faculty of Science and Technology, Keio University, Japan,

<sup>2)</sup>National Institute of Advanced Industrial Science and Technology, Japan

## 6WePo.4.11

### **Surface Textured of Al-doped ZnO Transparent Conductive Films by Wet-etching Methods for Dye-sensitized Solar Cells Application**

Jung-Jie Huang<sup>1)</sup>, Ming-Lin Li<sup>1)</sup>, Jian-Yang Lin<sup>2)</sup> and Yu-Lee Hsueh<sup>3)</sup>

<sup>1)</sup>Department of Materials Science and Engineering, MingDao University, TAIWAN, <sup>2)</sup>Department of Electronic Engineering, National Yunlin University of Science and Technology, TAIWAN, <sup>3)</sup>Graduate School of Engineering Science and Technology, National Yunlin University of Science and Technology, Taiwan

## 6WePo.4.12

### **High haze TCO Glass with Nano-particle Layer for Dye-sensitized Solar Cells**

Rena Otsuka<sup>1)</sup>, Takafumi Takano<sup>1)</sup>, Ryo Murakami<sup>1)</sup> and Masayuki Okuya<sup>1, 2)</sup>

<sup>1)</sup>Department of Electronics and Materials Science, Shizuoka University, Japan, <sup>2)</sup>Research Institute of Green Science and Technology, Shizuoka University, Japan

## 6WePo.4.13

### **Metal to Oxide Monolayer Heterogeneous Junction on Nanocatalysts Boosts the Dye-sensitized Solar Cell**

P.-C. Huang<sup>1)</sup>, Y.-T. Liu<sup>2)</sup>, T.-L. Lin<sup>1)</sup> and T.-Y. Chen<sup>1)</sup>

<sup>1)</sup>Department of Engineering and System Science, National Tsing Hua University, Taiwan, <sup>2)</sup>Department of Environmental Science and Engineering, Tunghai University, Taiwan

## 6WePo.4.14

### **Application of Foam-like TiO<sub>2</sub> Films to Dye-sensitized Solar Cells**

I. O. Oladeji<sup>1)</sup>, C. H. Cheng<sup>2)</sup>, M. J. Jeng<sup>2)</sup>, L. B. Chang<sup>2)</sup> and L. Chow<sup>3)</sup>

<sup>1)</sup>Sisom Thin Films LLC, USA, <sup>2)</sup>Department of Electronic Engineering, Chang Gung University, Taiwan, <sup>3)</sup>Department of Physics, University of Central Florida, USA

#### 6WePo.4.15

**Withdrawn**

#### 6WePo.4.16

### **Facile Preparation Method of Moth-Eye Nanopatterned Dye-Sensitized Solar Cells Appearing Light-Harvesting and Self-Cleaning Effects**

Cheol Hun Park, Sung Yeon Heo, Sang Jin Kim, Jung Pyo Jung and Jong Hak Kim

Department of Chemical and Biomolecular Engineering  
Yonsei University, Korea

#### 6WePo.4.17

### **Mesoporous SnO<sub>2</sub> Interfacial Layer Template by Comb-like Copolymer for Dye-sensitized Solar Cell**

H. R. Jeon<sup>1)</sup>, W. S. Chi<sup>1)</sup>, J. Y. Lim<sup>1)</sup>, J. H. Kim<sup>1)</sup> and J. T. Park<sup>2)</sup>

<sup>1)</sup>Department of Chemical and Biomolecular Engineering, Yonsei University, South Korea, <sup>2)</sup>Department of Chemical Engineering, Massachusetts Institute of Technology, United States

#### 6WePo.4.18

### **Photochemical Properties of Dye-sensitized Solar Cell using Mixed Natural Organic Dyes and Titanium Dioxide Nano Particles**

N. A. Ludin<sup>1)</sup>, N. E. Safie<sup>1)</sup>, N. H. Hamid<sup>2)</sup>, N. S. Abdul-Karim<sup>1)</sup>, K. Sopian<sup>1)</sup>, A. W. Azhari<sup>1)</sup> and S. Sepeai<sup>1)</sup>

<sup>1)</sup>Solar Energy Research Institute (SERI), Universiti Kebangsaan Malaysia, Malaysia, <sup>2)</sup>Faculty of Forestry, Universiti Putra Malaysia, Malaysia

**6WePo.4.19****Strategies to Improve the Deposition of CdS and CdSe for Quantum Dot-Sensitized Solar Cells**

I-Ping Liu, Kuan-Jung Chen, Huai-Ping Cho, Li-Tung Chen and Yuh-Lang Lee

Department of Chemical Engineering, National Cheng Kung University, Taiwan

**6WePo.4.20****Preparation of Cobalt (II/III)-Based Gel-State Electrolyte with Titanium Carbide Nanofiller for Dye-Sensitized Solar Cell Application**

Li-Tung Chen, I-Ping Liu, Kuan-Jung Chen, Ting-Wei Chang, Song-Chuan Su and Yuh-Lang Lee

Department of Chemical Engineering, National Cheng Kung University, Taiwan

**6WePo.4.21**

**Withdrawn**

**6WePo.4.22****Effect of Carbon Black and Titanium Blocking Layer on Zinc Oxide Electrode Using for Dye Sensitized Solar Cells**

S. Y. Lee and S. H. Kim

School of Energy, Materials and Chemical Engineering, Korea University of Technology and Education, South Korea

**6WePo.4.23****P-spice Modeling for Large Area Z-type Module of Transparent DSC with 2-dimensional Diode Equivalent Circuit**

J.-H. Pak<sup>1)</sup>, J.-C. Lee<sup>2)</sup> and M. Shin<sup>1)</sup>

<sup>1)</sup>School of Electronics, Telecommunications, and Computer Engineering, Korea Aerospace University, South Korea, <sup>2)</sup>Research Center, Dong-Jin Semichem, Pan-Gyo Techno-valley, South Korea

#### 6WePo.4.24

### Preparation of Silver Nanowire Applications in the Light Scattering Layer of a Dye-sensitized Solar Cell

Menq-Jion Wu<sup>1)</sup>, Jung-Jie Huang<sup>2)</sup>, Chun-Fa Hsu<sup>1)</sup> and Si-Jia Chen<sup>3)</sup>

<sup>1)</sup>Department of Mechatronics Engineering, National Changhua University of Education, Taiwan,

<sup>2)</sup>Department of Materials Science and Engineering, MingDao University, Taiwan, <sup>3)</sup>College of Materials Science and Engineering, Fujian University of Technology, China

#### 6WePo.4.25

### Secure & Efficient Dye-Sensitized Solar Cells with Nano-clay Electrolyte

Satoshi Uchida<sup>1)</sup>, Takaya Kubo<sup>2)</sup> and Hiroshi Segawa<sup>2)</sup>

<sup>1)</sup>Komaba Organization for Educational Excellence College of Arts and Sciences (KOMEX), The University of Tokyo, Japan, <sup>2)</sup>Research Center for Advanced Science and Technology(RCAST), The University of Tokyo, Japan

#### 6WePo.4.26

### Fabrications of Flexible Dye-Sensitized Solar Cells without Soaking Using Ultrasonic Spray Coating Technology

Hyun-Gyu Han<sup>1)</sup>, Hasitha C. Weerasinghe<sup>2,3)</sup>, Eung Lee<sup>1)</sup>, Yi-Bing Cheng<sup>4)</sup>, David J. Johnes<sup>2)</sup>, Andrew B. Holmes<sup>2,3)</sup> and Tae-Hyuk Kwon<sup>1)</sup>

<sup>1)</sup>Department of Chemistry, School of Natural Sciences, Ulsan National Institute of Science and Technology (UNIST), Republic of Korea, <sup>2)</sup>School of Chemistry, Bio<sup>2)</sup>Institute, University of Melbourne, Australia, <sup>3)</sup>Commonwealth Scientific and Industrial Research Organisation (CSIRO) Materials Science and Engineering, Australia, <sup>4)</sup>Department of Materials Engineering, Monash University, Australia

**6WePo.4.27****Low-Temperature Synthesis of ZnO Electrodes for Dye-sensitized Solar Cells via Chemical Bath Deposition Method Using Alcohol Solvents**

H. Ohashi, M. Hagiwara and S. Fujihara

Department of Applied Chemistry, Faculty of Science and Technology, Keio University, Japan

**6WePo.4.28****Low-temperature Fabrication of Dye-sensitized Solar Cells on Flexible Substrates with a Protective Layer**

T. Yasufuku, T. Yamamura, K. Ezaka, N. Kishi and T. Soga

Department of Frontier Materials, Nagoya Institute of Technology, Japan

**6WePo.4.29****Enhancing Electron Transport in Mesoporous TiO<sub>2</sub> Film by Sol-Gel Based Interconnecting Networks for Dye-Sensitized Solar Cell**

Po-Chun Huang, Tsan-Yao Chen, Yi-Lin Wang, Yuan Hu and Tsang-Lang Lin

Department of Engineering and System Science, National Tsing Hua University, Taiwan

**6WePo.4.30****Ammonia Treated ZnO Nanaoflowers Based CdS/CdSe Quantum Dot Sensitized Solar Cell**

Soo-Kyoung Kim and Hee-Je Kim

Department of Electrical Engineering, Pusan National University, South Korea

**6WePo.4.31****Synthesis, Characterisation, Electrical and Photovoltaic Properties of Nano Crystalline Fe Doped TiO<sub>2</sub>**

Sagar Bhardwaj<sup>1)</sup>, Aisha Malik<sup>1)</sup>, S. Hameed<sup>1)</sup> and M M

Haque<sup>2)</sup>

<sup>1)</sup>Department of Electrical Engineering, Aligarh Muslim University, India, <sup>2)</sup>Department of Chemistry, Aligarh Muslim University, India

#### 6WePo.4.32

#### **ZnO-based Dye-sensitized Solar Cells: Nanostructures, Dyes and Electrolyte Solutions**

G. Oskam<sup>1)</sup>, E. Canto<sup>1)</sup>, N. Gómez<sup>1)</sup>, J. Idígoras<sup>2)</sup>, J. A. Anta<sup>2)</sup>, Á. Sastre-Santos<sup>3)</sup>, F. Fernández-Lázaro<sup>3)</sup>, M. Macías<sup>4)</sup>, A. Borrás<sup>4)</sup>, A. Barranco<sup>4)</sup> and A. R. González-Elipe<sup>4)</sup>

<sup>1)</sup>Department of Applied Physics, CINVESTAV-IPN, Mérida, México, <sup>2)</sup>Departamento de Sistemas Físicos, Químicos y Naturales, Universidad Pablo de Olavide, Spain, <sup>3)</sup>Área de Química Orgánica, Instituto de Bioingeniería, Universidad Miguel Hernández, Spain, <sup>4)</sup>Instituto de Ciencia de Materiales de Sevilla, CSIC-Universidad de Sevilla, Spain

#### 6WePo.4.33

#### **TNO Transparent Conductive Oxide Films for Dye-sensitized Solar Cells**

Rena Otsuka<sup>1)</sup>, Takeshi Endo<sup>1)</sup>, Ryo Iwaki<sup>1)</sup> and Masayuki Okuya<sup>1, 2)</sup>

<sup>1)</sup>Department of Electronics and Materials Science, Shizuoka University, Japan, <sup>2)</sup>Research Institute of Green Science and Technology, Shizuoka University, Japan

#### 6WePo.4.34

#### **TCO-less Dye-Sensitized Solar Cells Consisting of Dye-Cocktail and Cobalt Redox Shuttle based Electrolyte**

M. Z. Molla, Y. Ogomi, S. S. Pandey, T. Ma and S. Hayase

Kyushu Institute of Technology, Japan

**6WePo.4.35****Solar Windows Originated from Highly Transparent Dye-sensitized Solar Cells**

K. Zhang, C. Qin and A. Islam. L. Han

Photovoltaic Materials Unit, National Institute for Materials Science, Japan

**6WePo.4.36****Large-sized Dye-sensitized Solar Cells and Perovskite Solar Cells**

Tingli Ma<sup>1)</sup>, Yuhei Ogomi<sup>1)</sup>, Shigeki Fujisawa<sup>2)</sup>, Shyam Pandey<sup>1)</sup> and Shuzi Hayase<sup>1)</sup>

<sup>1)</sup>Kyushu Institute of Technology, Japan, <sup>2)</sup>Ushio, INC, Japan

**6WePo.4.37****Withdrawn****6WePo.4.38****Solid Nanocomposite Polymer Electrolyte for Enhancement in Stability of Natural Dye Sensitized Solar Cell**

Mridula Tripathi and Priyanka Chawla

Department of Chemistry, C.M.P. Degree College, University of Allahabad, Allahabad, India

**6WePo.4.39****Restorative Effects of Heating on the Performance of Dye-sensitized Solar Cells**

M. Berginc, U. Opara Krašovec, and M. Topič

University of Ljubljana, Faculty of Electrical Engineering, Slovenia

**6WePo.4.40LN****A Simple, Room Temperature, Solid-state Synthesis Route for Metal Oxide Nanostructures**

S. A. Patil<sup>1)</sup>, D. V. Shinde<sup>1)</sup>, D. Y. Ahn<sup>1)</sup>, D. V. Patil<sup>1)</sup>, K. K. Tehare<sup>2)</sup>, V.V. Jadhav<sup>2)</sup>, J. K. Lee<sup>3)</sup>, R. S. Mane<sup>2)</sup>, N. K.

Shresthaa<sup>1)</sup> and S.H.Han<sup>1)</sup>

<sup>1)</sup>Department of Chemistry, Hanyang University, Republic of Korea, <sup>2)</sup>Center for Nanomaterials and Energy Devices, School of Physical Sciences, Swami Ramanand Teerth Marathwada University, India,

<sup>3)</sup>Energy Storage Research Centre, Korea Institute of Science and Technology, Republic of Korea

#### 6WePo.4.41LN

#### **Photovoltaic and Impedance Characteristics of Dye-Sensitized Solar Cell Using Polymer Gel Electrolyte**

Waode Sukmawati Arsyad<sup>1,2)</sup>, Herlin Pujiarti<sup>1)</sup>, Herman<sup>1)</sup> and Rahmat Hidayat<sup>1)</sup>

<sup>1)</sup>Physics of Photonics and Magnetism Research Division, Faculty of Mathematics and Natural Sciences, Bandung Institute of Technology, Indonesia, <sup>2)</sup>Physics Department, Faculty of Mathematics and Natural Sciences, Halu Oleo University, Indonesia

#### 6WePo.4.42LN

#### **DFT Study of Chromophore Structures of Coumarin Styryl Dyes as Sensitizer for Dye-Sensitized Solar Cells**

S. Tontapha<sup>1)</sup>, P. Chaiamornnugool<sup>1)</sup>, W. Sang-aroon<sup>2)</sup> and V. Amornkitbamrung<sup>3)</sup>

<sup>1)</sup>Integrated Nanotechnology Research Center, Department of Physics, Faculty of Science, Khon Kaen University, Thailand, <sup>2)</sup>Department of Chemistry, Faculty of Engineering, Rajamangala University of Technology Isan, Thailand, <sup>3)</sup>Integrated Nanotechnology Research Center, Department of Physics, Faculty of Science, Khon Kaen University, Thailand

#### 6WePo.4.43LN

#### **Realization of High-efficiency Platinum-free Dyed-Sensitized Solar Cell via a Ni<sub>3</sub>S<sub>2</sub> Composite Counter Electrode**

W. Maiaugree<sup>1)</sup>, A. Tangtrakarn<sup>1,2,3)</sup> and V.

Amornkitbamrung<sup>1,2,3)</sup>

<sup>1)</sup>Department of Physics, Faculty of Science,  
Khon Kaen University, Thailand, <sup>2)</sup>The Integrated  
Nanotechnology Research Center, Khon Kaen  
University, Thailand, <sup>3)</sup>Thailand Center of Excellence in  
Physics, CHE, Ministry of Education, Thailand

## 6WePo.4.44LN

### Fabrication and Characterization of Platinum- Graphene Based DSSCs

Yinghe Zhang<sup>1)</sup>, Shigeki Kuroiwaa<sup>1)</sup>, Tawfique Hasan<sup>2)</sup>

<sup>1)</sup>Applied Chemistry, Waseda University, Japan,

<sup>2)</sup>Cambridge Graphene Centre, Cambridge University,  
UK

## 6WePo.4.45LN

### Titanium Thin Film Based TiO<sub>2</sub> Nanostructures for DSSCs: Studies of Photocurrent and Photovoltage

Sadia Ameen, Hyung-Kee Seo, Minwu Song, M.  
Nazim, Hyung-Shik Shin

Energy Materials & Surface Science Laboratory,  
Solar Energy Research Center, School of Chemical  
Engineering, Chonbuk National University, Republic of  
Korea

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## Wednesday, November 26

**14:45 - 16:10 Annex**

**Area 7**

## 7WePo.10 Characterization and Modules Reliability 3

Chairperson:

Kohji Masuda (JET, Japan)

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## 7WePo.10.1

### An Convenient Way to Monitor the PID Resistant ARC Coating for Crystalline Silicon Solar Cells

Z. W. Peng, C. J. Lan and H. L. Chen

Motech Industries, Inc., Taiwan

#### 7WePo.10.2

### **Results of 3 Years of Thin Film Module Energy Yield Inter-comparison: Link Indoor to Outdoor Performance Data**

G. Friesen, M. Pravettoni, S. Dittmann, A. Virtuani, M. Marzoli, D. Strepparava and R. Meoli

University of Applied Sciences and Arts of Southern Switzerland (SUPSI), Institute for applied sustainability to the built environment (ISAAC), Switzerland

#### 7WePo.10.3

### **High Performance Si PV Module at Low Solar Irradiance**

Hyun Young Son, Hoon Oh, Indeok Chung, Nari Yoon, Won-jae Lee and Eun-Chel Cho and In-Sik Moon

PV Research Dep't, Green Energy Business Division, Hyundai Heavy Industries, Co., Ltd., Korea

#### 7WePo.10.4

### **Optical Loss Analysis of Colored PV Modules Using Comprehensive Ray Tracing**

M. R. Vogt<sup>1)</sup>, H. Holst<sup>2)</sup>, M. Winter<sup>1)</sup>, S. Knoc<sup>1)</sup>, A. Ruppenthal<sup>3)</sup>, M. Köntges<sup>2)</sup>, R. Brendel<sup>1,2)</sup> and P. P. Altermatt<sup>1)</sup>

<sup>1)</sup>Dep. Solar Energy, Inst. Solid-State Physics, Leibniz University of Hannover, Germany, <sup>2)</sup>Institute for Solar Energy Research Hamelin (ISFH), Germany, <sup>3)</sup>Momentive Performance Materials GmbH, Germany

#### 7WePo.10.5

### **Changes of Solar Cell Parameters During Damp-Heat Exposure**

J. Zhu<sup>1)</sup>, R. Gottschalg<sup>1)</sup>, M. Koehl<sup>2)</sup>, S. Hoffmann<sup>2)</sup>, K. A. Berger<sup>3)</sup>, S. Zamini<sup>3)</sup>, I. J. Bennett<sup>4)</sup>, E. Gerritsen<sup>5)</sup>, P. Malbranche<sup>5)</sup>, P. Pugliatti<sup>6)</sup>, A. Di Stefano<sup>6)</sup>, F. Aleo<sup>6)</sup>, D. Bertani<sup>7)</sup>, F. Paletta<sup>7)</sup>, F. Roca<sup>8)</sup>, G. Graditi<sup>8)</sup>, M. Pellegrino<sup>8)</sup>, O. Zubillaga<sup>9)</sup>, P. Cano<sup>9)</sup>, A. Pozza<sup>10)</sup> and T.

Sample<sup>10)</sup>

<sup>1)</sup>Centre for Renewable Energy Systems Technology (CREST), Loughborough University, UK, <sup>2)</sup>Fraunhofer ISE, Germany, <sup>3)</sup>AIT, Austria, <sup>4)</sup>ECN, Netherlands, <sup>5)</sup>CEA-INES, France, <sup>6)</sup>ENEL, Italy, <sup>7)</sup>RSE, Italy, <sup>8)</sup>ENEA, Italy, <sup>9)</sup>Tecnalia, Spain, <sup>10)</sup>JRC, Italy

## 7WePo.10.6

### **Analysis for Degradation of Crystalline Silicon PV Modules by EL and PL**

K. Shirasawa<sup>1)</sup>, S. Asao<sup>1)</sup>, K. Takano<sup>2)</sup>, K. Sugihara<sup>2)</sup> and H. Takato<sup>1)</sup>

<sup>1)</sup>National Institute of Advanced Industrial Science Technology, Japan, <sup>2)</sup>International Test & Engineering Services Co., Ltd., Japan

## 7WePo.10.7

### **Non-contact Measurement of Electric Potential of PV Cells in a Module and Novel Characterization Technologies**

Y. Hishikawa, K. Yamagoe and T. Onuma

National Institute of Advanced Industrial Science and Technology (AIST), Research Center for Photovoltaic Technologies (RCPVT)

## 7WePo.10.8

### **Crosslinking and Post-crosslinking of EVA in PV Modules**

G. Oreski<sup>1)</sup>, A. Rauschenbach<sup>1)</sup>, C. Hirschl<sup>2)</sup>, G. Eder<sup>3)</sup> and G. Pinter<sup>4)</sup>

<sup>1)</sup>Polymer Competence Center Leoben, Austria, <sup>2)</sup>Carinthian Tech Research AG, Austria, <sup>3)</sup>OFI Österreichisches Forschungsinstitut für Chemie und Technik, Austria, <sup>4)</sup>University of Leoben, Institute of Material Science and Testing of Plastics, Austria

### **7WePo.10.9**

#### **Measured and Guaranteed Degradation of c-Si PV Modules: A Module Level Performance Study after a Decade of Field Operation**

T. Aziz, N. Ketjoy and C. Sirisamphanwong

School of Renewable Energy Technology (SERT)  
Naresuan University Phitsanulok, Thailand

### **7WePo.10.10**

#### **Evaluation of Soiling Loss Measurement Methodologies for Different PV Module Technologies**

J. J. John, S. Chattpadhyay, R. Dubey, A. Kottantharayil and J. Vasi

Indian Institute of Technology Bombay, India

### **7WePo.10.11**

#### **Detection and Analysis of PID Affected Solar Modules in the Field**

Thomas Kaden<sup>1)</sup>, Stephan Hoffmann<sup>2)</sup>, Peter Bentz<sup>3)</sup>, Hans Joachim Moeller<sup>1)</sup> and Michael Koehl<sup>2)</sup>

<sup>1)</sup>Fraunhofer Technologiezentrum Halbleitermaterialien (THM), Germany, <sup>2)</sup>Fraunhofer-Institut für Solare Energiesysteme (ISE), Germany, <sup>3)</sup>Solar-Fabrik, Germany

### **7WePo.10.12**

#### **Spatial and Temporal Photovoltaic Module Temperature Variations in Outdoor Conditions**

B. Herteleer<sup>1,2,3,4)</sup>, H. Goverde<sup>2,3,4)</sup>, F. Catthoor<sup>3)</sup>, J. Driesen<sup>2,4)</sup> and J. Cappelle<sup>1)</sup>

<sup>1)</sup>E&A Research Group, Belgium, <sup>2)</sup>ESAT/ELECTA, Belgium, <sup>3)</sup>IMEC vzw, Belgium, <sup>4)</sup>EnergyVille, Belgium

### **7WePo.10.13**

#### **Measurement of Residual Stress in Copper Interconnectors on Crystalline Silicon Solar Cells by X-ray Diffraction**

A. Morlier, F. Haase and M. Köntges

ISFH, Institute for Solar Energy Research Hamelin,  
Germany

#### 7WePo.10.14

**The Temperature Variation of Test Specimen Due to White Bias Light Irradiation During the Spectral Response Measurement of Solar Cells and Its Effect on the Spectral Response Measurement Result**

S. K. Ahn<sup>1)</sup>, K. S. Lee<sup>1)</sup>, D. H. Kim<sup>2)</sup> and J. H. Yun<sup>1)</sup>

<sup>1)</sup>Photovoltaic Laboratory, Korea Institute of Energy Research, Korea, <sup>2)</sup>Department of Materials Science and Engineering, Korea University, Korea

#### 7WePo.10.15

**The Acceleration of Degradation by HAST and Air-HAST in c-Si PV Modules**

Soh Suzuki<sup>1)</sup>, Tadanori Tanahashi<sup>1)</sup>, Takuya Doi<sup>2)</sup> and Atsushi Masuda<sup>2)</sup>

<sup>1)</sup>ESPEC CORP., Japan, <sup>2)</sup>National Institute of Advanced Industrial Science and Technology, Japan

#### 7WePo.10.16

**Propagation of Measurement Uncertainties in Mismatch Factor Correction for Photovoltaic Device Calibration**

B. Mihaylov, M. Bliss, T. R. Betts and R. Gottschalg

Centre for Renewable Energy Systems Technology  
School of Electronic, Electrical and Systems  
Engineering, Loughborough University, United  
Kingdom

#### 7WePo.10.17

**Study on Interchangeability of Crystalline PV Modules**

N. Yamanaka<sup>1)</sup>, S. Nishikawa<sup>1)</sup>, Y. Takahashi<sup>2)</sup>, Y. Ishihara<sup>2)</sup> and H. Kato<sup>3)</sup>

<sup>1)</sup>Nihon University, Japan, <sup>2)</sup>Doshisha University, Japan,  
<sup>3)</sup>Japan Electrical Safety & Environment Technology  
Laboratories, Japan

**7WePo.10.18**

**Degradation Analysis of Silicone-encapsulated  
Photovoltaic Modules After 28 Years Operation**

Sadao Sakamoto<sup>1)</sup>, Atsuo Itoh<sup>2)</sup>, Hiroto Ohwada<sup>2)</sup>,  
Tomoyoshi Furihata<sup>2)</sup>, KIM Hyung-Bae<sup>2)</sup>, Naoki  
Yamakawa<sup>2)</sup>, Atsushi Yaginuma<sup>2)</sup>, Tomoo Imataki<sup>3)</sup> and  
Momoki Watanabe<sup>3)</sup>

<sup>1)</sup>Gifu-University (AIST) Japan, <sup>2)</sup>Shin-Etsu Chemical  
Co., Ltd, Japan, <sup>3)</sup>Sharp Co., Japan

**7WePo.10.19**

**Power Rating for Bifacial PV**

K. Sugibuchi, S. Goda and N. Ishikawa

PVG Solutions Inc., Japan

**7WePo.10.20**

**Time-resolved Photoluminescence  
Characterisation of Laser Induced Defects in  
Laser-doped Region**

K. Wang, Z. Hameiri and H. Kampwerth

School of Photovoltaic and Renewable Energy  
Engineering, University of New South Wales, Australia

**7WePo.10.21**

**Characteristics Evaluation of Various Photovoltaic  
Power Generation Systems**

Hideaki Masaki, Koki Nagai, Keiichiro Hakuta, Masashi  
Nagura and Masahiro Sone

NTT FACILITIES, Inc., Japan

**7WePo.10.22**

**Mathematical Modeling for Characteristic  
Analysis of Input and Output Parameter of Roof  
Top Photovoltaic System and Residential Air  
Conditioning Load**

J. Saelao<sup>1)</sup>, K. Treepak<sup>2)</sup> and N. Patcharaprakiti<sup>3)</sup>

<sup>1)</sup>Department of Mathematical, Faculty of Science, Maejo University, Thailand, <sup>2)</sup>Department of Electrical Engineering, Faculty of Engineering, Rajamangala University of Technology Lanna Payap, Thailand, <sup>3)</sup>Department of Electrical Engineering, Faculty of Engineering, Rajamangala University of Technology, Lanna Chiangrai, Thailand

## 7WePo.10.23

### **Application of Passivation Film on Thin-Film Photovoltaic Cells**

M. Yamashita, T. Fujimoto, T. Niwa, T. Jinda and M. Mori

Toray Engineering Co.,Ltd., Japan

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**Wednesday, November 26**

**10:15 - 11:30 Annex**

**Area 8**

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## **8WePo.8 Systems, BOS components and Grid Integration 1**

Chairpersons:

Kazuhiko Kato (AIST, Japan)  
Wilfried G.J.H.M. Van Sark (Utrecht University  
Copernicus Institute, The Netherlands)

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## **8WePo.8.1**

### **Autonomous Solar Power Forecasting System**

A. Okhorzina<sup>1)</sup>, A. Yurchenko<sup>1)</sup> and A. Kozloff<sup>2)</sup>

<sup>1)</sup>National Research Tomsk Polytechnic University, <sup>2)</sup>Institute of Atmospheric Optics SB RAS, Russia

## **8WePo.8.2**

### **Global Solar Radiation Prediction Using Multipoint Meteorological Data**

Y. Takigawa<sup>1)</sup>, K. Yukita<sup>1)</sup>, Y. Goto<sup>1)</sup>, K. Ichiyanagi<sup>1)</sup>, K. Kobayashi<sup>2)</sup> and Y. Miwa<sup>2)</sup>

<sup>1)</sup>Aichi Institute of Technology, Japan, <sup>2)</sup>Chubu Electric Power Co., INC, Japan

### 8WePo.8.3

#### **Development of Short Term Irradiance Forecasting Using LFM Model, in Japan**

Takashi OOZEKI<sup>1)</sup>, Joao Gari da Silva Fonseca Jr.<sup>1)</sup>, Hideaki Otake<sup>1)</sup>, Takumi Takashima<sup>1)</sup>, Yoshinori Yamada<sup>2)</sup> and Kazuhiko Ogimoto <sup>3)</sup>

<sup>1)</sup>National Institute of Advanced Industrial Science and Technology (AIST), JAPAN, <sup>2)</sup>Meteorological Research Institute (MRI), Japan Meteorological Agency (JMA), <sup>3)</sup>The University of Tokyo

### 8WePo.8.4

#### **A Study on Forecast Method for Short Period Variation of Solar Radiation by Using Cloud Image Data**

Ryuji Kawai<sup>1)</sup>, Katsuhiro Ichiyanagi<sup>1)</sup>, Kazuto Yukita<sup>1)</sup>, Yasuyuki Goto<sup>1)</sup>, Kazuhiro Kobayashi<sup>2)</sup> and Yasushi Miwa <sup>2)</sup>

<sup>1)</sup>Aichi Institute of Technology, Japan, <sup>2)</sup>Chubu Electric Power Co., Inc., Japan

### 8WePo.8.5

#### **Impact of PV Power Prediction Technology on Power System Operation**

Y. Udagawa<sup>1,2)</sup>, K. Ogimoto<sup>1)</sup>, T. Ikegami<sup>3)</sup>, T. Oozeki<sup>4)</sup>, H. Otake<sup>4)</sup> and S. Fukutome<sup>5)</sup>

<sup>1)</sup>The University Of Tokyo, Japan, <sup>2)</sup>KOZO KEIKAKU ENGINEERING Inc, Japan, <sup>3)</sup>Tokyo University of Agriculture and Technology, Japan, <sup>4)</sup>The National Institute of Advanced Industrial Science and Technology, Japan, <sup>5)</sup>JP Business Service Corporation, Japan

## 8WePo.8.6

### **Initial Results of PV System Performance with Two Different System Installations: The Case of A 1 kWp HIT PV System in A Suburb of Bangkok, Thailand**

A. Hongsingthong<sup>1)</sup>, S. Kittisontirak<sup>1,3)</sup>, P. Chinnavornrungsee<sup>1)</sup>, S. Songtrai<sup>1)</sup>, A. Limmanee<sup>1)</sup>, J. Sritharathikhun<sup>1)</sup>, N. Akarapanjavit<sup>2)</sup>, N. Boriraksantikul<sup>2)</sup>, T. Taratiwat<sup>2)</sup>, K. Sriprapha<sup>1)</sup> and W. Titiroongruang<sup>3)</sup>

<sup>1)</sup>Solar Energy Technology Laboratory (STL), National Electronics and Computer Technology Center (NECTEC), Thailand, <sup>2)</sup>PTT Research & Technology Institute, PTT Public Company Limited, Thailand, <sup>3)</sup>Faculty of Engineering, King Mongkut's Institute of Technology Ladkrabang, Thailand

## 8WePo.8.7

### **Effect of Sun Radiation on Solar Cell Modules with Different Directions**

Der-Ray Huang, Shao-Yu Fang and Huan-Sheng Zeng

Department of Opto-Electronics Engineering, National Dong Hwa University, Taiwan

## 8WePo.8.8

### **Investigate of Solar PV Rooftop Energy with Various of Tile and Angel in Winter Season at the Northern Thailand**

S. Teerasak<sup>1)</sup>, J. Sakorn<sup>2,3)</sup>, W. Muangjai<sup>1)</sup> and T. Jutturit<sup>2)</sup>

<sup>1)</sup>College of Integrated Science and Technology, <sup>2)</sup>Department of Electrical Engineering, Faculty of Engineering Rajamangala University of Technology Lanna, Thailand, <sup>3)</sup>Pasang Technical College, Thailand

## 8WePo.8.9

### **Evaluation of the Performance of Large Scale PV Plant in West China**

Hailing Li<sup>1)</sup>, Fang Lv<sup>1)</sup>, Yonghui Zhai<sup>1,2)</sup>, Shiyu Sang<sup>2)</sup>, Ye Zhang<sup>2)</sup> and Sicheng Wang<sup>3)</sup>

<sup>1)</sup>Institute of Electrical Engineering, Chinese Academy of Science, <sup>2)</sup>Photovoltaic and wind power systems quality test center of Chinese Academy of Sciences, <sup>3)</sup>Energy Research Institute National Development and Reform Commission

### **8WePo.8.10**

**Change to 8TuO.12.3**

### **8WePo.8.11**

#### **Outdoor Characterization of InGaP and GaAs solar cells Using the Optical Wavelength Splitter**

Y. Masuda<sup>1)</sup>, Y. Takiguchi<sup>1)</sup>, Y. Ueda<sup>2)</sup>, A. Hosono<sup>3)</sup>, S. Ishii<sup>3)</sup>, Y. Ogawa<sup>3)</sup>, T. Okamoto<sup>3)</sup> and M. Konagai<sup>1,4)</sup>

<sup>1)</sup>Department of Physical Electronics, Tokyo Institute of Technology, Japan, <sup>2)</sup>Department of Electrical Engineering, Tokyo University of Science, Japan, <sup>3)</sup>Department of Electrical and Electronic Engineering, Kisarazu National College of Technology, Japan, <sup>4)</sup>Photovoltaic Research Center (PVSEC), Tokyo Institute of Technology, Japan

### **8WePo.8.12**

#### **Performance Improvement on 120 kW<sub>p</sub> PV System of PV Microgrid System**

N. Ketjoy, A. Chimtavee, R. Ngoenmeesri, N. Khaosaad and M. Konyu

School of Renewable Energy Technology (SERT), Naresuan University, Thailand

### **8WePo.8.13**

#### **The Impact of Haze on Performance Ratio and Current Generation of PV Systems in Singapore**

H. Liu<sup>1,2)</sup>, A. M. Nobre<sup>1,3)</sup>, D. Yang<sup>1)</sup>, J. Y. Ye<sup>1,2)</sup>, F. R. Martins<sup>4)</sup>, R. Rüther<sup>3)</sup>, T. Reindl<sup>1)</sup>, A. G. Aberle<sup>1)</sup> and I. M. Peters<sup>1)</sup>

<sup>1)</sup>Solar Energy Research Institute of Singapore (SERIS), Singapore, <sup>2)</sup>NUS Graduate School for Integrative Sciences & Engineering (NGS), Singapore, <sup>3)</sup>Universidade Federal de Santa Catarina (UFSC),

Campus Universit rio Trindade, Brazil, <sup>4)</sup>Universidade Federal de São Paulo (UNIFESP), Campus Baixada Santista, Brazil

#### 8WePo.8.14

##### **A New Weather Classification Based on Solar Irradiance Variability**

A. Usami

Central Research Institute of Electric Power Industry,  
Japan

#### 8WePo.8.15

##### **Meeting the Challenge of Anti-Reflective Coatings for Ultra-Thin Photovoltaic Cover Glass**

B. Brophy, Z. R. Abrams, Y. S. Yang and P. Gonsalves  
Enki Technology Inc., USA

#### 8WePo.8.16

##### **Techno-economic of Commercial PV Power Plant: Case Study 3 MWp CIS PV Power Plant in Thailand**

C. Sirisamphanwong, N. Ketjoy, K. Mansiri and R. Ngonmeesri

School of Renewable Energy Technology (SERT)  
Naresuan University, Thailand

#### 8WePo.8.17

##### **Comparison of the Solar Irradiance Resource Datasets for Energy Yield Modeling and Standardization in Japan**

L. P. Johnson

Sunpulse K.K., Japan

#### 8WePo.8.18

##### **On Site Measurements of Current-voltage Characteristics of Photovoltaic String**

J. Asai<sup>1)</sup>, H. Naito<sup>2)</sup> and M. Kondo<sup>3)</sup>

<sup>1)</sup>Nippon Kernel System, Japan, <sup>2)</sup>Osaka Prefecture University, Japan, <sup>3)</sup>National Institute of Advanced

Industrial Science and Technology (AIST), Japan

#### **8WePo.8.19**

#### **An Apply MPPT PSO Algorithm within Partially Shaded Condition for Highland Area at Thailand**

W. Muangjai<sup>1)</sup>, T. Somsak<sup>1)</sup>, K. Oranpiroj<sup>2)</sup> and J. Thongpron<sup>2)</sup>

<sup>1)</sup>College of Integrated Science and Technology,

<sup>2)</sup>Department of Electrical Engineering, Faculty of Engineering Rajamangala University of Technology Lanna, Thailand

#### **8WePo.8.20**

#### **Two-Mode Multi-Channel High Accuracy Real-Time Data Logger for Photovoltaic Energy Harvesting Systems**

Afida Ayob<sup>1)</sup>, A. M. Buhari<sup>2)</sup>, M. Shakeri<sup>1)</sup>, C. Puvaneswaran<sup>2)</sup>, K. Sopian<sup>2)</sup> and N. Amin<sup>1, 2)</sup>

<sup>1)</sup>Department of Electrical, Electronic and Systems Engineering, Faculty of Engineering and Built Environment, The National University of Malaysia, Malaysia, <sup>2)</sup>Solar Energy Research Institute, The National University of Malaysia, Malaysia, <sup>3)</sup>Advanced Materials Research Chair, Chemistry Department, College of Sciences, King Saud University, Saudi Arabia

#### **8WePo.8.21**

#### **Performance and Yield Comparison of Eight Different Micro-Inverters**

S. Krauter

University of Paderborn, Department of Electrical Energy Technology - Sustainable Energy Concepts, Germany

#### **8WePo.8.22**

#### **Robust Battery Operation of Green Base Stations Considering Forecast of PV Output**

Y. Hara<sup>1)</sup>, T. Yamazaki<sup>1)</sup>, S. Wakao<sup>1)</sup>, K. Nukada<sup>2)</sup>, T.

Tamura<sup>2)</sup> and M. Takahata<sup>2)</sup>

<sup>1)</sup>Waseda University, Japan, <sup>2)</sup>NTT DOCOMO, Inc., Japan

## 8WePo.8.23

### **Study on BESS Operation Planning Considering with SOC of Individual Houses for Harmonized EMS**

K. Uchida<sup>1,2)</sup> and Y. Ueda<sup>1,2)</sup>

<sup>1)</sup>Tokyo University of Science, Japan, <sup>2)</sup>JST CREST

## 8WePo.8.24

### **Application of PV Output Prediction Interval to Battery Operation of Green Base Stations**

T. Yamazaki<sup>1,3)</sup>, Y. Hara<sup>1,3)</sup>, S. Wakao<sup>1,3)</sup>, Y. Fujimoto<sup>2,3)</sup>, Y. Hayashi<sup>1,3)</sup>, K. Nukada<sup>4)</sup>, T. Tamura<sup>4)</sup> and M. Takahata<sup>4)</sup>

<sup>1)</sup>Dept. Of Electrical Engineering & Bioscience, Waseda University, Japan, <sup>2)</sup>Institute for Nanoscience & Nanotechnology, Waseda University, Japan, <sup>3)</sup>JST, CREST, Japan, <sup>4)</sup>NTT DOCOMO, Inc., Japan

## 8WePo.8.25

### **Energy Control Optimization of Green Base Stations to Reduce Disaster Risk and Energy Cost Based on PV Power Production Forecasts**

K. Nukada, M. Takahata and T. Tamura

Research Laboratories, NTT DOCOMO, INC., Japan

## 8WePo.8.26

### **Evaluation of the Effectiveness of Voltage Control Methods using Acceptable Amount of PV Installation**

R. Takahashi, R. Miyoshi, N. Takahashi and Y. Hayashi

Department of Electrical Engineering and Bioscience, Waseda University, Japan

**8WePo.8.27****Behavior of Influential Parameters during Fault Occurrence due to Photovoltaic integration to Distribution System**

S. Ananwattanaporn and A. Ngaopitakkul

Department of Electrical Engineering, Faculty of Engineering, King Mongkut's Institute of Technology Ladkrabang, Thailand

**8WePo.8.28****A Low-Cost PV System for Cellular Base Stations**

Hosei Matsuoka and Masaki Nakamura

Research Laboratories, NTT DOCOMO, Inc.

**8WePo.8.29****An Economic Evaluation Comparison of Solar Water Pumping System With Engine Pumping System for Rice Cultivation**

K. Treepak<sup>1)</sup>, J. Saelao<sup>2)</sup> and N. Patcharaprakiti<sup>3)</sup>

<sup>1)</sup>Department of Electrical Engineering, Faculty of Engineering, Rajamangala University of Technology Lanna Payap, Thailand, <sup>2)</sup>Department of Mathematical, Faculty of Science, Maejo University, Thailand,

<sup>3)</sup>Department of Electrical Engineering, Faculty of Engineering, Rajamangala University of Technology, Lanna Chiangrai, Thailand

**8WePo.8.30****A 121 kWp PV-Diesel Generator Hybrid System in Kampong Chheuteal High School, Kampong Thom Province, Kingdom of Cambodia**

S. Kittisontirak<sup>1,2)</sup>, P. Chinnavornrungsee<sup>1)</sup>, S. Songtrai<sup>1)</sup>, K. Chumpolrat<sup>1)</sup>, A. Hongsingthong<sup>1)</sup>, J. Sritharathikhun<sup>1)</sup>, K. Sriprapha<sup>1)</sup>, P. Thajchayapong<sup>1)</sup> and W. Titiroongruang<sup>2)</sup>

<sup>1)</sup>Solar Energy Technology Laboratory (STL), National Electronics and Computer Technology Center (NECTEC), THAILAND, <sup>2)</sup>Faculty of Engineering,

King Mongkut's Institute of Technology Ladkrabang,  
THAILAND

### 8WePo.8.31

#### **Reduction of Energy Storage Capacity in a Large-scale Photovoltaic Generation System**

T. Makino, A. Takahashi, J. Imai and S. Funabiki

Okayama University, Japan

### 8WePo.8.32

**Withdrawn**

### 8WePo.8.33LN

**Withdrawn**

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### **Wednesday, November 26**

**13:00 - 14:25 Annex**

**Area 8**

#### **8WePo.9 Systems, BOS components and Grid Integration 2**

Chairpersons:

Pathom Attaviriyayanupap (Mitsubishi Electric Corporation, Japan)

Takayuki Tanabe (Meidensha Corporation, Japan)

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### 8WePo.9.1

#### **The Dutch Portal of Photovoltaic Energy**

A. Tozzi<sup>1)</sup>, O. Isabella<sup>1)</sup>, F. Lantsheer<sup>2)</sup>, G. Ganesan Nair<sup>1)</sup> and M. Zeman<sup>1)</sup>

<sup>1)</sup>Delft University of Technology, PVMD / Dimes, The Netherlands,

<sup>2)</sup>Koninklijk Nederlands Meteorologisch Instituut (KNMI), WEER/RB&C, The Netherlands

### 8WePo.9.2

#### **Photovoltaic Power Generation Forecast Using Numerical Weather Model and Statistical Method**

T. Kaishima<sup>1)</sup>, A. Okubo<sup>1)</sup>, T. Takagi<sup>1)</sup> and K. Ogimoto<sup>2)</sup>

<sup>1)</sup>ITOCHU Techno-Solutions Corporation, Japan, <sup>2)</sup>The

University of Tokyo, Japan

#### 8WePo.9.3

#### **Hours-ahead Solar Irradiation Forecast based on Hybridization of Numerical Weather Simulation and Locally Measured Ground Data**

M. Kakimoto<sup>1)</sup>, Y. Hanyu<sup>1)</sup>, H. Shin<sup>1)</sup>, T. Kawahara<sup>1)</sup>, H. Kobayashi<sup>1)</sup>, H. Kusaka<sup>2)</sup>, M. Okada<sup>2)</sup>, Y. Akimoto<sup>2)</sup>, Y. Takane<sup>3)</sup>, R. Ikeda<sup>2)</sup> and S. Otaka<sup>2)</sup>

<sup>1)</sup>R&D Center Toshiba Corp., Japan, <sup>2)</sup>Graduate School of Life and Environmental Sciences, University of Tsukuba, Japan, <sup>3)</sup>Atmospheric Environmental Study Group, National Institute of Advanced Industrial Science and Technology, Japan

#### 8WePo.9.4

#### **Fluctuation Range Prediction of PV Output by Using Just-In-Time Modeling**

H. Homma<sup>1,3)</sup>, T. Yamazaki<sup>1,3)</sup>, S. Yoshizawa<sup>1,3)</sup>, H. Kikusato<sup>1,3)</sup>, S. Wakao<sup>1,3)</sup>, Y. Fujimoto<sup>2,3)</sup> and Y. Hayashi<sup>1,3)</sup>

<sup>1)</sup>Dept. of Electrical Engineering & Bioscience, Waseda University, JST CREST, Japan, <sup>2)</sup>Institute for Nanoscience & Nanotechnology, Waseda University, Japan, <sup>3)</sup>JST CREST, Japan

#### 8WePo.9.5

#### **Statistical Evaluation of Ramp-Event of Spatial Average Irradiance in Electric Power System Service Area**

T. Kato<sup>1)</sup>, T. Mukai<sup>1)</sup>, Y. Manabe<sup>2)</sup>, M. Kurimoto<sup>1)</sup>, T. Funabashi<sup>2)</sup> and Y. Suzuoki<sup>1)</sup>

<sup>1)</sup>Dept. of Electrical Eng. and Comp. Sci., Grad. School of Eng., Nagoya Univ., Japan, <sup>2)</sup>Eco Topia Science Institute, Nagoya Univ., Japan

#### 8WePo.9.6

#### **Power Output Estimation of Flexible PV Module System for Off-grid Use**

M. Shibasaki and T. Yachi

Tokyo University of Science, Japan

### 8WePo.9.7

#### **Performance Evaluation of Photovoltaic Grid Connected System with Two Axes Tracking and Fixed Modules Under Hot - Wet Climate Condition of Thailand**

K. Mansiri, N. Ketjoy, C. Sirisamphanwong and R. Ngomesee

School of Renewable Energy Technology (SERT), Thailand

### 8WePo.9.8

#### **Combining Radiation Data with a Sunpath and Horizon Line to Determine the Annual Insolation on a Surface**

J. Allan<sup>1)</sup>, Z. Dehouche<sup>1)</sup> and S. Stankovic<sup>2)</sup>

<sup>1)</sup>School of Engineering and Design, Brunel University, United Kingdom, <sup>2)</sup>ChapmanBDSP

### 8WePo.9.9

#### **Two Years Demonstration results of Two Large a-Si Thin Film PV Power Plants at Different Locations**

T. Aiamtha<sup>1)</sup>, A. Hongsingthong<sup>2)</sup>, P. Manosukritkul<sup>3)</sup>, P. Chinnavornrungsee<sup>2)</sup>, S. Songtrai<sup>2)</sup>, T. Krajangsang<sup>2)</sup>, J. Sritharathikhun<sup>2)</sup>, W. Titiroongruang<sup>3)</sup> and K. Sriprapha<sup>2)</sup>

<sup>1)</sup>Bangkok Solar Power Co., Ltd, THAILAND, <sup>2)</sup>Solar Energy Technology Laboratory, National Electronics and Computer Technology Center, THAILAND, <sup>3)</sup>Faculty of Engineering, King Mongkut's Institute of Technology Ladkrabang, THAILAND

### 8WePo.9.10

#### **Evaluation of 60 kWp PV System Performance in Mexico City**

José Antonio Urbano<sup>1)</sup>, Yasuhiro Matsumoto<sup>1)</sup>, Oscar Iván Gómez<sup>1)</sup>, René Asomoza<sup>1)</sup>, Gabriela López<sup>1)</sup>, Claudia López<sup>2)</sup> and Ramón Peña<sup>1)</sup>

<sup>1)</sup>Electrical Engineering Department, Research Center

and Advanced Studies of the National Polytechnic Institute (CINVESTAV), Mexico, <sup>2)</sup>Fronius Mexico S.A. de C.V., División de Electrónica Solar, Mexico

#### 8WePo.9.11

#### **Outdoor Measurements of Spectral-splitting Photovoltaic System Using GaAs Solar Cell and GaInP Solar Cell**

T. Okamoto<sup>1)</sup>, A. Hosono<sup>1)</sup>, S. Ishii<sup>1)</sup>, Y. Ogawa<sup>1)</sup>, Y. Masuda<sup>2)</sup>, Y. Ueda<sup>3)</sup> and M. Konagai<sup>2,4)</sup>

<sup>1)</sup>Department of Electrical and Electronic Engineering, Kisarazu National College of Technology, <sup>2)</sup>Department of Physical Electronics, Tokyo Institute of Technology, <sup>3)</sup>Department of Electrical Engineering, Tokyo University of Science, <sup>4)</sup>Photovoltaic Research Center (PVREC), Tokyo Institute of Technology, Japan

#### 8WePo.9.12

#### **Demonstration of Failure Detection Method of PV Modules by second order differential of I-V Characteristics**

H. Hatta and H. Kobayashi

Central Research Institute of Electric Power Industry (CRIEPI), Japan

#### 8WePo.9.13

#### **Estimation of the Output from the Photovoltaic Systems Using the Estimated Solar Radiation Distribution**

T. Kinoshita, A. Takahashi, J. Imai and S. Funabiki

Okayama University, Japan

#### 8WePo.9.14

#### **Radiative Forcing of Solar Installations in Warm Urban Climates**

Brian R. Burg, Patrick Ruch, Stephan Paredes and Bruno Michel

IBM Research, Switzerland

**8WePo.9.15****Design Optimization of Bifacial PV**

K. Sugibuchi, S. Goda and N. Ishikawa

PVG Solutions Inc., Japan

**8WePo.9.16****New-fangled Platform for Sizing the Building Integrated Photovoltaics**

K. Jayachandran<sup>1)</sup> and S. Saravanan<sup>2)</sup>

<sup>1)</sup>Center for Alternate Energy Research, University of Petroleum and Energy Studies, India, <sup>2)</sup>National Centre for Photovoltaic Research and Education, Indian Institute of Technology Bombay, India

**8WePo.9.17****Heuristic Algorithm for Reconfiguring Solar Cell Interconnections within a Panel**

B. Lefevre<sup>1,2,3)</sup>, R. Appels<sup>1)</sup>, M. Flies<sup>1)</sup>, N. Charels<sup>1)</sup> and J. Driesen<sup>1,2)</sup>

<sup>1)</sup>KU Leuven, Belgium, <sup>2)</sup>Energyville, Belgium, <sup>3)</sup>imec vzw, Belgium

**8WePo.9.18****Analysis of the Effect of Fill Factor on the Efficiency of Solar PV System for Improved Design of MPPT**

D. K. Sharma and G. Purohit

School of Engineering, Sir Padampat Singhania University, India

**8WePo.9.19****GPS Assisted Open Loop Circuitry Based Solar Tracker**

P. Chelvanathan<sup>1)</sup>, M. Shakeri<sup>1)</sup>, M. A. Alghoul<sup>1)</sup>, M. M. Alam<sup>3)</sup>, K. Sopian<sup>1)</sup> and N. Amin<sup>1,2,3)</sup>

<sup>1)</sup>Solar Energy Research Institute, The National University of Malaysia, Malaysia, <sup>2)</sup>Department of Electrical, Electronic and System Engineering, Faculty

of Engineering and Built Environment, The National University of Malaysia, Malaysia, <sup>3)</sup>Advanced Materials Research Chair, Chemistry Department, College of Sciences, King Saud University, Saudi Arabia

**8WePo.9.20**

**Effect of Season on Inverter Performance**

K. Chumpolrat, V. Saengsuwan, N. Udomdachanut, S. Songtrai, S. Kittisontirak, S. Jaroensathainchok, A. Limmanee, T. Krajangsang, J. Sritharathikhun and K. Sriprapha

National Electronics and Computer Technology Center, Thailand

**8WePo.9.21**

**A Study of the Distributed Power Electronics Ability in the PV System Energy Output Improvement**

A. Chimtavee and N. Ketjoy

School of Renewable Energy Technology (SERT), Naresuan University, Thailand

**8WePo.9.22**

**Measures to Match Load Profile with Actual PV Generation to Achieve An Effective Integration into the Energy System**

S. Krauter

University of Paderborn, Department of Electrical Energy Technology, Germany

**8WePo.9.23**

**Design Considerations on Peak Power Clipping Thresholds in Microgrids**

T. Vogt<sup>1)</sup>, N. Fröhleke<sup>1)</sup>, J. Böcker<sup>1)</sup> and S. Kempen<sup>2)</sup>

<sup>1)</sup>University of Paderborn, Germany, <sup>2)</sup>AEG Power Solutions GmbH, Germany

## 8WePo.9.24

### **Energy Management Method with PV and Storage Battery by Optimal Combination of Various Control Modes**

T. Matsuyuki<sup>1)</sup>, S. Wakao<sup>1)</sup>, T. Iwato<sup>2)</sup>, T. Tanaka<sup>2)</sup>, Y. Kanai<sup>2)</sup> and N. Yamashita<sup>2)</sup>

<sup>1)</sup>Dept. Of Electrical Engineering & Bioscience, Waseda University, Japan, <sup>2)</sup>NTT Energy and Environment Systems Laboratories, Japan

## 8WePo.9.25

### **Basic Study of Voltage Control Method with Demand Response**

Satoru Akagi, Jun Yoshinaga and Yasuhiro Hayashi  
Waseda University, Japan

## 8WePo.9.26

### **Dynamic Control Method Based on JIT for LVR in Distribution Systems**

N. Takahashi<sup>1)</sup>, H. Kikusato<sup>1)</sup>, J. Yoshinaga<sup>1)</sup>, Y. Hayashi<sup>1)</sup>, S. Kusagawa<sup>2)</sup> and N. Motegi<sup>2)</sup>

<sup>1)</sup>Waseda University, Japan, <sup>2)</sup>TAKAOKA TOKO., LTD., Japan

## 8WePo.9.27

### **Impact of Protective Device Coordination due to Photovoltaic (PV) Connected in Distribution System**

S. Ananwattanaporn<sup>1)</sup>, S. Muangchareon<sup>1)</sup>, A. Ngaopitakkul<sup>1)</sup>, C. Pothisarn<sup>1)</sup>, C. Jettanasen<sup>1)</sup>, M. Leelajindakrainerk<sup>1)</sup> and S. Bunjongjit<sup>2)</sup>

<sup>1)</sup>Department of Electrical Engineering, Faculty of Engineering, King Mongkut's Institute of Technology Ladkrabang, Thailand, <sup>2)</sup>Faculty of Engineering, Rajamangala University of Technology Rattanakosin, Thailand

## 8WePo.9.28

### **Analysis of the Variability of PV Power and Residual Load**

Y. Udagawa<sup>1,2)</sup>, K. Ogimoto<sup>1)</sup>, T. Oozeki<sup>3)</sup> and H. Ootake<sup>3)</sup>

<sup>1)</sup>The University Of Tokyo, Japan, <sup>2)</sup>KOZO KEIKAKU ENGINEERING Inc, Japan, <sup>3)</sup>The National Institute of Advanced Industrial Science and Technology, Japan

## 8WePo.9.29

### **Stand-alone Photovoltaic Systems for Rural Community Education Center in Thailand**

K. Sriprapha, S. Kittisontirak, K. Chumpolrat, N. Udomdachanut, S. Kittisontirak, P. Chinnavornrungsee, J. Sritharathikhun, T. Krajangsang, A. Limmanee, K. Sriprapha and P. Thajchayapong

National Electronics and Computer Technology Center, Thailand

## 8WePo.9.30

### **Micro Combined Heat and Power Plants ( $\mu$ -CHP) in Combination with Photovoltaics for Autonomous Local Power and Heat Supply**

S. Krauter

University of Paderborn, Department of Electrical Energy Technology - Sustainable Energy Concepts, Germany

## 8WePo.9.31

### **Development of Intelligent Type Power Conditioner System with a Power Storage Device for Photovoltaic Generation**

Kohta Sakai<sup>1)</sup>, Kazuto Yukita<sup>1)</sup>, Katsuhiro Ichiyanagi<sup>1)</sup>, Yasuyuki Goto<sup>1)</sup>, Kenji Ando<sup>2)</sup> and Atsushi Miyamoto<sup>2)</sup>

<sup>1)</sup>Aichi Institute of Technology, Japan, <sup>2)</sup>Nitto Kogyo Co., Inc., Japan

**8WePo.9.32****Determination of Loss of Load Probability of Grid Connected Photovoltaic System Using Solar Shape Functions**

K. Nakaravarayut<sup>1)</sup>, R. Songprakorp<sup>1)</sup>, A. Sangswang<sup>2)</sup>, V. Monyakul<sup>3)</sup>, C. Jivacate<sup>4)</sup> and C. Limsakul<sup>4)</sup>

<sup>1)</sup>School of Energy Environment and Materials, King Mongkut's University of Technology Thonburi, Thailand, <sup>2)</sup>School of Energy Environment and Materials, King Mongkut's University of Technology Thonburi, Thailand, <sup>3)</sup>Pilot Plant Development and Training Institute, King Mongkut's University of Technology Thonburi, Thailand, <sup>4)</sup>CES Solar Cells Testing Center (CSSC), King Mongkut's University of Technology Thonburi, Thailand

**8WePo.9.33LN****Bifacial Modules Used in Cable Based PV Carport Applications**

F. Baumgartner<sup>1)</sup>, A. Büchel<sup>2)</sup>, H. Nussbaumer<sup>1)</sup>, T. Baumann<sup>1)</sup>, D. Schär<sup>1)</sup>, C. Comparotto<sup>3)</sup>, R. Harney<sup>3)</sup> and A. Schneider<sup>3)</sup>

<sup>1)</sup>ZHAW Zurich University of Applied Science SoE, Switzerland, <sup>2)</sup>LE - Light Energy Systems AG, <sup>3)</sup>ISC International Solar Research Center Constance, Germany

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**Wednesday, November 26****16:30 - 17:55 Annex****Area 9****9WePo.11 PV Deployment; Industry, Market and Policy**

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Chairpersons:

Masanori Ishimura (NEDO, Japan)

Arnulf Jäger-Waldau (European Commission, DG JRC, Italy)

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**9WePo.11.1**

**Change to 9WeO.7.2**

**9WePo.11.2**

**Photovoltaics in Spain. Present and Future**

J. Cáarabe

CIEMAT, Photovoltaic Unit, Spain

**9WePo.11.3**

**PV Systems in Indonesia: Dissemination and Development**

Angéle Reinders<sup>1)</sup>, Hans Veldhuis<sup>1)</sup>, Armi Susandi<sup>2)</sup>, Yuli S. Indartono<sup>2)</sup> and Abdurrachim Halim<sup>2)</sup>

<sup>1)</sup>University of Twente, Faculty of Engineering Technology, Department of Design, Production and Management, The Netherlands, <sup>2)</sup>Institut Teknologi Bandung, Faculty of Earth Sciences and Technology, Indonesia

**9WePo.11.4**

**Withdrawn**

**9WePo.11.5**

**Analysis of Soiling Losses and Optimal Cleaning Schedule for Several PV Technologies at an Experimental Station in Central Saudi Arabia**

A. Alsaeeri<sup>1)</sup>, Y. Yoshizawa<sup>2)</sup>, M. Arai<sup>2)</sup>, R. K Jones<sup>1)</sup>, F. Albirdisi<sup>1)</sup> and A. Baras<sup>1)</sup>

<sup>1)</sup>King Abdullah City for Atomic and Renewable Energy, Saudi Arabia, <sup>2)</sup>The University of Tokyo, Japan

**9WePo.11.6**

**Analysis of Influence of Resource Allocation in the PV R&D of Japan on PV Module Price and the Japan's FIT**

E. Endo

National Institute of Advanced Industrial Science and Technology, Japan

**9WePo.11.7****Modeling the Performance, Cost and Minimum Sustainable Price of Silicon-Based Tandem Solar Cells**

S. C. Siah<sup>1)</sup>, D. M. Powell<sup>1)</sup>, Zekun Ren<sup>2)</sup>, J. P. Mailoa<sup>1)</sup>, I. M. Peters<sup>3)</sup> and T. Buonassisi<sup>1)</sup>

<sup>1)</sup>Massachusetts Institute of Technology, United States,

<sup>2)</sup>Singapore-MIT Alliance for Research & Technology,

Singapore, <sup>3)</sup>Solar Energy Research Institute of

Singapore, Singapore

**9WePo.11.8****A Development of Software for Photovoltaic System Application Design and Economic Assessment in Thailand**

A. Tiengpal<sup>1)</sup>, C. Mahachai<sup>1)</sup>, N. Patcharaprakiti<sup>1)</sup> and K. Tripak<sup>2)</sup>

<sup>1)</sup>Department of Electrical Engineering, Rajamangala University of Technology Lanna Chiangrai, Thailand,

<sup>2)</sup>Department of Electrical Engineering, Rajamangala University of Technology Lanna Payap, Thailand

**9WePo.11.9****Photovoltaic Power Systems in Israel: An Overview and the Experience of Rooftop 4kW PV Power System Ownership: Installation Procedure, Electricity Output and Revenues**

Yona Siderer

Ben-Gurion University of the Negev, National Solar Center, Israel

**9WePo.11.10LN****Towards a Prospective Consequential LCA of Large-scale PV Penetration in the UK**

M. Raugei<sup>1)</sup>, C. Jones<sup>2)</sup>, P. Gilbert<sup>2)</sup>, S. Mander<sup>2)</sup>, P. Thornley<sup>2)</sup>, B. Azzopardi<sup>1,3)</sup> and K. Hayatleh<sup>1)</sup>

<sup>1)</sup>Department of Mechanical Engineering and Mathematical Sciences, Oxford Brookes University,

UK, <sup>2)</sup>Tyndall Centre for Climate Change Research, University of Manchester, UK, <sup>3)</sup>Institute of Electrical and Electronics Engineering, Malta College of Arts, Science and Technology (MCAST), Malta

#### **9WePo.11.11LN**

##### **Change to 9WeO.6.2**

#### **9WePo.11.12LN**

##### **PV Development as Prosumers: The Role and Challenges Associated to Producing and Self-consuming PV Electricity**

Ir. Gaëtan Masson<sup>1)</sup>, Sinead Orlandi<sup>2)</sup>, Kristian Petrick<sup>3)</sup>, Valerick Cassagne<sup>4)</sup>, José Ignacio Briano<sup>5)</sup>, Maria Jesus, Baez Morandi<sup>5)</sup> and Robert Margolis<sup>6)</sup>

<sup>1)</sup>IEA PVPS, Belgium, <sup>2)</sup>ICARES, Belgium, <sup>3)</sup>IEA-RETD, Spain, <sup>4)</sup>Total SA, France, <sup>5)</sup>Eclareon, Spain, <sup>6)</sup>NREL, USA

#### **9WePo.11.13LN**

##### **An Anticipatory Life-cycle Assessment Approach to Improve the Environmental Performance of CdTe Module Recycling Operations**

D. T. Ravikumar, T P Seager and M. P. Fraser

School of Sustainable Engineering and the Built Environment, ASU, USA

#### **9WePo.11.14LN**

##### **PV Modules' Learning Curve and Improved Term of PV Costs Trends**

Gaetan Masson<sup>1)</sup>, Ioannis-Thomas Theologitis<sup>2)</sup> and Paula Mints<sup>3)</sup>

<sup>1)</sup>ICARES Consulting, Belgium, <sup>2)</sup>European Photovoltaic Industry Association, Belgium, <sup>3)</sup>SPV Market Research, California, USA

#### **9WePo.11.15LN**

##### **Simplified Prospective LCA Models for Residential PV Installations Based on sc-Si and Installed in Europe in 2050**

C. Marini and I. Blanc

MINES ParisTech, PSL Research University, O.I.E. -  
Centre Observation, Impacts, Energie, Sophia Antipolis  
Cedex, France

**9WePo.11.16LN**

**Adverse Health Effects of Indium Tin Oxide and  
Copper Indium Gallium Diselenide**

A. Tanaka<sup>1)</sup>, M. Hirata<sup>1)</sup>, K. Koga<sup>2)</sup>, M. Shiratani<sup>2)</sup>, M.  
Nakano<sup>3)</sup>, K. Omae<sup>3)</sup> and Y. Kiyohara<sup>1)</sup>

<sup>1)</sup>Department of Environmental Medicine, Graduate School of Medical Sciences, Kyushu University, Japan,

<sup>2)</sup>Department of Electronics, Graduate School of Information Science and Electrical Engineering, Kyushu University, Japan, <sup>3)</sup>Department of Preventive Medicine and Public Health, School of Medicine, Tokyo, Keio University, Japan

## Side Events

# Asian Nations Joint Workshop on Photovoltaics

(JSPS 11th Workshop on the Future Direction of Photovoltaics)

The scope of this workshop is to provide an opportunity to review and discuss the present status and future of innovative solar cells. The aim is to contribute to further development in the science and technology of photovoltaics in order to meet worldwide sustainable energy targets.

**Organized by:** The Japan Society for the Promotion of Science,  
The 175th Committee on Innovative Photovoltaic  
Power Generating Systems

Japanese Chair: Makoto Konagai, Tokyo Institute of Technology

Chinese Chair: Ying Zhao, Nankai University

Korean Chair: Jinsoo Song, KIER

### Schedule of the Asian Nations Joint Workshop on Photovoltaics

Kyoto International Conference Center (Conf. venue of the WCPEC-6) Room B-1

Nov. 23 (Sun.), 2014

**Opening Session** Chairperson: Yuzuru Ueda  
10:00-10:15 **Opening Remarks**  
Makoto Konagai, Ying Zhao, Jinsoo Song

**Session 1** Chairperson: Yuzuru Ueda  
10:15-10:35 **Recent Progress in Development of Innovative Solar Cells in Japan**  
Makoto Konagai (Tokyo Institute of Technology)  
10:35-10:55 **China Photovoltaic Development Roadmap**  
Yuwen Zhao, Honorary Director of China Photovoltaic Society (CPVS)  
10:55-11:15 **History of Korean PV**  
Jinsoo Song (KIER)

**Session 2** Chairperson: Makoto Tanaka  
11:15-11:30 **R&D Activities of NEDO and JST Programs in Japan**  
Masafumi Yamaguchi (Toyota Technological Institute)  
11:30-11:45 **Defect Engineering in Multicrystalline Silicon**  
Deren Yang (Zhejiang University)  
11:45-12:00 **Loss Factor Minimization Passivation Technology for High Efficiency Solar Cell Fabrication**  
Junsin Yi (SungKyunKwan University)  
12:00-13:30 **Lunch**

**Session 3**

	Chairperson: Amornrat Limmanee
13:30-13:45	<b>Recent Progress in High Performance Silicon Solar Cells</b> Makoto Tanaka (Panasonic)
13:45-14:00	<b>Opportunities for Thin Film Solar Cells</b> Zhao Ying (Nankai University)
14:00-14:15	<b>Modeling of Light-induced Degradation and Regeneration Kinetics in Silicon Solar Cells of B-doped Cz Wafers</b> Donghwan Kim (Korea University)
14:15-14:30	<b>R&amp;D Progress of HIT Solar Cell in SIMIT-Trina Joint-lab</b> Zhengxin Liu (Shanghai Institute of Microsystem and Information Technology)
14:30-14:45	<b>Recent Progress of Photovoltaic Industry and Research in Taiwan</b> Chung-wen Lan (National Taiwan University)
14:45-15:00	<b>Performance of PV Modules and Systems in the Tropics</b> Armin ABERLE (National University of Singapore)

15:00-15:15   **Break**

**Session 4**

	Chairperson: Donghwan Kim
15:15-15:30	<b>Mission and Strategy for Next Generation PV Systems</b> Michio Kondo (Fukushima Renewable Energy Research Center)
15:30-15:45	<b>High-Efficiency Crystalline Silicon PV Modules: a Strategic Decision Process for Low Levelized Cost of Electricity</b> Zhiqiang Feng (Technology of Trina Solar)
15:45-16:00	<b>Perovskite Solar Cell Technology</b> Nam-Gyu Park (Sungkyunkwan University)
16:00-16:15	<b>Current Status and Future Prospect of CIS-based Thin-film PV Technology</b> Katsumi Kushiya (Solar Frontier)
16:15-16:30	<b>Current Status of CIGS Research and Development Activities in Korea</b> Byung Tae Ahn (KAIST)
16:30-16:45	<b>Thailand's Solar PV Development: Toward Strategic Positioning in ASEAN</b> Amornrat Limmanee, Aswin Hongsingthong, Taweewat Krajangsang, Sorapong Inthisang, Jaran Sritharathikhun and Kobsak Sriprapha (NSTDA)
16:45-17:00	<b>The Research and Demonstration of Distributed PV and its Hybrid Power System</b> Honghua Xu (Beijing Corona Sciences & Technology Co., Ltd.)

18:00-           **Welcome Reception (WCPEC-6)**

# **IEA PVPS Workshop at 6<sup>th</sup> WCPEC Kyoto, Japan**

**"Challenges and Promises to Large Scale PV Development"**

**Day:** Tuesday, 25<sup>th</sup> November, 2014

**Time:** 10:00– 17:30

**Site:** Room D, Kyoto International Conference Center

**Access:** Open to all registered WCPEC-6 participants

**In 2014, PV will provide at least 1% of the world electricity demand for the first time. While this percentage represents still a small contribution, PV's growth is at such a pace that it could become a significant source of electricity and modify radically the way how the world is powered in the coming decade. The IEA-PVPS has been researching the challenges associated with PV development for well over 20 years. This workshop will highlight the main challenges and promises PV will bear in the coming years and decades.**

As an official event of the 6<sup>th</sup> WCPEC, this PVPS Programme Workshop is jointly organised by the IEA - International Energy Agency, the WCPEC-6 and NEDO, New Energy and Industrial Technology Development Organization.

**Agenda (subject to change. See the latest agenda in IEA PVPS Website : <http://www.iea-pvps.org/>)**

This workshop will be Chaired by

Dr. Hiroyuki Yamada, Vice chairman of IEA PVPS/ NEDO, Japan  
Stefan Nowak, Chairman of IEA PVPS

**9:30**

**Registration and Morning Coffee/Tea**

**10:00 – 11:00**

**Opening session – Mainstream PV Electricity as a Game Changer in An Evolving Energy World**

This opening session will position the current and futures challenges and promises that the PV technology is bringing to the World. Declining prices, increase interest from dozens of governments, PV is changing the electricity and the energy landscape at the pace that could accelerate in the coming years.

Stefan Nowak Chairman of IEA PVPS - Switzerland

Gaëtan Masson Operating Agent of IEA PVPS Task 1 - Belgium

Christian Breyer LUT - Finland

**11:00 – 12:00**

**Session 1 – PV as a Game Changer – But Can the Grid and the Electricity System Afford Such Changes?**

This session will focus on the challenges linked to the integration of large shares of PV into distribution grids as well as in the electricity system in general. The question of very large scale PV systems and their impact on the electricity mix will also be

considered, with a long-term perspective for the energy sector in general.

Roland Bründlinger	Operating Agent IEA PVPS Task 14 - Austria
Ioannis-Thomas Theologitis	European PV Industry Association (EPIA) - Belgium
Thomas Stetz	Fraunhofer IWES - Germany

**12:00 – 13:30 – Lunch Time**

**13:30 – 15:00**

**Session 2 – PV Market Development Trends: The Expected Rise of New Business Models**

A focus on PV market development trends and new business models especially those concerning self-consumption. The future of utility-scale PV and competitiveness shall be discussed. This session will also look at the recent and possible future evolutions of Building Integrated PV Systems and the status and future of emerging new markets.

Arnulf-Jaeger Waldau	European Commission, Joint Research Center, Italy
Robert Margolis	NREL, USA
Thomas Meier	ENTEC, Switzerland
Anjali Shanker	Operating Agent IEA PVPS Task 9, France

**15:00 – 15:30**

**Session 3 – PV Recycling Policies and Technology**

Recycling PV has been considered a long time as a necessity for the PV industry in order to support environmental policies. This session will detail the existing status of recycling technologies and the policy options to frame its deployment.

Ricky Sinha First Solar, USA

**15:30-16:00**

**Coffee & Tea Break**

**16:00 – 17:00**

**Session 4 – The Quest for Quality and Reliability – Competitiveness through Performance.**

This session will focus on the latest developments in terms of performance analysis and quality improvements. It will detail how financial institutions hold the key to lowering the cost of PV electricity and how PV systems should benefit from the latest findings with regard to understanding components and system failures and losses of performances.

Gernot Oreski University of Leoben, Austria  
Ulrike Jahn Operating Agent IEA PVPS Task 13, Germany

**17:00-17:30**

**Session 5 – PV Development in Japan – An International and Domestic Perspective**

This session will explore the recent changes in the PV support policies in Japan and will compare with similar regulatory initiatives in IEA PVPS countries. How could Japan implement its new energy strategy, incorporating high shares of variable renewables?

Izumi Kaizuka RTS Corporation, Japan  
Prof. Kazuhiko Ogimoto University of Tokyo, Japan

**17:30 Conclusion**

**Contact for further information:** Mrs Izumi Kaizuka : kaizuka@rts-pv.com

# AIST-NREL Joint Workshop on Photovoltaics

- Date: November 21st, 2014
- Venue: AIST-FREA, Koriyama, Fukushima, Japan
- Registration fee: Free
- Capacity: 100 seats
- Registration URL: <https://docs.google.com/a/aist.go.jp/spreadsheet/viewform?formkey=dE91b1hsOUNydJJSV3ltYWgxQUFBNHc6MA>
- \* If you have a registration problem, please send an e-mail to [pv\\_module-ml@aist.go.jp](mailto:pv_module-ml@aist.go.jp).
- Registration deadline: November 7<sup>th</sup>, 2014
- \* If the number of registrants reaches the capacity, the registration will be closed.

## Program

10:00-10:15 Welcome Address

10:15-11:45 Keynote Speech

K1 "Building on 37 years of progress – NREL's photovoltaic research program in 2014", G. Wilson (NREL, USA)

K2 Y. Owadano (AIST, Japan)

K3 S. Niki (AIST, Japan)

K4 "FUTURE-PV Innovation - Toward an energy conversion efficiency exceeding 30%", M. Konagai (Tokyo Inst. Tech., MEXT/JST FUTURE-PV Innovation, Japan)

11:45-13:15 Lunch and Poster Session

13:15-16:15 Technical Session

T1 Invited talk, tbd

T2 "Progress in CIGS research at NREL"

K. Ramanathan, M. Contreras, L. Mansfield, B. Egaas, S. Glynn, R. Garris (NREL, USA)

T3 "CIGS research at AIST"

H. Shibata, S. Ishizuka, Y. Kamikawa, T. Koida, T. Nagai, H. Tampo, J. Nishinaga, S. Choi, K. Kim, S. Kim, A. Yamada, S. Kimura, A. Ohara, H. Higuchi, M. Iioka, S. Takaesu, H. Takahashi, A. Kurokawa, K. Matsubara, S. Niki (AIST, Japan)

T4 "Grain boundary carrier interactions in CIGS"

H. Guthrey, C.-S. Jiang, J. Moseley, K. Ramanathan, M. Al-Jassim (NREL, USA)

T5 "NREL PV reliability program overview"

S. Kurtz1, J. Wohlgemuth1, M. Yamamichi2, M. Kondo2, T. Sample3 (1NREL, USA, 2AIST, Japan, 3JRC, Italy)

T6 "PV reliability research at AIST"

A. Masuda, K. Sakurai, T. Doi, K. Hara (AIST, Japan)

T7 "Comparison of field-tested and accelerated lifetime-tested modules"

P. Hacke1, K. Terwilliger1, S. Glick1, G. Perrin1, S. Kurtz1, N. Bosco1, J. Wohlgemuth1, R. Smith2 (1NREL, 2LLC, USA)

T8 "Crystalline Si solar cell research at FREA"

H. Takato (AIST, Japan)

T9 "Energy rating of PV (tentative)"

K. Otani (AIST, Japan)

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16:15-16:30 Closing Remarks

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16:30-17:30 Technical Tour of FREA

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## Poster Session

P1 "Primary PV reference cell calibration technology"

S. Igari, J. Kokubo, H. Zhou, R. Watanabe (AIST, Japan)

P2 "PV performance measurement technologies"

Y. Hishikawa, A. Sasaki, H. Shimura, K. Yamogoe, T. Onuma, T. Ueda, A. Fukabori (AIST, Japan)

P3 "Effects of the convex solid-liquid interface of Si single bulk crystals on the quality of ingots grown by the noncontact crucible method"

K. Nakajima<sup>1</sup>, R. Murai<sup>1</sup>, K. Morishita<sup>1</sup>, D. M. Powell<sup>2</sup>, M. Kivambe<sup>2</sup>, T. Buonassisi<sup>2</sup> (1Kyoto Univ., Japan, 2Massachusetts Inst. Tech., USA)

P4 "Surface investigation of photovoltaic mono-crystalline silicon wafers"

T. Fukuda, N. Suzuki, K. Shirasawa, H. Takato (AIST, Japan)

P5 "The a-SiOx:H/c-Si heterojunction solar cell with high VOC of 738 mV"

H. Zhang<sup>1</sup>, K. Nakada<sup>2</sup>, S. Miyajima<sup>2</sup>, M. Konagai<sup>1,2</sup> (1JST, 2Tokyo Inst. Tech, Japan)

P6 "Voltage map of Si solar cell by means of absolute EL imaging"

T. Mochizuki<sup>1</sup>, C. Kim<sup>2</sup>, L. Zhu<sup>2</sup>, H. Akiyama<sup>2</sup>, H. Takato<sup>1</sup> (AIST, Univ. Tokyo, Japan)

P7 "Analysis for degradation of crystalline silicon PV modules by EL and PL"

K. Shirasawa<sup>1</sup>, S. Asao<sup>1</sup>, K. Takano<sup>2</sup>, K. Sugihara<sup>2</sup>, T.Ogai<sup>3</sup>, H. Takato<sup>1</sup> (1AIST, 2ITES, 3Meiji Univ., Japan)

P8 "Analysis of PV modules degraded under high voltage"

T. Doi<sup>1</sup>, K. Masuda<sup>2</sup>, H. Kato<sup>2</sup>, Y. Uchida<sup>2</sup>, K. Shibata<sup>2</sup>, S. Kawai<sup>3</sup>, Y. Fukumoto<sup>3</sup>, F. Tamai<sup>3</sup>, A. Masuda<sup>1</sup>, M. Kondo<sup>1</sup> (1AIST, 2JET, 3Indust. Tech. Center Saga, Japan)

P9 "Outdoor PID acceleration by regular water spraying"

K. Sakurai, R. Morinaga, R. Sato, M. Inoue, M. Akitomi, A. Masuda (AIST, Japan)

P10 "High-efficiency thin-film silicon solar cells using honeycomb textured substrates"

H. Sai<sup>1</sup>, K. Maejima<sup>2</sup>, T. Koida<sup>1</sup>, T. Matsui<sup>1</sup>, K. Matsubara<sup>1</sup>, M. Kondo<sup>1</sup>, S. Nakao<sup>3</sup>, Y. Takeuchi<sup>3</sup>, H. Katayama<sup>4</sup>, I. Yoshida<sup>2</sup> (1AIST, 2PVTEC, 3Mitsubishi Heavy Industries, 4Panasonic, Japan)

P11 "Microstructured 3D thin film Si-based solar cells"  
C. Niikura<sup>1,3</sup>, B. Janthong<sup>3</sup>, M. Konagai<sup>2,3</sup> (1NIMS, 2Tokyo Inst. Tech., 3JST, Japan)

P12 "Light trapping by plasmonic silver nanodisk arrays"  
H. Mizuno, H. Sai, K. Makita, Y. Hozumi, M. Kondo, K. Matsubara, H. Takato (AIST, Japan)

P13 "The light induced degradation in a-Si:H solar cells fabricated by the expanding thermal plasmas"  
T. Nagai<sup>1</sup>, T. Matsui<sup>1</sup>, J. Melkens<sup>2</sup>, M. Fischer<sup>2</sup>, A. H. M. Smets<sup>2</sup>, M. Zeman<sup>2</sup>, M. Kondo<sup>1</sup> (1AIST, Japan, 2Delft Univ. Tech., The Netherlands)

P14 "Influence on recombination process of CIGS solar cells induced by device processing"  
J. Nishinaga, Y. Kamikawa, H. Shibata, S. Niki (AIST, Japan)

P15 "Highly efficient CIGS thin film sun-module using three-stage process"  
Y. Kamikawa-Shimizu, A. Yamada, S. Ishizuka, M. Iioka, H. Higuchi, K. Matsubara, H. Shibata, S. Niki (AIST, Japan)

P16 "n-type transparent amorphous oxide semiconductor and p-type CIGS heterojunction solar cells"  
T. Koida, A. Kurokawa, H. Takahashi, Y. Kamikawa-Shimizu, A. Yamada, H. Shibata, S. Niki (AIST, Japan)

P17 "The investigation of Ge substitution effects in Cu<sub>2</sub>ZnSnSe<sub>4</sub> thin film solar cells"  
S. Kim, K. M. Kim, H. Tampo, H. Shibata, S. Niki (AIST, Japan)

P18 "Control of conductivity type in co-evaporated CuFeS<sub>2</sub> thin films"  
K. M. Kim, H. Tampo, H. Shibata, S. Niki (AIST, Japan)

P19 "Smart stacking technology for multi-junction solar cells"  
K. Makita, H. Mizuno, R. Oshima, T. Sugaya (AIST, Japan)

P20 "Fabrication of InGaP/(In)AlGaAs/GaAs triple junction top cells for smart stacked multijunction solar cells using molecular beam epitaxy"  
T. Sugaya<sup>1</sup>, T. Mochizuki<sup>2</sup>, K. Makita<sup>1</sup>, R. Oshima<sup>1</sup>, K. Matsubara<sup>1</sup>, Y. Okano<sup>2</sup>, S. Niki<sup>1</sup> (AIST, Tokyo City Univ., Japan)

P21 "Development of fabrication process for wire-array/silicon tandem solar cells"  
Y. Yashiki<sup>1</sup>, Y. Shirayanagi<sup>1</sup>, K. Nakada<sup>2</sup>, M. Konagai<sup>1,2</sup> (1JST, 2Tokyo Inst. Tech., Japan)

# [Side Events] AIST-NREL Joint Workshop on Photovoltaics

P22 "Engineering of the direct energy band gap of silicon at quantum confinement size"

V. Svrcek<sup>1</sup>, M. Lozach<sup>1</sup>, S. Mitra<sup>2</sup>, D. Mariotti<sup>2</sup>, K. Matsubara<sup>1</sup>  
(<sup>1</sup>AIST, Japan, <sup>2</sup>Univ. Ulster, UK)

P23 "Fabrication and characterization of CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> perovskite photovoltaic cells"

S. Kazaoui, T. N. Murakami, K. Sayama, N. Onozawa-Komatsuzaki, T. Funaki (AIST, Japan)

P24 "Advance of the dye-sensitized solar cells with the high-voltage and robust organic dye"

T. N. Murakami, N. Koumura (AIST, Japan)

P25 "Dye-sensitized solar cells using cyclometalated ruthenium complexes as near-IR sensitizers"

T. Funaki, N. Onozawa-Komatsuzaki, N. Koumura, K. Sayama (AIST, Japan)

P26 "Computational study of intermolecular interactions between Ru complex and organic dyes in cosensitized solar cells"

H. Kusama, T. Funaki, N. Koumura, K. Sayama (AIST, Japan)

# WCPEC-6 Satellite Meeting on Organic Photovoltaic Cells

The 6<sup>th</sup> world conference on photovoltaic energy conversion (WCPEC-6) will be held in Kyoto on 23–27 November, 2014. On this occasion, we are planning to offer a satellite meeting of organic photovoltaic cells (OPV) in Kyoto the day before the WCPEC-6, 22 November, 2014. Very recently, organic-inorganic perovskite solar cells have emerged as a next-generation organic-based solar cell. The energy conversion efficiency has abruptly exceeded 15% and now is approaching to 20%. Therefore, research and development of OPV just stand at a cross-roads now. In this time, we would like to offer an opportunity to discuss future research and development of OPV. What are the greatest advantages of OPV? What are the killer applications of OPV? What is the practical use of OPV? We would like to find a clue for resolving these issues in this satellite meeting.

## Date & Time:

22 November, 2014, from 13:00 to 20:00

## Venue:

Kyoto International Conference Center  
(<http://www.icckyoto.or.jp/en/access/index.html>)

## Registration Fee:

Free

Please register from URL below.

## URL:

<http://wcpec6satelite.web.fc2.com>

## Invited Speakers:

Prof. James Durrant (Imperial College London)

Prof. Kwanghee Lee (Gwangju Institute of Science and Technology)

Prof. Antonio Facchetti (Polyera/Northwestern University)

Prof. Shinzaburo Ito (Kyoto University)

Prof. Keisuke Tajima (RIKEN)

Prof. Kazuhiro Marumoto (Tsukuba University)

Dr. Hideo Yamagishi (CEREBA)

## Program:

### 13:00 Opening Remarks

- 13:10 Kwanghee Lee (Gwangju Institute of Science and Technology)

Recent Advances in Polymer Solar Cells; Single Cells, Tandem Cells, and Printed Modules

- 13:50 Antonio Facchetti (Polyera/Northwestern University)

Metal Oxide Films and Nanomaterials for Organic Solar Cells

- 14:30 Shinzaburo Ito (Kyoto University)

Progress on All-polymer Solar Cells Prepared by Donor/Acceptor Polymer Blends

- 15:10 Coffee Break

- 15:25 James Durrant (Imperial College London)  
Exciton and Charge Carrier Dynamics in Organic Solar Cells - The Impact of Morphology,  
Energetics and Molecular Structure
- 16:05 Keisuke Tajima (RIKEN)  
Interfaces and Nanostructures in Organic Solar Cells
- 16:45 Kazuhiro Marumoto (Tsukuba University)  
Direct Observation of Charge Accumulation in High Efficiency Polymer Solar Cells During  
Device Operation using Light-Induced Electron Spin Resonance
- 17:25 **Coffee Break**
- 17:35 Hideo Yamagishi (CEREBA)  
Approach to the Development of Evaluation Technologies for Flexible OPV at CEREBA
- 18:15 Nam-Gyu Park (Sungkyunkwan University)  
Size-Dependent Electric and Photovoltaic Properties of Perovskite Solar Cell  
\*joint session with WCPEC-6 Satellite Meeting "Perovskite Solar Cells"
- 19:00 Mixer

Sponsored by Sumitomo Chemical, JSPS and CEREBA.

Supported by Division of Molecular Electronics and Bioelectronics, JSAP

**Organizing Committee:**

Shuzi Hayase (Kyushu Institute of Technology)

Tetsuhiko Miyadera, Yuji Yoshida (AIST)

Hideo Ohkita (Kyoto University)

Itaru Osaka (RIKEN)

Makoto Kitano (Sumitomo Chemical)

Toshihiro Ohnishi (JSPS, Sumitomo Chemical)

## **10<sup>th</sup> Anniversary Event: Museum of Photovoltaics**

**(Presented by the 175<sup>th</sup> Committee  
on Innovative Photovoltaic  
Power Generating Systems, JSPS)**

- Date: 1<sup>st</sup> day: 12:00-17:00 November 24th, 2014  
2<sup>nd</sup> day: 9:00-17:00 November 25th, 2014
- Venue: **Room I**, Kyoto International Conference Center (Conf. venue of the WCPEC-6)
- Entrance fee: Free
- Theme: History of photovoltaics development in Japan (Exhibition of earliest or latest solar cells with a brief description etc.)

# WCPEC-6 Satellite Meeting on Perovskite solar Cells

Date & Time: 22 November, 2014, From 9:00

Venue: Kyoto International Conference Center (Room C1, Main Building 1F)

<http://www.icckyoto.or.jp/en/access/index.html>

Registration fee: Free

Please register from URL below.

URL:<http://www.jst.go.jp/presto/solar/sympo/WCPEC6.html>

## Program

09:00-09:10 Opening Remarks

Research Supervisor Shuzi Hayase (Kyushu Institute of Technology)

09:10-09:25 Atsushi Wakamiya (Kyoto University)

“Solution process for fabrication of perovskite-based solar cells: A X-ray crystallographic study”

09:25-09:40 Yasuhiro Yamada (Kyoto University)

“Time-resolved optical characterization of perovskite semiconductors for solar cell applications”

09:40-09:55 Hideaki Araki (Nagaoka National College of Technology)

“Fabrication of organic-inorganic metal halide solar cells via gas phase reaction”

09:55-10:10 Yasuhiro Tachibana (RMIT University)

“Photo-induced charge transfer dynamics at the interfaces of perovskite thin films”

10:10-10:40 Prof. Mohammad Khaja Nazeeruddin (ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE)  
[Invited Lecture] “Power from the sun : Perovskite solar cells”

10:40-10:55 Break

10:55-11:10 Qing Shen (The University of Electro-Communications)  
“Uncovering the detailed mechanism behind high efficiency perovskite hybrid solar cells by studying charge separation and recombination dynamics”

11:10-11:25 Tetsuro Katayama (Osaka University)  
“Observation of inhomogeneous deactivation process with UV excitation in submicron grains of lead iodide perovskite-based solar cell by means of femtosecond transient absorption microscopy”

11:25-11:40 Akinori Saeki (Osaka University)  
“Electronic and energetic landscape of perovskite solar cell : A microwave conductivity study”

11:40-12:00 Free discussion

13:00-18:15 OPV satellite session

18:15-18:45 Prof. Nam-Gyu Park (Sungkyunkwan University)  
[Invited Lecture] “Size-dependent electric and photovoltaic properties of perovskite solar cell”

# **International workshop for young researchers on thin film compound semiconductor solar cells**

Date: November 28 (Fri.), 2014

Venue: Ryukoku University Avanti Kyoto Hall  
(southern part of JR Kyoto station)  
<http://www.ryukoku.ac.jp/ryudaihall/access/>

## **Organized by**

Professional Group of “Multinary Compounds and Solar Cells”  
in The Japan Society of Applied Physics

## **Co-organized by**

Ryukoku University, Innovative Materials and Processing Research Center

Registration (On-Site)

Member of Professional Group of “Multinary Compounds and Solar Cells”: free

Non-member: 3,000 JPY (annual membership fee)

Keynote lecture : Hans-Werner Schock (Helmholtz-Zentrum Berlin, Germany)

Invited speakers and title (tentative) of the presentation

Shiro Nishiwaki (EMPA, Switzerland)

“Preparation of high quality CIGS absorber layer by thermal co-evaporation”

Paul Pistor (Martin-Luther-University, Germany)

“Co-evaporating compound solar cell absorbers: growth and characterization”

Shogo Ishizuka (AIST, Japan)

“Alkali effects and interface study on CuGaSe<sub>2</sub> thin-films and solar cells”

Shin Tajima (Toyota Central R&D Labs, Japan)

“Process and analysis of CZTS photovoltaic cell with high conversion efficiency”

Hideaki Araki (Nagaoka National College of Technology, Japan)

“Progress in thin film solar cells based on Cu<sub>2</sub>SnS<sub>3</sub> and the related compounds, Cu<sub>2</sub>GeS<sub>3</sub> and Cu<sub>2</sub>SiS<sub>3</sub>”

(Midsummer, Sweden)

“Preparation of CIGS and CZTS solar cells by sputtering”

Discussion:moderator Akira Yamada (Tokyo Tech)

“Toward high efficiency CZTS solar cells”

Contact information:

Mutsumi SUGIYAMA, e-mail: mutsumi@rs.noda.tus.ac.jp

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Chou, Wen-Yao	<b>7TuPo.10.24LN</b>	Craciun, D.	<b>9WeO.6.5</b>
Chou, Yen-Chun	<b>4TuPo.7.48,</b> <b>4WePo.7.68LN</b>	Crafts, D.	<b>4WeO.19.3</b>
Choulat, P.	<b>4WeO.19.4</b>	Cros, S.	<b>9WeO.6.5</b>
Chow, L.	<b>6WePo.4.14</b>	Crossay, A.	<b>3TuPo.6.11</b>
Chowdhury, Ahrar Ahmed		Crovetto, A.	<b>3WePo.5.18</b>
	<b>4TuPo.7.63</b>	Cryan, M J.	<b>6WePo.3.6</b>
Chowdhury, Amartya	<b>2WeO.14.5</b>	Cunnusamy, Jessen	<b>4TuPo.7.15</b>
Chowdury, Ahrar	<b>4WePo.7.62</b>	<b>D</b>	
Chu, Yen-Ho	<b>2TuPo.4.35</b>	Dai, X.	<b>1WePo.1.10</b>
Chuang, Wen-Jie	<b>3WePo.6.6</b>	Daif, O. El	<b>J1ThO.7.1</b>
Chubaci, J. F. D.	<b>4TuPo.7.5</b>	Dale, P. J.	<b>3TuPo.6.11</b>
Chueh, Yu-Lun	<b>1TuPo.1.22</b>	Dam, B.	<b>1TuO.8.2</b>
Chumpolrat, K.	<b>7TuPo.11.5,</b> <b>8WePo.8.30, 8WePo.9.20,</b> <b>8WePo.9.29</b>	Danel, A.	<b>4WePo.7.45</b>
Chung, H. S.	<b>4WePo.7.57</b>	Dannenberg, T.	<b>2TuPo.4.13</b>
Chung, Hak-Jun	<b>3TuPo.5.3</b>	Darbe, Sunita	<b>1TuPl.1</b>
Chung, Indeok	<b>7TuPo.11.11,</b> <b>4WePo.7.24, 7WePo.10.3</b>	Das, Gourab	<b>2TuPo.4.34,</b> <b>4TuPo.7.13</b>
Chung, S.	<b>1MoO.5.1,</b> <b>4TuPo.7.55</b>	Das(Bhattacharya), K.	
Chung, T.	<b>6WePo.3.14</b>		<b>7TuPo.11.25LN</b>
Cifuentes, Luis	<b>5TuPo.9.20</b>	Dasika, Vaishno	<b>5TuPo.8.8</b>
Claverie, A.	<b>5TuPo.9.6</b>	Data, A.	<b>1WePo.1.11</b>
Clement, F.	<b>4WeO.17.1,</b> <b>4WeO.17.2, 4TuPo.7.10</b>	Date, H.	<b>4ThO.13.5</b>
Cojocaru, Ludmila	<b>6ThO.10.2</b>	Dauwe, S.	<b>7TuPo.10.9</b>
Collin, S.	<b>1WeO.2.2</b>	De Ceuster, D.	<b>4WeO.19.3</b>
Colombara, D.	<b>3TuPo.6.11</b>	de Jong, M. M.	<b>8TuO.11.3</b>
Comparotto, C.	<b>7TuPo.11.21,</b> <b>8WePo.9.33LN</b>	de Monsabert, T. Goislard	
Conibeer, G.	<b>1MoO.5.1,</b> <b>1TuPo.1.9, 1WePo.1.10</b>		<b>7TuPo.10.17</b>
Conibeer, Gavin	<b>1WePo.1.8</b>	de Moure-Flores, F.	<b>5TuPo.8.13</b>
Conibeer, Gavin J.	<b>1WePo.1.20</b>	de Nicolas, S. Martin	
Connolly, J.	<b>5TuPo.9.6</b>		<b>J1MoO.2.4, 6ThO.10.3</b>
Contreras, M.A.	<b>3MoRu.9.2</b>	de Rijk, P.	<b>8TuO.11.3</b>
Contreras, Miguel	<b>3MoO.4.1</b>	de Wild-Scholten, M. J.	
			<b>9WeO.5.1</b>
		De Wolf, S.	<b>J1MoO.2.4,</b> <b>6ThO.10.3</b>
		De Zoysa, M.	<b>2TuPo.3.16,</b> <b>2TuPo.4.38</b>
		Debrot, F.	<b>4WeO.17.4,</b>

	<b>5TuPo.8.2</b>	Disney, C.	<b>1TuPo.1.12</b>
Debucquoy, M	<b>4TuPo.7.67LN</b>	Disney, Claire	<b>1TuO.8.1,</b> <b>1TuPo.1.14</b>
Deguchi, D.	<b>3WePo.6.21</b>	Dittmann, S.	<b>J3WeO.9.2,</b> <b>7WePo.10.2</b>
Deguchi, T.	<b>8WeO.11.1</b>	Dmitriev, P. A.	<b>5TuPo.8.3</b>
Dehouche, Z.	<b>8WePo.9.8</b>	Doi, T.	<b>J3WeO.10.2,</b> <b>4WeO.18.4, 7ThO.2.4,</b> <b>7ThO.3.2, 7ThO.3.5</b>
Dekker, D.	<b>4TuO.3.2</b>	Doi, Takuya	<b>7TuRu.17.2,</b> <b>J3WeO.10.4, 7TuPo.10.1,</b>
Dekker, N.	<b>J3WeO.9.2</b>	Dominé, D.	<b>7WePo.10.15</b>
del Cañizo, C.	<b>5WeO.4.5</b>	Domnik, A.	<b>7TuPo.11.7</b>
Demant, M.	<b>4TuPo.7.10</b>	Dong, J. J.	<b>6WePo.2.29</b>
Demaurex, B.	<b>J1MoO.2.4</b>	Dong, Jingjing	<b>1TuPo.1.24</b>
Demicoli, D.	<b>7TuPo.11.23</b>	Doolittle, W.A	<b>5TuPo.9.23LN</b>
Demizu, K.	<b>5TuPo.8.9,</b> <b>5TuPo.9.8, 5TuPo.9.22LN</b>	Dore, J.	<b>2TuPo.4.15</b>
Deng, Huiyang	<b>2TuPo.4.1</b>	Dreier, C.	<b>7ThO.1.3</b>
Deng, Weiwei	<b>4sMoO.1.4</b>	Driesen, J.	<b>8WeO.11.5,</b> <b>7WePo.10.12, 8WePo.9.17</b>
Deng, Y.	<b>4WePo.7.6</b>	Droz, Corinne	<b>5TuPo.8.24LN,</b> <b>7TuPo.11.4</b>
Depauw, V.	<b>2ThO.8.4</b>	Du, H.	<b>8WeO.11.2</b>
Depauw, Valerie	<b>J1ThO.7.1</b>	Du, W.	<b>3TuPo.5.23,</b> <b>3TuPo.6.18, 7TuPo.11.23,</b> <b>3WePo.5.20, 3WePo.5.22</b>
Deschler, Felix	<b>6ThO.9.3</b>	Du, Z.	<b>3TuPo.6.23</b>
Descoeuadres, A.	<b>4WeO.17.4,</b> <b>5TuPo.8.2</b>	Duan, Weiyuan	<b>2TuPo.4.6</b>
Despeisse, M.	<b>4WeO.17.4,</b> <b>7WeO.8.3, 7ThO.1.2,</b> <b>5TuPo.8.2</b>	Dubey, R.	<b>7WeO.8.4,</b> <b>7WePo.10.10</b>
Deura, M.	<b>4ThO.13.3,</b> <b>4TuPo.7.46</b>	Dher, N. G.	<b>4WeO.19.4</b>
Dhamrin, M.	<b>4TuPo.7.50</b>	Di Stefano, A.	<b>4WeO.17.3</b>
Dhamrin, Marwan	<b>4WePo.7.63</b>	Dugan, Shannon	<b>4WeO.2.2</b>
Dhar, Sukanta	<b>2TuPo.4.34,</b> <b>4TuPo.7.13</b>	Dupuis, C.	<b>1WeO.2.2</b>
Dhere, N. G.	<b>7ThO.2.5</b>	Durrant, James R	<b>6sMoO.8.1</b>
Di Stefano, A.	<b>J3WeO.9.2,</b> <b>9WeO.6.5, 7ThO.3.3,</b> <b>7WePo.10.5</b>	Duval, L.	<b>4WePo.7.30</b>
Diao, H. W.	<b>4TuPo.7.8</b>	<b>E</b>	
Diao, Hongwei	<b>4WePo.7.46</b>	Ebert, C.	<b>5TuPo.8.6</b>
Dielissen, B.	<b>4WeO.19.4</b>	Ebner, Rita	<b>7TuPo.10.2,</b> <b>7TuPo.11.6</b>
Dielissen, Bas	<b>4TuPo.7.17</b>	Dimitrevska, M.	<b>3WePo.6.14</b>
Digdaya, I. A.	<b>1TuO.8.2</b>	Dimmock, J. A. R	<b>1MoO.5.2</b>
Dimitrevska, M.	<b>3WePo.6.14</b>	Dimroth, F.	<b>5TuO.10.4</b>
Dimmock, J. A. R	<b>1MoO.5.2</b>	Dimroth, Frank	<b>J2WeO.1.1</b>
Dimroth, F.	<b>5TuO.10.4</b>	Ding, K.	<b>2TuPo.4.16</b>
Dimroth, Frank	<b>J2WeO.1.1</b>	Ding, W.	<b>5TuPo.9.10</b>
Ding, K.	<b>2TuPo.4.16</b>	Ding, Yi	<b>6WePo.3.13</b>
Ding, W.	<b>5TuPo.9.10</b>	Eder, G.	<b>7WePo.10.8</b>
Ding, Yi	<b>6WePo.3.13</b>	Edler, A.	<b>7TuPo.11.21</b>
		Edwards, M.	<b>7TuPo.11.15</b>
		Efinger, R.	<b>4WeO.17.1</b>

Egaas, B.	<b>3MoRu.9.2,</b> <b>3TuPo.5.7</b>	Fan, YingYing	<b>1TuPo.1.3</b>
Eguchi, Y.	<b>7ThO.3.2</b>	Fang, J.	<b>2TuPo.4.40</b>
Ehara, Tomoki	<b>9WeO.7.3</b>	Fang, Shao-Yu	<b>8WePo.8.7</b>
Einhaus, R.	<b>4TuO.4.4,</b> <b>7TuPo.11.21</b>	Farrell, D.	<b>5TuPo.9.7</b>
Eisele, C.	<b>3WePo.6.5</b>	Farrell, Daniel J.	<b>5WeO.3.2</b>
Eisler, Carissa N.	<b>1TuPl.1</b>	Feichtinger, J.	<b>3WeO.15.4</b>
Ekins-Daukes, N. J.	<b>1MoO.5.2,</b> <b>5TuO.10.2, 5TuPo.9.7,</b> <b>5WeO.3.4, 5WeO.3.6</b>	Fejfar, A.	<b>1MoO.6.3</b>
Elarde, V.	<b>5TuO.9.2</b>	Felder, T.	<b>7TuO.14.2</b>
Elborg, Martin	<b>5TuPo.8.23LN,</b> <b>1WePo.1.17</b>	Fell, A.	<b>4TuO.3.1,</b> <b>4TuPo.7.3</b>
Elleuch, O.	<b>5TuPo.9.8,</b> <b>5TuPo.9.12</b>	Fellmeth, T.	<b>4WeO.17.1</b>
Emmer, H. S.	<b>5TuPo.9.11</b>	Feng, Qi	<b>6WePo.4.6</b>
Emura, S.	<b>1TuPo.2.21</b>	Feng, Y.	<b>1MoO.5.1,</b> <b>1TuPo.1.9</b>
Endo, E.	<b>9WePo.11.6</b>	Feng, Yu	<b>1WePo.1.8</b>
Endo, M.	<b>6ThO.9.4,</b> <b>6WePo.3.21</b>	Feng, Zhiqiang	<b>4sMoO.1.4,</b> <b>4TuO.4.2, 9WeO.5.5</b>
Endo, Takeshi	<b>6WePo.4.33</b>	Fenner, Y.	<b>2TuO.5.2</b>
Enebish, Namjil	<b>9WeO.7.3</b>	Ferlito, S.	<b>5WeO.4.3</b>
Enomoto, T.	<b>6WePo.4.10</b>	Fernández-Lázaro, F.	<b>6WePo.4.32</b>
Enomoto, Y.	<b>4WeO.18.1</b>	Ferrara, W.	<b>J3WeO.9.2</b>
Eo, Young-Joo	<b>3TuPo.5.1,</b> <b>3TuPo.5.5</b>	Fesquet, L.	<b>2TuO.5.2</b>
Eperon, Giles E.	<b>6ThO.10.4,</b> <b>6ThO.11.2</b>	Feuser, E.	<b>2TuO.6.1</b>
Erath, D.	<b>4WeO.17.1</b>	Findlay, A.	<b>4WePo.7.69LN</b>
Ernst, M.	<b>4TuPo.7.3</b>	Finger, F.	<b>2TuPo.4.9,</b> <b>2TuPo.4.16</b>
Escarré, J.	<b>7WeO.8.3</b>	Fink, Alke	<b>1TuPo.2.22</b>
Eschrich, H.	<b>3WeO.15.4</b>	Fink, F.	<b>3MoO.4.4,</b> <b>3WePo.5.3, 3WeO.15.2</b>
Espinet, Pilar	<b>5TuPo.9.20</b>	Fink, T.	<b>2TuPo.4.12</b>
Espinoza-Figueroa, J. A.	<b>5TuPo.8.13</b>	Fischer, M.	<b>9WeO.5.4,</b> <b>2TuPo.4.29</b>
Etienne, D.	<b>7ThO.1.3</b>	Flaminio, G.	<b>J3WeO.9.2</b>
Ettlinger, R. B.	<b>3WePo.5.18</b>	Flies, M.	<b>8WePo.9.17</b>
Evans, R.	<b>7TuPo.11.15</b>	Flowers, Cristofer	<b>1TuPl.1</b>
Ezaka, K.	<b>6WePo.4.28</b>	Foldyna, M.	<b>1MoO.6.3</b>
<b>F</b>			
Fabero, J. F.	<b>7TuPo.10.8</b>	Fong, K. C.	<b>4TuO.3.1</b>
Facchetti, Antonio	<b>6sMoO.8.3</b>	Fong, K. Y.	<b>4TuPo.7.54</b>
Faes, A.	<b>4WeO.17.4,</b> <b>7WeO.8.3, 5TuPo.8.2</b>	Fons, P. J.	<b>3MoO.3.2</b>
Fakhfouri, Vahid	<b>7TuPo.11.4</b>	Fonseca Jr., J. G. S.	<b>8WeO.11.3</b>
Faleev, N.	<b>5TuPo.8.21LN</b>	Fonseca Jr., Joao Gari da Silva	<b>8WePo.8.3</b>
		Fontané, X.	<b>7TuPo.10.17,</b> <b>3WePo.6.14</b>
		Forster, M.	<b>4TuO.4.4</b>

Fountaine, Katherine	<b>1TuPl.1</b>	Fukami, Takuro	<b>7TuO.14.4,</b> <b>7TuPo.10.6</b>
Frankl, Paolo	<b>0MoPl.2</b>	Fukano, T.	<b>3WeO.16.2,</b> <b>3TuPo.5.10</b>
Fränzel, Wolfgang	<b>3MoO.4.5</b>	Fukatsu, Ken	<b>4WePo.7.17</b>
Fraser, M. P.	<b>9WePo.11.13LN</b>	Fukuda, T.	<b>4TuPo.7.47</b>
French, R. H.	<b>7TuO.13.2</b>	Fukuda, Tetsuo	<b>4WePo.7.47</b>
Frese, J.	<b>7TuPo.10.18</b>	Fukui, Hidehito	<b>4WePo.7.14,</b> <b>4WePo.7.17</b>
Friedrich, F.	<b>3WeO.15.3</b>	Fukumochi, S.	<b>7TuO.13.5</b>
Friend, Richard H	<b>6ThO.9.3</b>	Fukumoto, Y.	<b>J3WeO.10.2</b>
Friesen, G.	<b>J3WeO.9.2,</b> <b>7WePo.10.2</b>	Fukumoto, Yutaka	<b>7TuPo.10.1</b>
Friestad, K.	<b>4ThO.13.5</b>	Fukunaga, K.	<b>1WePo.1.12</b>
Frijnts, Tim	<b>2ThO.8.2</b>	Fukunaka, Y.	<b>2TuPo.3.36,</b> <b>2TuPo.4.25, 2TuPo.4.30</b>
Fröhleke, N.	<b>8WePo.9.23</b>	Fukushima, T.	<b>1TuPo.2.19,</b> <b>3TuPo.6.27, 3WePo.6.1</b>
Fu, O.	<b>7TuO.14.2</b>	Fukutome, S.	<b>8WePo.8.5</b>
Fucci, R.	<b>7TuPo.10.8</b>	Fukuyama, A.	<b>5TuPo.8.7,</b> <b>5TuPo.9.9, 5TuPo.9.10</b>
Fuchigami, H.	<b>2WeO.14.4,</b> <b>4WeO.19.2, 2TuPo.3.12,</b> <b>4WePo.7.9</b>	Fukuyama, T.	<b>3WeO.16.2</b>
Fuchuya, K.	<b>4TuPo.7.38</b>	Fukuzawa, M.	<b>4TuPo.7.38</b>
Führer, M.	<b>5WeO.3.6,</b> <b>5TuO.10.2, 5TuPo.9.7</b>	Fukuzumi, Takahiro	<b>6WePo.2.24</b>
Fujihara, S.	<b>6WePo.4.9,</b> <b>6WePo.4.10, 6WePo.4.27</b>	Funabashi, T.	<b>8WePo.9.5</b>
Fujii, H.	<b>5WeO.3.3,</b> <b>5TuPo.9.7</b>	Funabiki, S.	<b>8WeO.12.3,</b> <b>8WePo.8.31, 8WePo.9.13</b>
Fujii, Hiromasa	<b>1WePo.1.18</b>	Funato, I.	<b>1TuPo.2.15</b>
Fujii, S.	<b>6WePo.2.5</b>	Furihata, Tomoyoshi	<b>7WePo.10.18</b>
Fujikake, Shinji	<b>7TuPo.11.28LN</b>	Furube, A.	<b>6WePo.2.25</b>
Fujikawa, Naotaka	<b>6ThO.9.1</b>	Furuhata, T.	<b>4WePo.7.9</b>
Fujimori, M.	<b>7ThO.2.2,</b> <b>7ThO.3.4</b>	Furuya, Y.	<b>3TuPo.5.24</b>
Fujimoto, K.	<b>7TuPo.11.24</b>	Fuss-Kailuweit, Peter	<b>J2WeO.1.1</b>
Fujimoto, T.	<b>7WePo.10.23</b>	Fuyuki, T.	<b>4TuPo.7.69LN,</b> <b>1WePo.1.12, 4WePo.7.20</b>
Fujimoto, Y.	<b>8WePo.8.24,</b> <b>8WePo.9.4</b>	<b>G</b>	
Fujimura, S.	<b>4WePo.7.11</b>	Gabriel, O.	<b>2TuO.6.5</b>
Fujisawa, Shigeki	<b>6WePo.4.36</b>	Gabriel, Onno	<b>2ThO.8.2</b>
Fujiseki, T.	<b>2TuPo.3.8</b>	Gadermaier, J.	<b>7TuPo.10.8</b>
Fujishima, K.	<b>4WeO.19.1</b>	Galbiati, G.	<b>7TuPo.11.21</b>
Fujita, S.	<b>2TuPo.3.16</b>	Gall, Stefan	<b>2ThO.8.2</b>
Fujiwara, H.	<b>3MoO.4.2,</b> <b>2TuPo.3.8, 2TuPo.3.15,</b> <b>2TuPo.3.29, 2TuPo.3.32,</b> <b>3TuPo.6.15</b>	Gallardo-Hernandez, S.	<b>5TuPo.8.13</b>
Fukabori, A.	<b>7TuPo.11.26LN</b>	Galleano, R.	<b>7TuPo.10.8</b>
Fukai, Hirofumi	<b>3ThO.6.1</b>	Galliano, F.	<b>4WeO.17.4</b>
		Gambogi, W.	<b>7TuO.14.2</b>

Gambogi, William J.		Gómez, Oscar Iván	<b>8WePo.9.10</b>
	<b>7TuRu.17.1</b>		
Gao, B.	<b>4ThO.13.2</b>	Gonsalves, P.	<b>8WePo.8.15</b>
Gao, H.	<b>2TuPo.4.10</b>	González-Elipe, A. R.	<b>6WePo.4.32</b>
Gao, Haibo	<b>2TuPo.3.38</b>	Goodnick, S.M.	<b>1MoO.6.5LN,</b> <b>5TuPo.9.23LN</b>
Gao, Hua	<b>1TuPo.1.24</b>	Gopalakrishnan, R.	<b>3TuPo.5.19</b>
Garabedian, Raffi	<b>3TuPl.2</b>	Gordijn, A.	<b>2TuPo.4.12</b>
Garcia-Alonso, Diana	<b>4TuPo.7.17</b>	Gordon, I.	<b>9WeO.6.5,</b> <b>J1ThO.7.1, 2ThO.8.4</b>
Garde, F.	<b>8TuO.12.5</b>	Gorgoi, M.	<b>6ThO.11.1</b>
Garreau-Iles, L.	<b>7TuO.14.2</b>	Goris, M. J. A. A.	<b>7TuPo.10.15</b>
Garris, R.	<b>3MoRu.9.2</b>	Gortzen, Roger	<b>4TuPo.7.17</b>
Gau, Chie	<b>1TuPo.2.28LN,</b> <b>4WePo.7.65LN</b>	Görtzen, R.	<b>4WeO.19.4</b>
Gauthier, M.	<b>4TuPo.7.22</b>	Goto, M.	<b>3TuPo.5.13,</b> <b>3WePo.6.15</b>
Ge, Yang	<b>3TuPo.6.13</b>	Goto, T.	<b>6ThO.11.3,</b> <b>1TuPo.2.26, 1TuPo.2.27,</b> <b>2TuPo.3.34, 2TuPo.4.30</b>
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Merdes, S.	<b>3WePo.5.3</b>	Miwa, Y.	<b>8WeO.11.1,</b> <b>8WePo.8.2</b>
Mereu, B.	<b>2TuO.5.2</b>	Miwa, Yasushi	<b>8WePo.8.4</b>
Merkle, A.	<b>4WeO.18.3</b>	Miyabayashi, Ryosuke	
Merten, J.	<b>J3WeO.9.2,</b> <b>9WeO.6.5</b>	<b>7TuO.14.4,</b> <b>7TuPo.10.6</b>	
Mertens, R.	<b>J1ThO.7.1</b>	Miyadera, Tetsuhiko	<b>6TuO.15.5</b>
Metz, A.	<b>9WeO.5.4,</b> <b>7TuPo.10.9</b>	Miyajima, S.	<b>J1MoO.2.3,</b> <b>2TuPo.3.24,</b> <b>2TuPo.4.2,</b> <b>1WePo.1.19,</b> <b>4WePo.7.12,</b> <b>4WePo.7.19</b>
Mewe, A. A.	<b>4TuO.3.2,</b> <b>4TuPo.7.23</b>	Miyajima, Shinsuke	<b>4TuPo.7.4,</b> <b>4TuPo.7.21,</b> <b>4TuPo.7.44</b>

Miyamoto, Atsushi	<b>8WePo.9.31</b>	Moon, Chan-Su	<b>6WePo.3.3</b>
Miyamoto, H.	<b>5TuO.9.2</b>	Moon, D. K.	<b>6WePo.2.4,</b> <b>6WePo.2.8, 6WePo.2.9,</b> <b>6WePo.2.13, 6WePo.2.14</b>
Miyamura, Y.	<b>4ThO.13.2,</b> <b>4TuPo.7.37, 4WePo.7.34,</b> <b>4WePo.7.39</b>	Moon, In-Sik	<b>7TuPo.11.11,</b> <b>4WePo.7.24, 7WePo.10.3</b>
Miyano, K.	<b>1WeO.2.5,</b> <b>1TuPo.1.20, 1WePo.1.3</b>	Moon, S. J.	<b>6ThO.10.3,</b> <b>6WePo.2.17</b>
Miyao, K.	<b>7ThO.1.4</b>	Moon, Se Youn	<b>3TuPo.5.1</b>
Miyasaka, Tsutomu	<b>1MoPl.6,</b> <b>6ThO.10.2</b>	Moon, Soo-Jin	<b>6ThO.10.6</b>
Miyashita, M.	<b>6TuO.16.6</b>	Moraitis, P.	<b>8TuO.11.3</b>
Miyashita, N.	<b>5TuO.10.4,</b> <b>5TuO.10.5, 5TuPo.9.4</b>	Morandi, Baez	<b>9WePo.11.12LN</b>
Miyashita, Naoya	<b>1WePo.1.24</b>	Mori, D.	<b>6TuO.16.3,</b> <b>6WePo.2.2</b>
Miyazaki, Hisashi	<b>3WePo.5.14,</b> <b>3WePo.5.15</b>	Mori, M.	<b>7WePo.10.23</b>
Miyoshi, R.	<b>8WePo.8.26</b>	Morihamo, M.	<b>3WePo.6.11</b>
Mizoguchi, Kosuke	<b>1TuO.7.3</b>	Morimoto, Hiroshi	<b>4sThO.12.1</b>
Mizui, Y.	<b>3WePo.6.17</b>	Morimoto, Masashi	<b>5WeO.4.6</b>
Mizui, Yuichi	<b>3TuPo.6.4</b>	Morioka, T.	<b>4WePo.7.9</b>
Mizuki, K.	<b>6WePo.2.10</b>	Morishita, K.	<b>4TuPo.7.30</b>
Mizuno, H.	<b>1TuPo.1.17</b>	Morita, Atsushi	<b>6ThO.9.1</b>
Mizuno, Hidenori	<b>5TuPo.9.3</b>	Morita, H.	<b>6TuO.16.6,</b> <b>7ThO.2.4</b>
Mizuno, S.	<b>1TuO.8.3,</b> <b>1TuPo.2.1, 1TuPo.2.11,</b> <b>5TuPo.8.15, 4WePo.7.5</b>	Morita, K.	<b>7ThO.1.3,</b> <b>7ThO.2.2, 7ThO.3.4</b>
Mizuta, Gai	<b>6WePo.3.15,</b> <b>6WePo.3.18, 6WePo.3.19</b>	Morita, S.	<b>4WeO.17.5</b>
Mizutani, Y.	<b>4WePo.7.58</b>	Morito, N.	<b>6WePo.3.2</b>
Mochihara, Akiko	<b>3TuPo.6.26,</b> <b>3WePo.5.24</b>	Moriyasu, Y.	<b>5TuPo.9.10</b>
Mochizuki, Shuhei	<b>4WePo.7.17</b>	Morlier, A.	<b>7WePo.10.13</b>
Mochizuki, T.	<b>5TuO.10.1</b>	Morohara, O.	<b>5TuPo.9.10</b>
Mochizuki, Toshimitsu	<b>5WeO.3.1</b>	Moseley, John	<b>3MoO.4.1</b>
Modestino, M.	<b>2TuPo.3.42</b>	Motegi, N.	<b>8WePo.9.26</b>
Moeller, Hans Joachim	<b>7WePo.10.11</b>	Motohiro, T.	<b>1TuO.8.3,</b> <b>3TuO.1.3, 1TuPo.2.1,</b> <b>1TuPo.2.9, 1TuPo.2.11,</b> <b>5TuPo.8.15, 4WePo.7.5,</b> <b>6WePo.3.30LN</b>
Molière, T.	<b>5TuPo.9.6</b>	Moulin, E.	<b>2TuO.6.1,</b> <b>2WeO.13.2</b>
Molla, M. Z.	<b>6WePo.4.34</b>	Mozumder, Z. U.	<b>2TuPo.4.42LN</b>
Momose, N.	<b>3WePo.5.16</b>	Muangchareon, S.	<b>8WePo.9.27</b>
Monnier, A.	<b>8TuO.12.5</b>	Muangjai, W.	<b>7TuPo.11.13,</b> <b>8WePo.8.8, 8WePo.8.19</b>
Monokroussos, C.	<b>7ThO.1.3</b>	Mück, A.	<b>2TuPo.4.12</b>
Montiel-Chicharro, D.	<b>7TuPo.10.18, 7TuPo.11.12</b>	Mueller, T.	<b>4TuPo.7.1,</b> <b>4WePo.7.1</b>
Monyakul, V.	<b>8WePo.9.32</b>	Mueller, Thomas	<b>4TuPo.7.15</b>
Moollakorn, A.	<b>2TuPo.3.17</b>	Muenpinij, B.	<b>7TuPo.10.21,</b>
Moollakorn, Apichan	<b>4WePo.7.43</b>		

Mukai, T.	<b>7TuPo.11.3</b>	Naka, Toshio	<b>3TuPo.6.26</b>
Mukherjee, D.	<b>7TuPo.11.25LN</b>	Nakada, K.	<b>4WePo.7.19</b>
Mukhopadhyay, Sumita		Nakada, Kazuyoshi	<b>4TuPo.7.4</b>
	<b>2TuPo.4.34, 4TuPo.7.13</b>	Nakada, T.	<b>3MoO.3.5</b>
Muller, Matthew	<b>7ThO.1.1</b>	Nakada, Tokio	<b>3ThO.6.1</b>
Müller, J.	<b>4TuO.4.5</b>	Nakagawa, Y.	<b>3WePo.5.21</b>
Munggonrit, S.	<b>7TuPo.11.3</b>	Nakagoshi, I.	<b>4TuPo.7.36</b>
Muñoz, D.	<b>4WePo.7.45</b>	Nakahama, H.	<b>7TuPo.10.11</b>
Murai, R.	<b>4TuPo.7.30</b>	Nakahara, H.	<b>1TuPo.2.20</b>
Murakami, Ryo	<b>6WePo.4.12</b>	Nakaido, K.	<b>5TuO.10.3</b>
Murakami, T.	<b>5TuPo.8.7</b>	Nakaike, Y.	<b>6WePo.3.21</b>
Muraki, Y.	<b>3TuPo.6.24</b>	Nakaishi, M.	<b>7TuPo.11.5</b>
Muraoka, H.	<b>7TuPo.11.2</b>	Nakajima, A.	<b>7TuPo.11.2</b>
Muraoka, J.	<b>4WePo.7.60</b>	Nakajima, K.	<b>4sThO.12.2,</b> <b>2TuPo.3.36, 4TuPo.7.30</b>
Murata, D.	<b>2TuPo.3.32</b>	Nakajima, Masahiro	<b>3WePo.6.22</b>
Murata, Y.	<b>6WePo.3.21</b>	Nakajima, T.	<b>7TuO.13.5</b>
Murooka, T.	<b>4TuPo.7.28</b>	Nakajima, Yasuhiro	<b>3ThO.5.5</b>
Murugadoss, Govindhasamy		Nakamura, H.	<b>5TuPo.8.10</b>
	<b>6WePo.3.15, 6WePo.3.18,</b> <b>6WePo.3.19</b>	Nakamura, Hiroya	<b>5TuPo.8.11</b>
Murukesan, K.	<b>4TuPo.7.40</b>	Nakamura, J.	<b>4WePo.7.67LN</b>
Muthmann, S.	<b>2TuPo.4.12</b>	Nakamura, Junichi	<b>4TuO.4.1</b>
Muthubalan, V.	<b>4WePo.7.59</b>	Nakamura, K.	<b>4TuO.3.5,</b> <b>J4ThO.4.2, 3TuPo.5.21,</b> <b>3WePo.6.11, 4WePo.7.55,</b> <b>4WePo.7.67LN</b>
Myo, Than Htay	<b>3WePo.5.16</b>	Nakamura, Kazuyo	<b>5TuO.9.3</b>
<b>N</b>			
Nagai, H.	<b>5WeO.4.1,</b> <b>5TuPo.8.19</b>	Nakamura, Kyotaro	<b>4TuO.4.1</b>
Nagai, Koki	<b>7WePo.10.21</b>	Nakamura, Masaki	<b>8WePo.8.28</b>
Nagai, T.	<b>2TuPo.4.29</b>	Nakamura, S.	<b>3TuPo.6.7,</b> <b>3WePo.6.17, 3WePo.6.27</b>
Nagao, C.	<b>7TuPo.10.22</b>	Nakamura, T.	<b>5TuO.9.1,</b> <b>7TuO.13.5</b>
Nagao, M.	<b>4WePo.7.37</b>	Nakamura, Tetsuro	<b>7TuPo.11.28LN</b>
Nagaoka, A.	<b>3TuPo.5.15,</b> <b>3TuPo.5.29, 3WePo.6.20</b>	Nakamura, Tetsuya	<b>5TuO.9.3,</b> <b>5WeO.3.1</b>
Nagaoka, Akira	<b>3WePo.5.10</b>	Nakano, M.	<b>9WePo.11.16LN</b>
Nagasaki, H.	<b>7TuO.14.5</b>	Nakano, S.	<b>4ThO.13.2,</b> <b>2TuPo.4.32, 3TuPo.5.4,</b> <b>4WePo.7.39</b>
Nagayoshi, H.	<b>4TuPo.7.28,</b> <b>4WePo.7.27</b>	Nakano, Y.	<b>1WeO.2.3,</b> <b>5WeO.3.3, 5WeO.3.5,</b> <b>5TuPo.8.7</b>
Nagura, Masashi	<b>7WePo.10.21</b>	Nakano, Yoshiaki	<b>1WePo.1.18</b>
Nagura, O.	<b>8WeO.12.1</b>	Nakao, S.	<b>2TuO.5.3,</b> <b>6TuO.15.4, 2WeO.14.1</b>
Nair, G. Ganesan	<b>8WePo.9.1</b>		
Naito, H.	<b>8WePo.8.18</b>		
Naito, S.	<b>1TuO.7.4,</b> <b>1WePo.1.9</b>		
Naitoh, Shunya	<b>1WePo.1.24</b>		

Nakaravarayut, K.	<b>8WePo.9.32</b>	Niederhäuser, E.-L.	<b>1TuPo.2.22</b>
Nakashima, Mitsuki	<b>3TuPo.6.4, 3WePo.5.8</b>	Niemeyer, G.	<b>5WeO.4.1</b>
Nakatsuka, O.	<b>1TuPo.1.29LN</b>	Niemeyer, Markus	<b>J2WeO.1.1</b>
Nakatsuka, S.	<b>3WePo.5.23</b>	Niepelt, R.	<b>J1ThO.7.4</b>
Nakazaki, Jotaro	<b>6TuO.16.5</b>	Niesen, B.	<b>2TuO.6.1, 2ThO.8.3, 6ThO.10.3</b>
Nakazawa, K.	<b>2TuPo.3.37, 3TuPo.6.22</b>	Nihiwaki, S.	<b>3WePo.6.5</b>
Nam, D.	<b>3TuPo.5.29</b>	Nikura, C.	<b>2WeO.14.3</b>
Nam, Jung Seung	<b>6WePo.4.4</b>	Niinobe, D.	<b>4WeO.19.2</b>
Nam, Kwanwoo	<b>3TuPo.6.12, 3WePo.5.27</b>	Niki, S.	<b>3MoRu.9.1, 3MoO.3.2, 3MoO.4.2, 3TuO.1.6LN, 5TuO.10.1, 3ThO.5.1, 3ThO.5.3, 3TuPo.5.6, 3TuPo.5.8, 3TuPo.6.15, 3WePo.5.13, 3WePo.6.23</b>
Namin, A.	<b>7TuO.13.3</b>	Niki, Shigeru	<b>3WeO.15.5, 3WeO.16.3</b>
Namnuan, B.	<b>3TuPo.6.8</b>	Ninomiya, S.	<b>4TuPo.7.46</b>
Nampalli, N.	<b>7TuPo.11.15</b>	Niquille, X.	<b>2TuO.6.1</b>
Nandakumar, Naomi	<b>4TuPo.7.15, 4TuPo.7.17</b>	Nirmal Kumar, V.	<b>3TuPo.5.19</b>
Narabe, T.	<b>6WePo.4.9</b>	Nishi, Toshiaki	<b>5TuPo.8.11</b>
Naracha, C.	<b>7TuPo.11.13</b>	Nishida, T.	<b>7TuO.13.5</b>
Narasimhan, K. L.	<b>7WeO.8.4</b>	Nishihara, Hironori	<b>7TuPo.11.28LN</b>
Naumann, V.	<b>J3WeO.10.5</b>	Nishihara, Y.	<b>6WePo.2.10</b>
Nazeeruddin, Mohammad Khaja	<b>6sMoO.7.1, 6ThO.10.5</b>	Nishikawa, S.	<b>7TuPo.10.22, 7WePo.10.17</b>
Nazim, M.	<b>6WePo.4.45LN</b>	Nishikawa, Y.	<b>7ThO.1.4</b>
Negami, T.	<b>3ThO.5.1</b>	Nishimura, H.	<b>4TuPo.7.69LN, 4WePo.7.20</b>
Nematollahi, M.	<b>1TuO.7.2</b>	Nishimura, S.	<b>4WeO.19.2</b>
Neubert, S.	<b>2TuO.6.5</b>	Nishimura, T.	<b>3MoO.3.4</b>
Neubert, Sebastian	<b>2ThO.8.2</b>	Nishimura, Tetsuro	<b>7TuO.14.4, 7TuPo.10.6</b>
Neuschitzer, M.	<b>3TuO.1.5</b>	Nishinaga, J.	<b>3MoRu.9.1, 5TuPo.8.4</b>
Ngaopitakkul, A.	<b>8WePo.8.27, 8WePo.9.27</b>	Nishino, Hitoshi	<b>6ThO.10.5, 6WePo.3.15, 6WePo.3.18, 6WePo.3.19</b>
Ngo, T.	<b>7ThO.3.5</b>	Nishio, Mitsuhiro	<b>1TuO.7.3</b>
Ngoenmeesri, R.	<b>8WePo.8.12</b>	Nishio, Y.	<b>2TuPo.4.41, 4TuPo.7.50</b>
Ngomesee, R.	<b>8WePo.9.7</b>	Nishioka, K.	<b>5WeO.4.1, 5TuPo.8.16, 5TuPo.8.17, 5TuPo.8.22LN, 5TuPo.9.13, 5TuPo.9.17</b>
Ngonmeesri, R.	<b>8WePo.8.16</b>	Nishioka, Kensuke	<b>5TuPo.9.16</b>
Nguyen, T. H.	<b>3TuO.1.2</b>	Nishioka, Y.	<b>6WePo.2.5</b>
Nguyen, Van Hoang	<b>1TuPo.1.1, 1TuPo.1.16</b>	Nishitani, Mikihiko	<b>3TuPo.5.26</b>
Nguyen, X.-V.	<b>2TuO.5.2</b>		
Ni, J.	<b>2TuPo.3.39</b>		
Ni, Jian	<b>2TuPo.3.1</b>		
Nichiporuk, O.	<b>7TuPo.11.21</b>		
Nicholas, Robin J.	<b>6ThO.11.2</b>		
Nicolay, S.	<b>6ThO.10.3, 2TuPo.3.42</b>		
Nicolay, Sylvain	<b>6ThO.10.6</b>		

Nishiwaki, S.	<b>3MoO.3.1</b>		<b>3WePo.5.19</b>
Nishiyama, Naoki	<b>J3WeO.10.4</b>	Oda, H.	<b>1TuPo.1.29LN</b>
Niwa, T.	<b>7WePo.10.23</b>	Odden, J. O.	<b>4ThO.13.5</b>
Niwano, M.	<b>6WePo.3.8</b>	Ogawa, Y.	<b>3TuPo.5.16,</b>
No, Duck Ho	<b>6WePo.4.4</b>		<b>3TuPo.6.16, 8WePo.8.11,</b>
Nobre, A. M.	<b>8TuO.11.2,</b>		<b>8WePo.9.11</b>
	<b>8WeO.11.2, 8WePo.8.13</b>	Ogimoto, K.	<b>8WeO.11.1,</b>
Noda, M.	<b>9WeO.5.2</b>		<b>8WePo.8.5, 8WePo.9.2,</b>
Noda, S.	<b>2TuPo.3.16,</b>	Ogimoto, Kazuhiko	<b>8WePo.9.28</b>
	<b>2TuPo.4.38</b>	Ogishi, A.	<b>8WePo.8.3</b>
Noda, Takeshi	<b>5TuPo.8.23LN,</b>	Ogomi, Y.	<b>4WeO.18.4</b>
	<b>1WePo.1.17</b>		<b>6WePo.3.21,</b>
Noge, H.	<b>4WePo.7.13,</b>	Ogomi, Yuhei	<b>6ThO.9.1,</b>
	<b>4WePo.7.23</b>		<b>6ThO.9.2, 6WePo.4.36</b>
Noguchi, Takuma	<b>4TuPo.7.16</b>	Ogura, A.	<b>4WeO.18.1,</b>
Nogueira, E.	<b>5WeO.4.5</b>		<b>4WeO.18.4, J4ThO.4.2,</b>
Nohira, T.	<b>2TuPo.3.6,</b>		<b>4ThO.13.1, 2TuPo.4.17,</b>
	<b>2TuPo.3.11, 4TuPo.7.52,</b>		<b>4TuPo.7.20, 4TuPo.7.36,</b>
	<b>4WePo.7.52, 4WePo.7.58</b>		<b>4TuPo.7.56, 4TuPo.7.57,</b>
Noikaew, B.	<b>3TuPo.6.8</b>	Ogusu, T.	<b>4TuPo.7.58, 5TuPo.8.1,</b>
Noll, J.	<b>J3WeO.9.2</b>		<b>4WePo.7.31, 4WePo.7.56</b>
Nomoto, T.	<b>3TuPo.5.24</b>	Oh, Hoon	<b>J1MoO.2.3</b>
Nomura, K.	<b>5TuPo.8.16,</b>		<b>7TuPo.11.11,</b>
	<b>5TuPo.9.13, 5TuPo.9.17</b>		<b>7WePo.10.3</b>
Nonomura, Kazuteru	<b>6ThO.10.2</b>	Oh, Misol	<b>3WePo.5.7</b>
Nonomura, S.	<b>1TuPo.2.15,</b>	Oh, W.	<b>7TuPo.11.20</b>
	<b>2TuPo.3.22, 2TuPo.4.21</b>		
Nose, Y.	<b>3TuPo.5.15,</b>	Ohashi, F.	<b>1TuPo.2.15</b>
	<b>3WePo.5.23, 3WePo.6.20</b>		
Novikov, A.	<b>1TuPo.1.10</b>	Ohashi, H.	<b>6WePo.4.27</b>
Novikov, Gennady	<b>3WePo.5.1</b>	Ohdaira, K.	<b>1TuPo.1.13,</b>
Nowak, Stefan	<b>9WePl.2</b>		<b>1TuPo.1.26, 4TuPo.7.45</b>
Nozaki, Tomohiro	<b>6WePo.3.13</b>	Ohdaira, Keisuke	<b>4WeO.18.2,</b>
Nukada, K.	<b>8WePo.8.22,</b>		<b>4TuPo.7.42, 4WePo.7.7</b>
	<b>8WePo.8.24, 8WePo.8.25</b>		
Nukui, Y.	<b>3WePo.6.19</b>	Ohigashi, Takashi	<b>9WeO.7.2</b>
Nunez, R.	<b>5WeO.4.3</b>	Ohishi, T.	<b>1TuO.8.3</b>
Nuñez, Neftali	<b>5TuPo.9.20</b>	Ohishi, K.	<b>3TuO.1.3</b>
Núñez, R.	<b>5WeO.4.1, 5WeO.4.5</b>	Ohki, T.	<b>6WePo.3.12</b>
Nussbaumer, H.	<b>8WePo.9.33LN</b>	Ohkita, H.	<b>6TuO.16.3,</b>
			<b>6WePo.2.2, 6WePo.2.3,</b>
			<b>6WePo.2.21, 6WePo.2.26</b>
O		Ohkita, Hideo	<b>6WePo.3.7</b>
O'Sullivan, B.J.	<b>4TuPo.7.67LN</b>	Ohkub, S.	<b>6WePo.4.5</b>
Obara, K.	<b>3WeO.16.2</b>	Ohkuma, Hideo	<b>7TuO.14.4,</b>
Obayashi, T.	<b>J3WeO.10.2</b>		<b>7TuPo.10.6</b>
Obayashi, Tadashi	<b>7TuPo.10.1</b>	Ohmi, H.	<b>1TuPo.1.6</b>
Ochoa Landín, R.	<b>3TuPo.6.21,</b>	Ohnishi, T.	<b>4WePo.7.67LN</b>
		Ohnishi, Tetsuya	<b>4TuO.4.1</b>
		Ohno, Y.	<b>4ThO.13.3,</b>
			<b>4TuPo.7.46</b>
		Ohshima, T.	<b>5TuO.9.1</b>

Ohshita, Y.	4TuO.3.5, J4ThO.4.2, 4TuPo.7.58, 4TuPo.7.59, 4TuPo.7.70LN, 5TuPo.8.9, 5TuPo.8.10, 5TuPo.9.8, 5TuPo.9.12, 5TuPo.9.22LN, 4WePo.7.55, 4WePo.7.56	Omae, K.	9WePo.11.16LN
		Omar, E.	5TuPo.8.9
		Omine, Eitaro	8WeO.12.4
		Onitsuka, R.	5TuO.10.3
		Onitsuka, Ryusuke	5WeO.4.6
Ohshita, Yoshio	5TuPo.8.11	Onmori, R. K.	4TuPo.7.5
Ohtake, H.	8WeO.11.3	Ono, H.	4TuPo.7.57, 4WePo.7.31
Ohtake, Hideaki	8WePo.8.3	Ono, S.	4TuPo.7.30
Ohwada, Hiroto	7WePo.10.18	Onuma, T.	7WePo.10.7
Oikawa, T.	1TuPo.1.13, 4TuPo.7.45	Ooka, Sachiyō	5TuO.9.3
Oji, H.	4TuPo.7.56	Ootake, H.	8WePo.8.5, 8WePo.9.28
Okada, I.	6TuO.16.3	Ooyama, Y.	6WePo.4.2
Okada, M.	8WePo.9.3	Oozeki, T.	8WeO.11.1, 8WeO.11.3, 8WePo.8.5, 8WePo.9.28
Okada, Y.	1TuO.7.4, 5TuO.10.2, 5TuO.10.4, 5TuO.10.5, 1WeO.2.2, 1WeO.2.5, 1TuPo.1.20, 5TuPo.8.1, 5TuPo.9.4, 1WePo.1.3, 1WePo.1.5, 1WePo.1.9, 1WePo.1.11, 1WePo.1.14	Oozeki, Takashi	8WePo.8.3
Okada, Yoshitaka	5WeO.3.2, 1WePo.1.24	Opara Krašovec, U.	6WePo.4.39
Okamoto, C.	4WePo.7.67LN	Oranpiroj, K.	8WePo.8.19
Okamoto, Chikao	4TuO.4.1	Oreski, G.	7WePo.10.8
Okamoto, H.	2TuPo.4.41	Orlandi, Sinead	9WePo.11.12LN
Okamoto, K.	8TuO.11.5, 5TuPo.8.18, 5TuPo.9.14	Orlando, Vincenzo	5TuPo.9.20
Okamoto, N.	1WePo.1.12	Osada, K.	1TuO.7.4, 1WePo.1.9
Okamoto, S.	7TuO.13.5, 4WeO.19.1	Osada, Naoya	6ThO.9.2
Okamoto, Shingo	4MoPl.4	Osaka, I.	6TuO.16.1
Okamoto, T.	3TuPo.5.16, 3TuPo.6.16, 8WePo.8.11, 8WePo.9.11	Osaka, M.	6WePo.2.21
Okamoto, Tetsuhito	3WePo.5.25	Oshima, Minoru	3TuPo.6.26
Okano, M.	3TuPo.5.8	Oshima, R.	5TuO.10.1
Okano, Makoto	3WePo.5.10	Oshima, Ryuji	5TuPo.9.3
Okano, Y.	5TuO.10.1	Oshima, Takuya	6ThO.9.2
Okhorzina, A.	8WePo.8.1	Oskam, G.	6WePo.4.32
Oki, Kohei	1TuPo.1.15	Osowski, M.	5TuO.9.2
Okubo, A.	8WePo.9.2	Ota, Y.	5WeO.4.1, 5TuPo.8.16, 5TuPo.8.17, 5TuPo.8.22LN, 5TuPo.9.13, 5TuPo.9.17
Okuda, T.	3WeO.16.2	Ota, Yasuyuki	5TuPo.9.16
Okura, T.	7TuPo.11.27LN	Otaka, S.	8WePo.9.3
Okuya, Masayuki	6WePo.4.12, 6WePo.4.33	Otsubo, E.	2TuO.5.3
Oladeji, I. O.	6WePo.4.14	Otsuka, Rena	6WePo.4.12, 6WePo.4.33
		Ott, J. A.	5TuPo.8.6
		Ou, N. T.	4TuPo.7.35, 4WePo.7.16
		Øvreliid, Eivind Johannes	

Oya, N.	<b>4WePo.7.64</b>	Park, S. H	<b>6WePo.2.22</b>
Oyanagi, T.	<b>2TuPo.3.37</b>	Park, S. J.	<b>3WePo.6.24</b>
Ozawa, H.	<b>2TuPo.3.36</b>	Park, Sang Joon	<b>4TuPo.7.62</b>
	<b>6TuO.15.1,</b> <b>6WePo.4.2</b>	Park, Won-Kyu	<b>5TuPo.9.5</b>
		Park, Y. I.	<b>3ThO.5.6</b>
<b>P</b>		Park, Yongseob	<b>3WePo.5.26,</b> <b>3WePo.6.3</b>
Paetzold, U. W.	<b>2TuPo.4.12</b>	Parthasarathy, S.	<b>7TuPo.11.17,</b> <b>7TuPo.11.22</b>
Pai, Richard	<b>4TuPo.7.33,</b> <b>4WePo.7.18</b>	Patcharaprakiti, N.	
Pai, Y. P.	<b>4TuPo.7.2,</b> <b>4TuPo.7.7, 4TuPo.7.14</b>	<b>7WePo.10.22, 8WePo.8.29,</b> <b>9WePo.11.8</b>	
Pai, Yu-Pan	<b>4TuPo.7.6</b>	Pathak, Sandeep	<b>6ThO.9.3</b>
Painchaud, T.	<b>3TuPo.6.1</b>	Patil, D. V.	<b>6WePo.4.40LN</b>
Pak, J.-H.	<b>6WePo.4.23</b>	Patil, S. A.	<b>6WePo.4.40LN</b>
Pakhuruddin, M. Z.	<b>2TuPo.4.15</b>	Paviet-Salomon, B.	<b>J1MoO.2.4</b>
Paletta, F.	<b>J3WeO.9.2,</b> <b>9WeO.6.5, 7ThO.3.3,</b> <b>7WePo.10.5</b>	Pavlovic, R.	<b>2TuPo.4.13</b>
Pan, N.	<b>5TuO.9.2</b>	Pawlak, M.	<b>4TuPo.7.22</b>
Pandey, S. S.	<b>6WePo.4.34</b>	Pei, Z.	<b>6WePo.3.5</b>
Pandey, Shyam	<b>6WePo.4.36</b>	Pelet, Yanik	<b>5TuPo.8.24LN,</b> <b>7TuPo.11.4</b>
Pandey, Shyam S.	<b>6ThO.9.1</b>	Pellegrino, M.	<b>J3WeO.9.2,</b> <b>9WeO.6.5, 7ThO.3.3,</b> <b>7WePo.10.5</b>
Pani, Bhagyashree	<b>3TuPo.5.11,</b> <b>3TuPo.6.9</b>	Peña, Ramón	<b>8WePo.9.10</b>
Papathanasiou, N.	<b>3WeO.15.3</b>	Peng, Z. W.	<b>7WePo.10.1</b>
Papet, P.	<b>7WeO.8.3</b>	Perez, V.	<b>5WeO.4.5</b>
Parafiniuk, K.	<b>6TuO.16.4</b>	Pérez-Rodríguez, A.	<b>3TuO.1.5,</b> <b>3WePo.6.14</b>
Paredes, Stephan	<b>8WePo.9.14</b>	Pérez-Rodríguez, Al.	
Parinya, P.	<b>7TuPo.11.3,</b> <b>7TuPo.11.16</b>	Pérez-Rodríguez, Al.	<b>7TuPo.10.17</b>
Park, C.	<b>4TuPo.7.55</b>	Perret-Aebi, L.	<b>4WeO.17.4</b>
Park, Cheol Hun	<b>6WePo.4.16</b>	Persoz, J.	<b>2ThO.8.3</b>
Park, Chinho	<b>3WePo.5.2,</b> <b>6WePo.2.15</b>	Peshek, T. J.	<b>7TuO.13.2</b>
Park, Gye-Choon	<b>3WePo.6.29</b>	Peters, I. M.	<b>2TuPo.3.9,</b> <b>4WePo.7.3, 8WePo.8.13,</b> <b>9WePo.11.7</b>
Park, Hyeongsik	<b>2TuPo.4.4</b>	Petrick, Kristian	
Park, J. H.	<b>2TuPo.3.41</b>	Pettenkofer, C.	<b>9WePo.11.12LN</b>
Park, J. J.	<b>3TuPo.5.28LN</b>	Pettersen, T.	<b>4TuO.3.3</b>
Park, J. T.	<b>6WePo.4.17</b>	Pham, A.	<b>9WeO.6.5</b>
Park, Jinjoo	<b>2TuPo.4.8</b>	Pham, Viet Thanh Hau	<b>2TuPo.4.25</b>
Park, Ju Hyung	<b>3TuPo.5.1,</b> <b>3TuPo.5.5</b>		<b>6WePo.2.15</b>
Park, M. J.	<b>4WePo.7.66LN</b>	Philip, M.	<b>1WePo.1.16</b>
Park, Nam-Gyu	<b>6sMoO.7.2</b>	Philipps, S. P.	<b>5TuO.10.2,</b> <b>5TuO.10.4, 5WeO.3.6</b>
Park, S.	<b>2TuO.6.3,</b> <b>7TuPo.11.20</b>	Philipps, Simon P.	<b>J2WeO.1.1</b>

Phok, Sovannary	<b>3TuPo.5.22</b>	Puri, Nitin K.	<b>6WePo.3.26</b>
Pianezzi, F.	<b>3MoO.3.1,</b> <b>3WePo.6.5</b>	Purohit, G.	<b>5TuPo.9.19,</b> <b>8WePo.9.18</b>
Pillai, S.	<b>1TuPo.1.12,</b> <b>7TuPo.10.10</b>	Puvaneswaran, C.	<b>8WePo.8.20</b>
Pillai, Supriya	<b>1TuO.8.1,</b> <b>1TuPo.1.14</b>	<b>Q</b>	
Ping, Feilin	<b>4sMoO.1.4</b>	Qin, C.	<b>6ThO.10.1,</b> <b>6WePo.3.24, 6WePo.4.35</b>
Pinter, G.	<b>7WePo.10.8</b>	Qin, Peng	<b>6ThO.10.5</b>
Pistor, Paul	<b>3MoO.4.5</b>	Qing, Shen	<b>6ThO.9.1</b>
Piszczor, Michael	<b>5TuO.9.4</b>	Qiu, J.	<b>6WePo.2.5</b>
Placidi, M.	<b>3TuO.1.5</b>	Qiu, Zixuan	<b>4TuO.3.4</b>
Polman, A.	<b>4WePo.7.30</b>	Quan, Peng	<b>4sMoO.1.4</b>
Polyakov, S.	<b>1WePo.1.26</b>	Quaschning, V.	<b>3MoO.4.4,</b> <b>3WeO.15.2, 3WePo.5.3</b>
Pomaska, M.	<b>2TuPo.4.16</b>		
Ponce, F.	<b>5TuPo.9.23LN</b>	<b>R</b>	
Ponomarenko, S. A.	<b>6WePo.2.11,</b> <b>6WePo.2.12</b>	Raghunath, P.	<b>1TuPo.2.10</b>
Poortmans, J.	<b>8WeO.11.5,</b> <b>J1ThO.7.1, 2ThO.8.4</b>	Rahman, A.	<b>2TuPo.4.42LN</b>
Popescu, L.	<b>7TuPo.11.21</b>	Rahman, K. S.	<b>3TuPo.6.17</b>
Poplavskyy, Dmitry	<b>4WeO.17.3</b>	Raihel, S.	<b>9WeO.5.4</b>
Pospischil, M.	<b>4WeO.17.1</b>	Raj, P. Goutham	<b>6WePo.2.31LN</b>
Pothisarn, C.	<b>8WePo.9.27</b>	Raja, J.	<b>4TuPo.7.55</b>
Powalla, M.	<b>3WeO.15.1</b>	Rale, P.	<b>1WeO.2.2</b>
Powell, D. M.	<b>4TuPo.7.30,</b> <b>9WePo.11.7</b>	Ramachandra Rao, M.S.	<b>3WePo.6.28LN</b>
Pozza, A.	<b>J3WeO.9.2,</b> <b>9WeO.6.5, 7ThO.3.3,</b> <b>7WePo.10.5</b>	Ramanathan, Kannan	<b>3MoRu.9.2, 3MoO.4.1</b>
Prakash, R. R.	<b>4TuPo.7.37,</b> <b>4TuPo.7.70LN</b>	Ramirez-Lopez, M.	<b>5TuPo.8.13</b>
Pravettoni, M.	<b>7TuPo.10.8,</b> <b>7WePo.10.2</b>	Ramkumar, J.	<b>1TuPo.2.29LN,</b> <b>1TuPo.2.30LN, 3WePo.5.28LN,</b> <b>6WePo.2.32LN</b>
Prem kumar, T.	<b>3TuPo.6.12,</b> <b>3WePo.5.27</b>	Ramspeck, K.	<b>7TuPo.10.9</b>
Preu, Ralf	<b>0MoPl.1</b>	Ransome, Steve	<b>J3WeO.9.3</b>
Price, Michael	<b>6ThO.9.3</b>	Rapp, C.	<b>7ThO.1.5</b>
Probst, V.	<b>3WeO.15.4</b>	Rapp, Christoph	<b>7ThO.1.1</b>
Prommee, W.	<b>7TuPo.11.14</b>	Rashid, M. J.	<b>3WePo.6.16</b>
Psimouli, I.	<b>2TuO.5.2</b>	Ratsimba, T.	<b>8TuO.12.5</b>
Pugin, R.	<b>2TuO.6.1</b>	Rau, B.	<b>3MoO.4.4,</b> <b>3WeO.15.2, 3WePo.5.3</b>
Pugliatti, P.	<b>9WeO.6.5,</b> <b>7ThO.3.3, 7WePo.10.5</b>	Rau, Björn	<b>2ThO.8.2</b>
Pugliatti, P. M.	<b>J3WeO.9.2</b>	Rau, U.	<b>2TuPo.4.16</b>
Pujari, Herlin	<b>6WePo.4.41LN</b>	Raugei, M.	<b>9WePo.11.10LN</b>
Pulwin, Z.	<b>5TuPo.8.6</b>	Rauschenbach, A.	<b>7WePo.10.8</b>
		Raval, M.	<b>4TuPo.7.40</b>
		Ravi, T. S.	<b>J1ThO.7.3</b>
		Ravikumar, D. T.	

	<b>9WePo.11.13LN</b>	Rose, D.	<b>4sTuO.2.2</b>
Razongles, G.	<b>J3WeO.9.2</b>	Rößler, R.	<b>4TuO.3.3</b>
Reber, S.	<b>2TuPo.4.13</b>	Rougieux, F. E.	<b>4TuO.4.4</b>
Rech, B.	<b>2TuO.6.5,</b> <b>4TuO.3.3, J1ThO.7.5,</b> <b>4WePo.7.42</b>	Rousu, S.	<b>9WeO.6.5</b>
Rech, Bernd	<b>2ThO.8.2</b>	Roux, C.	<b>4WePo.7.45</b>
Reckers, Philip	<b>6ThO.9.5</b>	Ru, X.	<b>2TuO.5.1</b>
Reece, Peter J.	<b>1WePo.1.20</b>	Ruankham, P.	<b>6WePo.3.6</b>
Reenaas, T. W.	<b>1TuO.7.2,</b> <b>1WePo.1.26</b>	Ruch, Patrick	<b>8WePo.9.14</b>
Reinders, Angéle	<b>9WePo.11.3</b>	Ruppenthal, A.	<b>7WePo.10.4</b>
Reindl, T.	<b>8TuO.11.2,</b> <b>8WeO.11.2, 8WePo.8.13</b>	Ruske, F.	<b>J1ThO.7.5</b>
Reinecke, Patrick	<b>4WePo.7.44</b>	Rusli	<b>2TuPo.3.5</b>
Reinhard, P.	<b>3MoO.3.1,</b> <b>3WePo.6.5</b>	Russell, R.	<b>4WeO.19.4</b>
Remund, Jan	<b>9WeO.7.4</b>	Rüther, R.	<b>8TuO.11.2,</b> <b>8WeO.11.2, 8WePo.8.13</b>
<b>S</b>			
Ren, Xiaodong	<b>3TuPo.6.28LN</b>	Sablon, Kimberly	<b>5TuPo.9.1</b>
Ren, Zekun	<b>9WePo.11.7</b>	Sada, C.	<b>2TuPo.4.41</b>
Renard, C.	<b>5TuPo.9.6</b>	Sadono, A.	<b>3ThO.5.4</b>
Rever III, W. B.	<b>9WeO.7.5</b>	Sadoughi, G.	<b>6ThO.11.1</b>
Reyes, P.	<b>3TuPo.6.1,</b> <b>3TuPo.6.2</b>	Saelao, J.	<b>7WePo.10.22,</b> <b>8WePo.8.29</b>
Ribeyron, P. J.	<b>4WePo.7.45</b>	Saengsuwan, V.	<b>8WePo.9.20</b>
Richter, A.	<b>2TuPo.4.16</b>	Safie, N. E.	<b>6WePo.4.18</b>
Riesen, Y.	<b>7ThO.1.2</b>	Sagawa, T.	<b>6WePo.3.6</b>
Rimmelspacher, Lorenz	<b>7WeO.8.1</b>	Sahraei., N.	<b>2TuPo.3.9</b>
Ring, Sven	<b>2ThO.8.2</b>	Sai, H.	<b>2TuO.5.3,</b> <b>2TuO.5.4, 2TuO.6.2,</b> <b>2WeO.13.4, 2WeO.14.1,</b> <b>J4ThO.4.3, 1TuPo.1.17,</b> <b>2TuPo.3.35, 2TuPo.4.27</b>
Ristau, S.	<b>2TuO.5.2</b>	Saifuddin, S. M.	<b>2TuPo.4.42LN</b>
Ritzau, Kurt-Ulrich	<b>4WePo.7.44</b>	Saito, Takahiro	<b>6ThO.9.1</b>
Roberts, J. S.	<b>5WeO.3.4</b>	Saito, H.	<b>9WeO.5.2</b>
Roca, F.	<b>J3WeO.9.2,</b> <b>9WeO.6.5, 7ThO.3.3,</b> <b>7WePo.10.5</b>	Saito, K.	<b>2TuO.6.2,</b> <b>4WePo.7.13, 4WePo.7.23</b>
Rock, C.	<b>1TuPo.2.7</b>	Saito, Katsuhiko	<b>1TuO.7.3</b>
Rodriguez-Alvarez, H.	<b>3WeO.15.3</b>	Saito, M.	<b>2TuPo.3.22</b>
Rogojina, Elena	<b>4WeO.17.3</b>	Saitoh, H.	<b>8TuO.11.5</b>
Roh, Si-Cheol	<b>4WePo.7.41</b>	Saitoh, S.	<b>7ThO.1.4</b>
Rohatgi, A.	<b>J1MoO.2.2</b>	Saive, R.	<b>5TuPo.9.11</b>
Rohini, M.	<b>3TuPo.6.2</b>	Sakai, Kohta	<b>8WePo.9.31</b>
Romanyuk, Y.	<b>3MoO.3.1</b>	Sakai, N.	<b>3WePo.5.13</b>
Romijn, I. G.	<b>4TuO.3.1</b>	Sakai, Noriyuki	<b>3WeO.16.3</b>
Rosca, V.	<b>7TuPo.10.15</b>	Sakai, T.	<b>3TuO.1.3,</b> <b>4WePo.7.67LN</b>
Roschek, T.	<b>2TuO.5.2</b>	Sakai, Toshiaki	<b>7TuPo.11.28LN</b>

Sakai, Toshihiko	<b>4TuO.4.1</b>	Santamaría Lancia, A. A
Sakai, Y.	<b>4WeO.19.2,</b> <b>4WePo.7.9</b>	<b>J3WeO.9.2</b>
Sakaki, Hiroyuki	<b>5TuPo.8.23LN</b>	Santbergen, R.
Sakakima, H.	<b>3TuPo.6.16</b>	<b>2TuO.6.4,</b> <b>2WeO.13.1, 2WeO.13.3,</b> <b>1TuPo.1.4</b>
Sakakima, Hiroshi.	<b>3TuPo.5.26</b>	
Sakamoto, K.	<b>1WePo.1.1</b>	Saravanan, S.
Sakamoto, Sadao	<b>7WePo.10.18</b>	<b>4TuPo.7.40,</b> <b>6WePo.3.10, 8WePo.9.16</b>
Sakamoto, Y.	<b>7TuPo.11.5</b>	Saruwatari, T.
Sakanaka, Y.	<b>2TuPo.3.34,</b> <b>2TuPo.4.30</b>	<b>4WeO.18.4</b>
Sakoda, Kazuaki	<b>1WePo.1.17</b>	Sasa, T.
Sakorn, J.	<b>8WePo.8.8</b>	<b>1TuPo.2.27</b>
Sakurai, Keiichiro		Sasaki, A.
	<b>7TuPo.11.28LN</b>	<b>7TuPo.10.16,</b> <b>7TuPo.11.2</b>
Sakurai, T.	<b>3MoRu.9.1,</b> <b>3TuPo.5.6, 3TuPo.5.8,</b> <b>3WePo.5.13, 6WePo.3.1</b>	Sasaki, K.
Sakurai, Takeaki	<b>3WeO.16.3</b>	<b>5TuO.10.3,</b> <b>5WeO.4.2</b>
Sala, G.	<b>5WeO.4.1,</b> <b>5WeO.4.3, 5WeO.4.5,</b> <b>5TuPo.8.14</b>	Sasaki, T.
		<b>7TuO.13.4</b>
Salabas, A.	<b>2TuO.5.2</b>	Sasaki, Takuo
Salabas, E. L.	<b>2TuO.5.2</b>	<b>5TuPo.8.11</b>
Salas, Vicente	<b>9WeO.6.2</b>	Sasamori, T.
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Suzuki, Yoshiyuki	<b>5TuO.9.3</b>	<b>Takahashi, K.</b>
Suzuoki, Y.	<b>8WePo.9.5</b>	<b>6WePo.2.7,</b>
Svrcek, V.	<b>1TuPo.2.7,</b>	<b>6WePo.3.25</b>
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Syu, H.-J.	<b>1TuPo.2.17</b>	<b>Takahashi, N.</b>
Szabo, Sandor	<b>9WeO.5.3</b>	<b>8WePo.8.26,</b>
Szlufcik, J.	<b>4WeO.19.4,</b>	<b>8WePo.9.26</b>
	<b>2ThO.8.4, 4TuPo.7.67LN</b>	
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Tabushi, A.	<b>2TuPo.3.34</b>	<b>Takai, D.</b>
Tachibana, T.	<b>4TuPo.7.58,</b>	<b>4TuPo.7.58,</b>
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Tachikawa, Hiroto	<b>6WePo.2.23,</b>	<b>Takamoto, T.</b>
	<b>6WePo.2.24</b>	<b>5TuO.10.3,</b>
Tada, H.	<b>4TuPo.7.50</b>	<b>5WeO.4.2, J4ThO.4.6</b>
Tada, K.	<b>8TuO.11.5,</b>	<b>Takamoto, Tatsuya</b>
	<b>7TuPo.10.4</b>	<b>5TuO.9.3,</b>
Tadaki, D.	<b>6WePo.3.8</b>	<b>5WeO.4.6</b>
Tadaumi, T.	<b>8TuO.11.5,</b>	<b>Takamura, Kenji</b>
	<b>7TuPo.10.4</b>	<b>7TuO.14.4,</b>
Tadokoro, H.	<b>4WePo.7.67LN</b>	<b>7TuPo.10.6</b>
Tadokoro, Hiroyuki	<b>4TuO.4.1</b>	<b>Takane, Y.</b>
Tagashira, K.	<b>2TuO.5.3</b>	<b>Takani, M.</b>
Taguchi, M.	<b>4WeO.19.1,</b>	<b>Takani, Masayoshi</b>
	<b>7TuPo.11.2</b>	<b>7TuPo.11.28LN</b>
Taima, T.	<b>6WePo.2.7,</b>	<b>Takano, Akihiro</b>
	<b>6WePo.3.25</b>	<b>7TuPo.11.28LN</b>
Taishi, T.	<b>3WePo.5.16</b>	<b>Takano, K.</b>
Tajima, M.	<b>4ThO.13.1</b>	<b>7WePo.10.6</b>
Tajima, S.	<b>3WeO.16.2,</b>	<b>Takano, Takafumi</b>
	<b>3TuPo.5.10</b>	<b>6WePo.4.12</b>
Takabayashi, Y.	<b>3TuPo.5.8</b>	<b>Takashima, S.</b>
Takabe, R.	<b>3TuPo.5.23,</b>	<b>1TuPo.2.26</b>
		<b>Takashima, T.</b>
		<b>8TuO.12.1,</b>
		<b>8WeO.11.3</b>
		<b>Takashima, Takumi</b>
		<b>8WePo.8.3</b>
		<b>Takato, H.</b>
		<b>1TuPo.1.17,</b>
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		<b>Takato, Hidetaka</b>
		<b>5TuPo.9.3,</b>
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		<b>Takeda, Y.</b>
		<b>3TuO.1.3,</b>
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		<b>5TuPo.8.15, 4WePo.7.5,</b>
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Takemoto, Yujin	<b>3TuPo.6.26</b>	Tanaka, Soichiro	<b>6ThO.10.5,</b>
Takenouchi, T.	<b>7TuPo.11.26LN</b>		<b>6WePo.3.15, 6WePo.3.18,</b>
Takeuchi, E.	<b>J3WeO.9.5,</b> <b>7TuPo.11.2</b>	Tanaka, T.	<b>6WePo.3.19</b>
Takeuchi, H.	<b>3WePo.5.20</b>	Tanaka, Tooru	<b>8WePo.9.24</b>
Takeuchi, W.	<b>1TuPo.1.29LN</b>	Tanaka, Y.	<b>1TuO.7.3</b>
Takeuchi, Y.	<b>2TuO.5.3,</b> <b>2WeO.14.1, 2TuPo.4.32</b>	Tang, yehua	<b>2TuPo.3.16,</b>
Takigawa, Y.	<b>8WePo.8.2</b>	Tang, Z.	<b>2TuPo.4.38</b>
Takiguchi, Y.	<b>8WePo.8.11</b>	Tangtrakarn, A.	<b>4TuPo.7.18</b>
Takimiya, K.	<b>6TuO.16.1</b>	Tani, A.	<b>3ThO.5.2,</b>
Takitani, K.	<b>8WeO.11.1,</b> <b>8WeO.11.4</b>	Tanikawa, T.	<b>3WePo.6.19</b>
Tallián, M.	<b>4WePo.7.69LN</b>	Tanimoto, Kenji	<b>6WePo.4.43LN</b>
Tamai, F.	<b>J3WeO.10.2</b>	Tanitsu, K.	<b>1WePo.1.12</b>
Tamai, Fujio	<b>7TuPo.10.1</b>	Taniwaki, S.	<b>1TuPo.2.16</b>
Tamai, Y.	<b>6WePo.2.26</b>	Tanizaki, A.	<b>4WePo.7.14</b>
Tamaki, K.	<b>6ThO.11.3</b>	Taratiwat, T.	<b>4WePo.7.22</b>
Tamaki, R.	<b>1WeO.2.2,</b> <b>1WeO.2.5, 1TuPo.1.20,</b> <b>1WePo.1.3, 1WePo.1.11</b>	Tarwal, N. L.	<b>2TuPo.4.17</b>
Tamakoshi, M.	<b>4TuPo.7.24</b>	Tatavarti, R.	<b>J4ThO.4.2</b>
Tamayo R., E. E.	<b>1TuPo.1.20</b>	Tatavarti, Rao	<b>8WePo.8.6</b>
Tampo, H.	<b>3MoRu.9.1,</b> <b>3TuO.1.6LN, 3TuPo.6.15,</b> <b>3WePo.5.13, 3WePo.6.23</b>	Tate, Keith	<b>6TuO.15.1</b>
Tampo, Hitoshi	<b>3WeO.16.3</b>	Tatebe, Kyohei	<b>4TuPo.7.63</b>
Tamura, T.	<b>8WePo.8.22,</b> <b>8WePo.8.24, 8WePo.8.25</b>	Tawaraya, Y.	<b>2TuPo.3.18</b>
Tan, H.	<b>2TuO.6.4,</b> <b>2WeO.13.1, 2WeO.13.3,</b> <b>2WeO.14.2, 1TuPo.2.6</b>	Tayagaki, T.	<b>1TuO.8.4,</b>
Tanabe, S.	<b>1TuPo.2.20</b>		<b>1TuPo.1.5, 1TuPo.1.10,</b>
Tanahashi, T.	<b>7ThO.3.2</b>		<b>1TuPo.1.13</b>
Tanahashi, Tadanori		Taylor, Charles	<b>5TuO.9.4</b>
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Tanaka, A.	<b>7TuPo.10.12,</b> <b>7TuPo.10.14, 9WePo.11.16LN</b>	Teerasak, S.	<b>7TuPo.11.13,</b>
Tanaka, H.	<b>3WePo.6.1</b>		<b>8WePo.8.8</b>
Tanaka, I.	<b>4WePo.7.37</b>	Tehare, K. K.	<b>6WePo.4.40LN</b>
Tanaka, J.	<b>6WePo.2.7</b>	Tempez, A.	<b>4WeO.18.3</b>
Tanaka, K.	<b>5TuPo.8.20,</b> <b>4WePo.7.36, 4WePo.7.40</b>	Terada, M.	<b>7TuPo.10.3</b>
Tanaka, Kazufumi	<b>7TuO.13.1</b>	Terada, N.	<b>3MoRu.9.1,</b>
Tanaka, M.	<b>1MoO.6.2,</b> <b>7TuPo.10.3</b>	Teraji, S.	<b>3WeO.16.2</b>
Tanaka, Naotaka	<b>4TuPo.7.31</b>	Terakawa, A.	<b>3ThO.5.2</b>
		Teranishi, H.	<b>1MoO.6.2,</b>
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		Terasawa, Toshiki	<b>1WeO.2.1</b>
		Tetreault, Nicolas	<b>1TuO.7.3</b>
		Tex, D. M.	<b>6ThO.10.5</b>
		Thaidigsmann, B.	<b>1WePo.1.13</b>
		Thajchayapong, P.	<b>4WeO.17.1</b>
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		Thanawala, Z.	<b>1TuPo.2.6</b>

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Thilakan, Periyasamy	Toyama, T.
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Thomas, T.	Toyonaga, Kotoba
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Thornley, P.	Toyota, Kouji
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Tian, Cong-sheng	Tozzi, A.
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Tiengpal, A.	Tranell, Gabriella
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Tiwari, A. N.	Trinh, Kieu Thanh
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Tiwari, Brajesh	Tripak, K.
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Tobita, Hiromi	Tripathi, Mridula
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Togonal, A. S.	Trompoukis, C.
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Tokioka, H.	Trout, T. J.
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Tokitoh, N.	Truong, Nguyen Tam Nguyen
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Toko, K.	Trupke, T.
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Toko, S.	Tsai, C. C.
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Tokuhisa, H.	Tsai, Cheng Han
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Tokunaga, K.	Tsai, Chih-Hung
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Tokuzawa, T.	Tsai, Din-Ping
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Tomar, Monika	Tsai, J. H.
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Tomasi, A.	Tsai, Min-An
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Tomić, S.	Tsai, Wei-Tseng
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Tomita, M.	Tsai, Y. F.
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Tomizawa, H.	Tsai, Yu-Lin
1WePo.1.29LN	1MoO.5.4
Tomizawa, Y.	Tsang, M.
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Tomizawa, Yuka	Tsang, S. C. E.
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Tondelier, D.	Tsao, Y. K.
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Tontapha, S.	Tsao, Yun-Kuo
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	Tsuda, Y.
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Tsuji, F.	<b>2TuPo.3.34</b>	Ueda, Y.	<b>8WePo.8.11, 8WePo.8.23, 8WePo.9.11</b>
Tsuji, S.	<b>7TuO.13.5</b>	Ueda, Yuzuru	<b>J3WeO.9.4</b>
Tsujino, K.	<b>4WePo.7.67LN</b>	Uedono, A.	<b>2TuPo.3.4</b>
Tsujino, Kazuya	<b>4TuO.4.1</b>	Uegaki, H.	<b>3WePo.6.19</b>
Tsukahara, D.	<b>3TuPo.5.20</b>	Uemura, Y.	<b>6WePo.2.10</b>
Tsukahara, Y.	<b>7TuPo.10.19</b>	Ueno, K.	<b>4WeO.18.4, 4WePo.7.8, 6WePo.3.12, 6WePo.3.22</b>
Tsukamoto, S.	<b>4WeO.17.5</b>	Ufheil, J.	<b>7WeO.8.3</b>
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Tsukamoto, Syota	<b>6ThO.9.2</b>	Ujiro, Takumi	<b>J3WeO.10.4</b>
Tsukamoto, T.	<b>4WePo.7.11</b>	Ujvari, G.	<b>7ThO.3.3</b>
Tsukidate, T.	<b>7TuPo.10.19</b>	Ujvari, Gusztav	<b>7TuPo.10.2</b>
Tsuno, Y.	<b>7ThO.3.4, 7TuPo.11.26LN</b>	Ulanski, J.	<b>1TuPo.2.22</b>
Tsunomura, T.	<b>4WeO.19.1</b>	Ulset, T.	<b>4ThO.13.5</b>
Tsurugai, M.	<b>8WeO.11.1</b>	Um, Youngho	<b>3TuPo.6.3</b>
Tsurumaki, H.	<b>6WePo.4.5</b>	Umeda, N.	<b>7TuO.14.5</b>
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Tsutsumi, T.	<b>7TuPo.10.19</b>	Umeshara, M.	<b>3TuO.1.3</b>
Tsuyuki, Y.	<b>2TuPo.4.25</b>	Umeno, M.	<b>1TuPo.2.12</b>
Tsuzaki, Shogo	<b>4WeO.18.2, 4WePo.7.7</b>	Uno, T.	<b>4WePo.7.31</b>
Turner, A.	<b>4WeO.19.3</b>	Unold, T.	<b>3TuO.1.1</b>
Tutashkonko, Sergii	<b>1TuPo.1.1, 1TuPo.1.16</b>	Unsur, Veysel	<b>4WePo.7.62</b>
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Uchida, K.	<b>1WePo.1.1, 8WePo.8.23</b>	Urabe, Shunsuke	<b>4TuPo.7.21</b>
Uchida, S.	<b>7ThO.1.4, 1WePo.1.1</b>	Uraoka, Y.	<b>4TuPo.7.39, 4WePo.7.26, 4WePo.7.32</b>
Uchida, Satoshi	<b>6ThO.10.2, 6WePo.4.25</b>	Urbano, José Antonio	<b>8WePo.9.10</b>
Uchida, Y.	<b>J3WeO.10.2, 7ThO.3.2</b>	Uruena, A.	<b>4WeO.19.4</b>
Uchida, Yasunori	<b>7TuPo.10.1</b>	Urushibata, K.	<b>4TuPo.7.36</b>
Uda, T.	<b>3WePo.5.23</b>	Usami, A.	<b>8WeO.11.1, 8WePo.8.14</b>
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Uddin, Ashraf	<b>6TuO.16.2</b>	Usami, Noritaka	<b>1TuPo.1.1, 1TuPo.1.16</b>
Udomdachanut, N.	<b>7TuPo.11.5, 8WePo.9.20, 8WePo.9.29</b>	Utsunomiya, K.	<b>7TuPo.11.18</b>
Ueda, J.	<b>1TuPo.2.20</b>	Uzum, Abdullah	<b>1TuPo.2.8, 4TuPo.7.16, 4WePo.7.14, 4WePo.7.15, 4WePo.7.17,</b>
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van der Velde, H.	<b>8TuO.11.3</b>	Wada, Takahiro	<b>3TuPo.5.26</b>
van Erven, A. J. M.	<b>2WeO.13.2</b>	Wägele, Leonard	<b>3MoO.4.5</b>
Van Nieuwenhuysen, K.		Wagner, Florian	<b>4WePo.7.44</b>
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van Sark, W. G. J. H. M.	<b>8TuO.11.3</b>	Wakamiya, A.	<b>6ThO.9.4,</b> <b>6WePo.3.21</b>
van Swaaij, R. A. C. M. M.	<b>2TuO.6.3, 2TuO.6.4</b>	Wakamiya, Shota	<b>1TuPo.1.15</b>
Vandamme, N.	<b>1WeO.2.2</b>	Wakao, S.	<b>8WeO.12.1,</b> <b>8WePo.8.22, 8WePo.8.24,</b> <b>8WePo.9.4, 8WePo.9.24</b>
Vanel, J. C.	<b>2TuPo.3.5</b>	Wakita, Kazuki	<b>3WePo.5.5,</b> <b>3WePo.6.9, 3WePo.6.22</b>
Varache, R.	<b>9WeO.6.5,</b> <b>4WePo.7.45</b>	Walukiewicz, Wladek	<b>1TuO.7.1,</b> <b>1TuO.7.3</b>
Varlamov, S.	<b>2TuPo.4.15</b>	Wang, C.	<b>6WePo.3.6</b>
Varlamov, Sergey	<b>2TuPo.4.3</b>	Wang, Chen-Lieh	<b>7TuPo.10.24LN</b>
Vasi, J.	<b>7WePo.10.10</b>	Wang, Chien-Chun	<b>4WePo.7.68LN</b>
Vasudevan, R.	<b>1TuPo.2.6</b>	Wang, Dianlei	<b>4TuPo.7.25,</b> <b>4WePo.7.21</b>
Vauche, L.	<b>3TuPo.6.11</b>	Wang, Dongliang	<b>2TuPo.4.28</b>
Vázquez, Manuel	<b>5TuPo.9.20</b>	Wang, F.	<b>2TuPo.4.18</b>
Veerhoek, J. M.	<b>1TuPo.1.4</b>	Wang, G. H.	<b>4TuPo.7.8</b>
Veldhuis, Hans	<b>9WePo.11.3</b>	Wang, Gonghou	<b>4WeO.17.3</b>
Velumani, S.	<b>3TuPo.5.7,</b> <b>3TuPo.6.1, 3TuPo.6.2</b>	Wang, Guanghong	<b>4WePo.7.46</b>
Velumani, Subramaniam	<b>2TuPo.4.4</b>	Wang, Haibin	<b>6TuO.16.5</b>
Venkataraj, S.	<b>2TuPo.3.10,</b> <b>3TuPo.5.2</b>	Wang, Jessica	<b>4TuO.3.4</b>
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Zhang, Dekun	<b>2TuPo.3.1, 2TuPo.3.7</b>
Zhang, De-kun	<b>2TuPo.4.23</b>
Zhang, G.-Q.	<b>7TuO.13.2</b>
Zhang, He	<b>4TuPo.7.4</b>
Zhang, J.	<b>2TuO.5.1, 2TuPo.3.39</b>
Zhang, K.	<b>6WePo.4.35</b>
Zhang, KangPing	<b>4TuO.4.2</b>
Zhang, Li	<b>3TuPo.6.13</b>
Zhang, Liping	<b>2TuPo.4.6, 2TuPo.4.28</b>
Zhang, N.	<b>3TuPo.5.21</b>
Zhang, Penfei	<b>1WePo.1.8</b>
Zhang, Shu	<b>4sMoO.1.4, 4TuO.4.2</b>
Zhang, Song	<b>4WePo.7.64</b>
Zhang, X.	<b>2TuPo.3.26, 2TuPo.3.39, 2TuPo.4.9, 2TuPo.4.10, 2TuPo.4.18, 2TuPo.4.40</b>
Zhang, XF.	<b>3WePo.6.10</b>
Zhang, Xiaodan	<b>2TuPo.3.1, 2TuPo.3.7, 2TuPo.3.38, 2TuPo.4.26</b>
Zhang, Xiao-dan	<b>2TuPo.4.23, 3TuPo.6.13</b>
Zhang, Xiaomei	<b>1TuPo.1.11</b>
Zhang, Xueling	<b>4sMoO.1.4, 4TuO.4.2</b>
Zhang, Y.	<b>3TuPo.5.13, 3WePo.6.15</b>
Zhang, Ye	<b>8WePo.8.9</b>
Zhang, Yingbin	<b>4sMoO.1.4</b>
Zhang, Yinghe	<b>6WePo.4.44LN</b>
Zhao, L.	<b>2TuPo.4.16, 4TuPo.7.8</b>
Zhao, Lei	<b>4WePo.7.46</b>
Zhao, Li	<b>2TuPo.4.1</b>
Zhao, P.	<b>7TuO.13.2</b>
Zhao, Y.	<b>2TuPo.3.26, 2TuPo.3.39, 2TuPo.4.9,</b>
	Zhao, Yan
	Zhao, Ying
	<b>2TuPo.3.7, 2TuPo.3.38, 2TuPo.4.23, 2TuPo.4.26, 3TuPo.6.13</b>
	Zheng, Qinglin
	Zhou, Andrew
	Zhou, Chunlan
	Zhou, H.
	Zhou, Shu
	Zhou, Su
	Zhu, J.
	<b>9WeO.6.5, 7ThO.3.3, 7TuPo.10.18, 7TuPo.11.12, 7WePo.10.5</b>
	Zhu, Lin
	Zhu, Y.
	Zi, Wei
	Zielinski, J.
	Zielke, D.
	Ziem, F.
	Zollondz, Jens-Hendrik
	<b>2ThO.8.2</b>
	Zomer, C.
	<b>8TuO.11.2</b>
	Zou, L.
	<b>4WePo.7.67LN</b>
	Zou, Liumin
	<b>4TuO.4.1</b>
	Zubillaga, O.
	<b>9WeO.6.5, 7ThO.3.3, 7WePo.10.5</b>



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