



PVSEC-33

33rd International Photovoltaic Science and
Engineering Conference

November 13-17, 2022 **Nagoya, Japan**



<https://www.pvsec-33.com>

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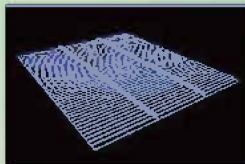
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NAMICS aims to be the Only one, Number one company in the field of electrochemical materials and will take on the challenge of new possibilities.

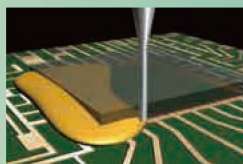
Examples of typical products



Metallization Paste for PV (HIMEC SOLAR)



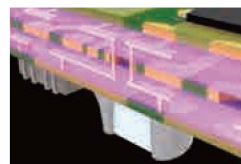
Heat-curing Solar Cell Surface and Back Electrode Agents (UNIMEC)



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Thin-Film Photovoltaic Research Consortium

The goal of the Thin Film Solar Cell Research Consortium is to accelerate the practical application of thin film solar cell technologies in general, and perovskite solar cells in particular. To that end, we invite companies in a wide range of fields, including material manufacturers and device manufacturers, to participate in this project to share information about user needs, standardization, safety, and social trends. The Consortium also carries out PR activities for solar cell and peripheral technologies.

<https://www.scl.kyoto-u.ac.jp/~wakamiya/consortium/index.html>



Disaster Tent with Perovskite Thin-Film Solar Cells

<https://www.youtube.com/watch?v=0lTXNcWWytY>



Compact storage



Unfold



Large Area

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Program Outline

| Date | Room | Shirotorii Hall | 141+142 | 133+134 | 431 | 432 | 131+132 | Event Hall | Shirotorii Hall |
|-----------------|-------------|---------------------------|-------------|---------|-----------------|-----------------|---------|------------|-----------------|
| Sun 13 Nov. | 10:00-11:45 | | | | Tutorial T-S-01 | Tutorial T-M-01 | | | |
| | 11:45-13:30 | | | | Lunch Break | | | | |
| | 13:30-15:15 | | | | Tutorial T-S-02 | Tutorial T-M-02 | | | |
| | 15:15-17:00 | | | | Tutorial T-S-03 | Tutorial T-M-03 | | | |
| Mon 14 Nov. | 08:30-10:00 | MoO-41a | MoO-31a | MoO-32a | MoO-42a | MoO-23a | | | |
| | 10:00-10:30 | | Break | | | | | | |
| | 10:30-12:00 | MoO-41b | MoO-31b | MoO-32b | MoO-42b | MoO-23b | | | |
| | 12:00-13:30 | | Lunch Break | | | | | | |
| | 13:30-15:30 | Opening Ceremony | | | | | | | |
| | 15:30-16:00 | Break | | | | | | | |
| Tue 15 Nov. | 16:00-18:00 | Opening Plenary | | | | | | | |
| | 08:30-10:00 | Plenary 1 (1-1, 2-1, 4-2) | | | | | | | |
| | 10:00-10:30 | | Break | | | | | | |
| | 10:30-12:00 | TuO-41c | TuO-31c | TuO-32c | | TuO-23d | | | |
| | 12:00-12:30 | | Lunch Break | | | | | | |
| | 12:30-13:00 | | | | | | | | |
| | 13:00-13:30 | | | | | | | | |
| | 13:30-15:00 | | | | | | | | |
| | 15:30-17:00 | TuO-41d | TuO-31d | TuO-32e | TuO-42c | TuO-21a | | | |
| | 17:00-17:30 | | Break | | | | | | |
| Wed. 16 Nov. | 17:30-19:00 | TuO-41e | TuO-31e | TuO-32f | TuO-42d | TuO-21b | | | |
| | 08:30-10:00 | Plenary 2 (2-2, 3-1, 4-1) | | | | | | | |
| | 10:00-10:30 | | Break | | | | | | |
| | 10:30-12:00 | WeO-41f | WeO-31h | WeO-32g | WeO-11a | WeO-22a | | | |
| | 12:00-13:00 | | Lunch Break | | | | | | |
| | 13:00-15:00 | | Break | | | | | | |
| | 15:30-17:30 | WeO-41g | WeO-31g | WeO-32h | WeO-12a | WeO-23c | | | |
| | 17:30-19:00 | | | | | | | | |
| | 19:00-21:00 | | Banquet | | | | | | |
| | 08:30-10:00 | ThO-41h | ThO-31h | ThO-32i | ThO-12b | ThO-22b | | | |
| Thu 17 Nov. | 10:00-10:30 | | Break | | | | | | |
| | 10:30-12:00 | ThO-41i | ThO-41j | ThO-32j | ThO-12c | ThO-22c | | | |
| | 12:00-13:30 | | Lunch Break | | | | | | |
| | 13:30-15:00 | Plenary 3 (1-2, 2-3, 3-2) | | | | | | | |
| | 15:00-16:00 | Closing Ceremony | | | | | | | |

※ Joint and Special Sessions are highlighted in yellow.

Session code

Mo 0 - 41 a

Day code

Mo: Monday, Nov. 14
 Tu: Tuesday, Nov. 15
 We: Wednesday, Nov. 16
 Th: Thursday, Nov. 17

Session type

O: Oral session
 P: Poster session

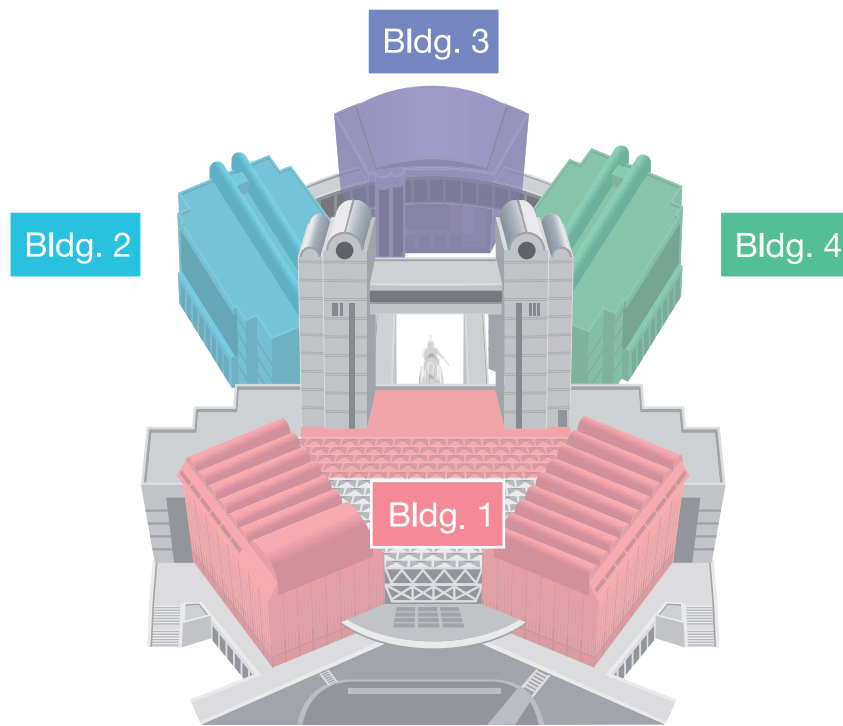
Sub area code

- 11: Policy, market and deployment
- 12: Energy management and related technologies
- 21: Solar to X
- 22: Advanced applications of photovoltaics
- 23: Field performance of photovoltaic systems and related issues
- 31: Water-based silicon photovoltaics and related technologies
- 32: Organic and inorganic thin-film photovoltaics, III-V high-efficiency devices and related technologies
- 41: Perovskite photovoltaics and related technologies
- 42: Emerging materials and game-change technologies

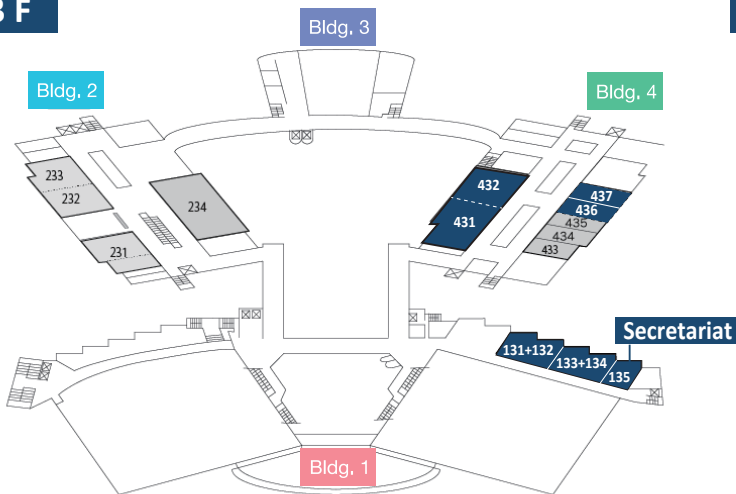
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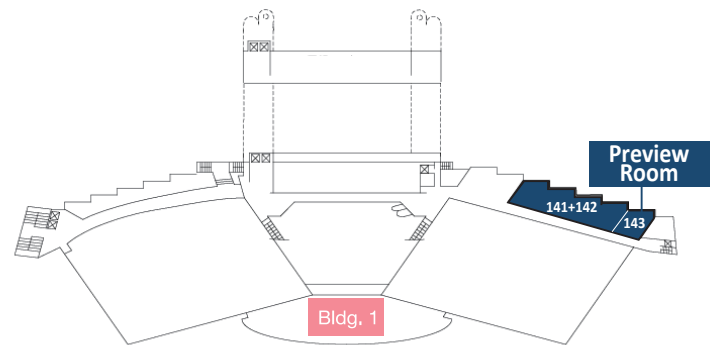
Floor Map



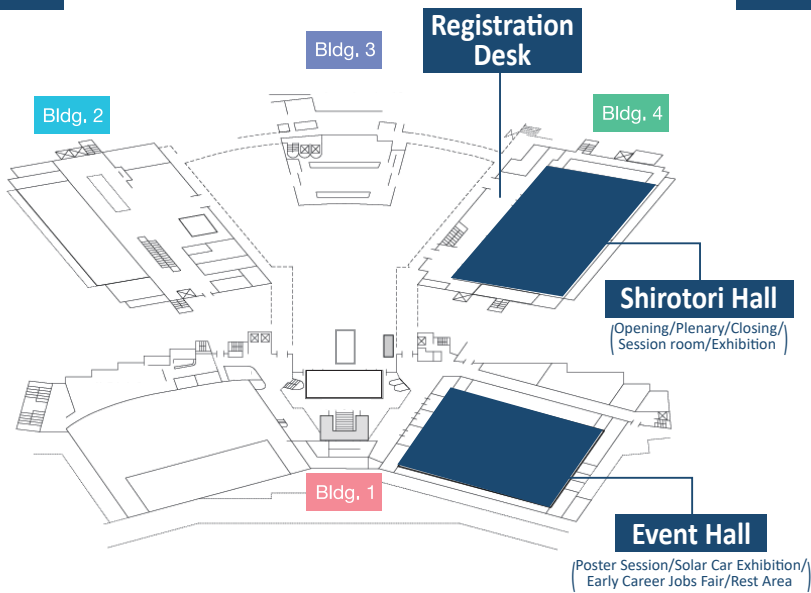
3 F



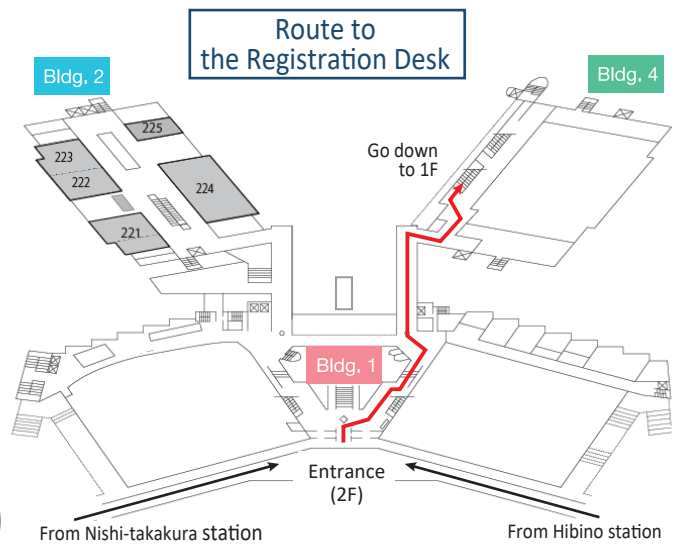
4 F



1 F



2 F





Noritaka Usami
Nagoya University

Message from the General Chair

On behalf of the Organizing Committee, I would like to invite you to participate in the 33rd International Photovoltaic Science and Engineering Conference (PVSEC-33), which will be held in Nagoya, Japan, from 13 to 17 November 2022. PVSEC-33 will be the largest and most comprehensive PV conference in 2022 in the Asia-Pacific region. PVSEC-33 will provide an excellent platform for the world's photovoltaic scientists and engineers to showcase and share the latest developments in solar PV technologies.

The program encompasses the full range of PV topics, including fabrication, characterization and simulation of PV materials, cells, modules and systems, and their reliability and policies. Furthermore, in the midst of growing expectations for renewable energy toward the realization of a decarbonized society, PVSEC-33 will deal with the “integration” and “extension” of PV technologies for mobility, buildings, agriculture, solar to X, and so on. The plenary and invited speakers are globally recognized experts in their respective fields.

As a conference in the new era with Corona, we will provide opportunities that both on-site and on-line participants can enjoy the conference to communicate with colleagues and old/new friends on new results and new ideas.

We look forward to seeing you at PVSEC-33.

宇佐美 徳隆



Atsushi Masuda
Niigata University

Message from the Program Chair

On behalf of the Technical Program Committee, I welcome you to the 33rd International Photovoltaic Science and Engineering Conference (PVSEC-33) in Nagoya, Japan. The Technical Program Committee for this conference consists of 4 areas including total 9 sub-areas. All of research and development fields in photovoltaics science and technology are included in this conference. Scope of this conference is very wide from fundamental physic and chemistry, cell and module materials and processes, new applications, system-related issues, market and policy issues, and so on. The characteristic themes of PVSEC-33 are “extension” and “integration” for the new era of photovoltaics. Areas 1 and 2 cover the theme of “extension”. Areas 3 and 4 are based on the theme of “integration”. Other than separate sessions on different topics, we wish integrate common topics from different fields into shared sessions to facilitate the exchange of ideas.

More than 700 research papers were submitted from all over the world. The program was prepared by 115 Technical Program Committee members under the leadership of sub-area chairs. These members also selected 15 plenary speakers and 37 invited speakers. After fair review processes, about 200 contributed papers were selected to oral presentation. I greatly appreciate much efforts of all the Technical Program Committee members.

Finally, I am profoundly grateful to plenary and invited speakers, oral and poster presenters, and fruitful discussion with all the participants. The success of this conference is not achieved without their huge contribution.

We look forward to seeing you at PVSEC-33.

増田淳

Awards

PVSEC Award (PVSEC-33)

The PVSEC Award will be presented for outstanding contributions to the development of photovoltaic science and technology. The recipient is selected by the PVSEC Committee, J-PVS, according to nominations.

The PVSEC Award (PVSEC-33, 2022) will be presented to:



Prof. Akira Yamada

Prof. Akira YAMADA received his Doctor of Engineering from Tokyo Institute of Technology in 1989. He is currently a Professor of Department of Electrical and Electronic Engineering at Tokyo Institute of Technology, Japan.

He started his research career from low-temperature Si epitaxy and entered the PV research field in 1991. In the very early stage of his career he studied on both amorphous Si solar cells and $\text{Cu}(\text{InGa})\text{Se}_2$ (CIGS) solar cells, and after several years later he focused his research subject on CIGS solar cells. He has consistently pursued the improvement of the heterojunction interface of CIGS solar cells, and developed several new buffer layers, such as Zn-In-Se, ZnMgO, and addressed the importance of a surface Cu-deficient layer. He received several paper awards from PVSEC according to these achievements. Recently, he is interested in combination of machine learning methods with device modeling.

In addition to these scientific activities, he made many key contributions to organization of international conferences. He was the general affair chair of PVSEC-9 (1996), the technical program chair of PVSEC-27 (2017) and the conference vice-chair of WCPEC-7 (2018), and he is currently a member of the international advisory committee of PVSEC. He has also devoted himself to the development of the PV communities. He was the general affairs of the Japan Society for the Promotion of Science (JSPS), the 175th Committee on Innovative Photovoltaic Power Generation Systems, and he is currently a director of the Japan Photovoltaic Society in charge of education and human resource development. Additionally, he has also led several NEDO photovoltaic R&D programs since 1999.

PVSEC Special Award (PVSEC-33)

The PVSEC Special Award will be presented for outstanding contributions to the growth of Photovoltaic Industrial Technology or who has been actively participating in Public-Policy-Making or the like. The recipient is selected by the PVSEC Committee, J-PVS, according to nominations.

The PVSEC Special Award (PVSEC-33, 2022) will be presented to:



Dr. Shigeru Niki

Dr. Shigeru Niki received his Ph. D. degree from University of California, San Diego in 1991. He is currently the director general of Sustainable Energy Unit, Technology Strategy Center, New Energy and Industrial Technology Development Organization (NEDO). He is also working as a guest professor at Yamagata Univ., Gifu Univ. and Kagoshima Univ.

He joined Electrotechnical Laboratory (ETL) in Apr. 1991, and started his career in the area of photovoltaics dedicating primarily to the CuInGaSe_2 (CIGS) technologies.

He first concentrated on the understanding of intrinsic properties of CIS. He succeeded in the growth of excellent-quality CIS epitaxial films and identified systematically the dominant intrinsic defects in CIS as V_{Cu} and defect complexes such as $V_{\text{Cu-Se}}$.

ETL was reorganized to National Institute of Advanced Industrial Science and Technology (AIST) in 2001. He shifted his research topics to the R&D of CIGS solar cells and modules. The activities of his group have been highly evaluated with outstanding achievements and unique approaches.

He was selected as a leader of NEDO's CIGS projects and led the Japan CIGS consortium with Solar Frontier and key universities. The consortium worked well providing good chemistry and useful collaboration among the participating organizations.

He became the deputy director of the Research Center (RC) for Photovoltaics in 2004 and became the director of the RC for Photovoltaic Technologies in 2013, and became the director of Renewable Energy RC in 2015. Throughout his career at AIST, he has dedicated to the promotion of collaborative research with industries and academia as well as the activation of global photovoltaic communities. He was a leader of AIST team at the 1st and 2nd Terawatt Workshop organized by NREL, Fh.G ISE and AIST.

He moved to NEDO in Feb. 2019, since then he has been engaged in the development of strategies in various energy-related fields including photovoltaics.

Awards

Hamakawa Award (PVSEC-33)

The Hamakawa 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 purpose of the award is to recognize scientists and engineers who have made outstanding research and technological accomplishment, and creativity of PV energy conversion. The recipient is selected by the PVSEC Committee, J-PVS, according to nominations.

The Hamakawa Award (PVSEC-33, 2022) will be presented to:



Prof. Shuzi Hayase

For his outstanding contributions to pioneering studies on perovskite solar cells.

Prof. Shuzi Hayase graduated from Osaka University in 1976 and received Ph.D from Osaka University in 1983. He joined R&D Center in Toshiba Corporation from 1978 to 2000, during which he joined polysilane research in Robert West group of Wisconsin University from 1988 to 1990. He engaged in the research on high-insulation materials, polysilane materials, high resolution lithography technology for LSI, fuel cells, solar cells and so on.

He was a professor of Kyushu Institute of Technology (National Institute) from 2001 to 2019. He promoted research on dye-sensitized solar cells and their solidification, and perovskite solar cells focused on Sn perovskite solar cells. From 2009 to 2017, he was a Supervisor of PRESTO project (Japan Science and Technology Agency (JST), "Photoenergy conversion systems and materials for the next generation solar cells" project), in which collective research on perovskite solar cells was organized by young researchers.

From 2016 to 2018, he was an Executive Director, Vice-President of Kyushu Institute of Technology. Since 2019, he is a professor of The University of Electro-Communications (National University in Tokyo). He received fellowship of The Society of Polymer Science, Japan, in 2020, Kamura Memorial Award in 2017, The Chemical Society of Japan Award for Technological Development, Awarded for distinguished contributions in technological development in chemical industry in 1992, and so on. His research interest is printable solar cells including perovskite solar cells.

Awards

PVSEC Award (PVSEC-32)

The PVSEC Award will be presented for outstanding contributions to the development of photovoltaic science and technology. The recipient is selected by the PVSEC-IAC according to nominations.

The PVSEC Award (PVSEC-32, 2022) will be presented to:



Prof. Chung-wen Lan

Prof. Lan is Distinguished Professor in Chemical Engineering at National Taiwan University (NTU) and Founder and Honorary Chairman of Taiwan Photovoltaic Industry Association (TPVIA).

He received his Ph.D. in Materials Science from the University of Wisconsin at Madison in 1991, where he started his research in crystal growth. He has been a senior consultant of Sino-American Silicon Products Inc. (SAS) since 2001 helping the company to develop PV silicon. From 2007 to 2010, he was General Director of Photovoltaics Technology Center at Industrial Technology Research Center (ITRI) and Chairman of TPVIA. He was also a consultant of a few companies including AUO, Solartech Energy, Sunshine PV, TGE Polysilicon, Gigasolar etc. for PV materials, solar cells, modules, and systems.

He developed high-performance multi-crystalline silicon for PV industry in 2011. This technology, based on uniform nucleation of small grains, became the main stream of silicon PV till 2018. Nowadays, more than 300 GWs of solar panels have been installed using this material. With this contribution, the International Organization for Crystal Growth (IOCG) awarded him the 2016 Laudise Prize, which is the highest honor in IOCG given triennially for technology. Even for the mono-crystalline silicon, main design concepts for highly-efficient pulling were proposed by him in 2004. His research group further proposed the $\text{Al}_2\text{O}_3/\text{SiNx}$ passivation structure in 2008 EU PVSEC, which has also been widely adopted by silicon PERC cells. Recently, his group also developed vapor phase texturing and inverted pyramid texturing methods for silicon wafers having potential industrial applications.

He was the founder of Bluestar Materials Co., a NTU startup company, for energy storage materials. His patented SiO technology has been adopted by Gigasolar Co. for mass production; SiO is an anode material that plays a crucial role in boosting the capacity of lithium-ion batteries used in electric vehicles and storages.

PVSEC Award (PVSEC-32)

The PVSEC Award will be presented for outstanding contributions to the development of photovoltaic science and technology. The recipient is selected by the PVSEC-IAC according to nominations.

The PVSEC Award (PVSEC-32, 2022) will be presented to:



Prof. Armin Gerhard Aberle

Prof Armin Aberle is currently the CEO of the Solar Energy Research Institute of Singapore (SERIS) at the National University of Singapore and the Director of two of the institute's R&D Clusters.

He entered the PV research field in 1986 when he joined the Fraunhofer Institute for Solar Energy Systems (Fraunhofer ISE) in Germany as a final-year thesis student, and then PhD student, to conduct fundamental investigations of surface recombination losses in crystalline silicon solar cells. He received his PhD in physics from the University of Freiburg in 1992. In the 1990s he was the Scientific Director of the Silicon PV Department at the Institute for Solar Energy Research (ISFH) in Hamelin, Germany. He then worked for 10 years as a faculty at the University of New South Wales (UNSW) in Sydney, Australia, researching novel c-Si thin-film solar cells on glass. In 2008 he joined NUS to establish SERIS, as the Deputy CEO and Director of the Silicon PV Department.

His research has covered the full spectrum from fundamental materials and device research to the industrial evaluation of novel PV technologies at the pilot line level and their transfer to industry. He performed pioneering research in the area of c-Si surface passivation, including the discovery that the effective surface recombination velocity S at thermal oxide passivated c-Si surfaces is light intensity (or injection level) dependent, the demonstration of the importance of fixed interface charges for low S values, the development of the concept of field effect passivation of c-Si solar cells, and the invention of the gate-enhanced solar cell.

He also developed low-temperature remote-plasma silicon nitride films giving record-low S values on Si wafers, invented a glass texturing method for thin-film PV modules, and developed three novel c-Si thin-film solar cells on glass.

Social Programs

(1) Conference Banquet

* Date: Nov. 16 (Wed) 19:00-21:00

* Venue: ANA CROWNE PLAZA Hotel Grand Court NAGOYA

* Style: Seating

(2) Excursion

* Nagoya Half Day Excursion

* Date: Nov. 18 (Fri)



◆Nagoya Castle◆

Nagoya Castle was completed in 1615 by the Shogun, Tokugawa Ieyasu. Topped with golden shachihoko, votive tiger-fish roof devices, and boasting the largest floorspace of any tower keep, Nagoya Castle and its magnificent Hommaru Palace were operated as a military facility. Nagoya Castle was Japan's first castle to be designated a National Treasure. Even after wartime air raid destruction, it was deemed historically important enough to be designated a National Historic Site. Restoration work being carried out is returning Nagoya Castle to original condition.

◆Mandara (Lunch)◆

A Japanese restaurant near Nagoya Castle. Let's enjoy Nagoya's specialty, Kishimen. Officially Kishimen is a type of Udon noodle that you may be familiar with, simply made from water, wheat, and salt. While the noodles themselves may be simple, that makes them great for a mixture of different sauces and soups to go along with it. Traditionally, Kishimen is served in a hot broth with various ingredients such as spinach, steamed fish cakes, deep-fried bean curd, topped off with some spring onion, and dry bonito flakes.

Tutorials

PVSEC33

PV Materials

Session Chair: Akira Yamada (Tokyo Inst. Technology, Japan)

Sun. Nov 13, 2022 10:00 AM - 5:00 PM 432 (Bldg. 4, 3F)

10:00 AM - 11:45 AM

[T-M-01] Solar Cells: Fundamental to application for carbon neutrality

Takashi Minemoto (Ritsumeikan Univ., Japan)

A solar cell is a promising electrical device for clean energy conversion. The scientific and technical area of solar cells are broad such as operation principle, theoretical limit (S-Q limit), single junction and tandem configuration, absorber materials (crystalline Si, CdTe, CIS, perovskite, organic thin-film, thin-film Si, etc.), module fabrication process, characterization, PV system, application, and system (FIT and FIP). In this tutorial, the overview of solar cell technology will be discussed.

1:30 PM - 3:15 PM

[T-M-02] Machine learning and its application to research and development of photovoltaics

– Materials informatics, process informatics and measurement informatics for PV –

Kentaro Kutsukake (RIKEN, Japan)

Today, machine learning, a method derives useful rules from data, is applied to the various research field in photovoltaics, including material search, process optimization, and material and device characterizations.

This tutorial will provide a survey of the machine learning applications to PV research, such as Bayesian optimization for process conditions and real-time prediction of material properties, as well as a brief introduction to machine learning.

3:15 PM - 5:00 PM

[T-M-03] Perovskite solar cells – Fundamentals and applications –

Shuzi Hayase (Univ. Electro-Communications, Japan)

The certified efficiency of the Pb perovskite solar cell is 25.5 % and is approaching the 26.7% of the single crystalline Si solar cells. It is incredible that the high efficiency was achieved by the cell prepared with a simple low temperature-printing process, where a lot of impurities should remain in the film. The fundamental for the high efficiency is discussed from the viewpoint of the defect tolerance properties. In addition, the recent research trends of the perovskite tandem cells and Pb free perovskite solar cells are reviewed, and the issues to be solved are disclosed. The enhancement of the efficiency for the Sn and SnPb perovskite solar cells expected as the

perovskite tandem cells is discussed, while comparing it with the Pb perovskite. Finally, the new applications of these solar cells are reviewed.

PVSEC33

PV Systems

Session Chairs: Takahito Nishimura (Tokyo Inst. Technology, Japan), Takashi Oozeki (National Inst. Advanced Industrial Science and Technology, Japan)

Sun. Nov 13, 2022 10:00 AM - 5:00 PM 431 (Bldg. 4, 3F)

10:00 AM - 11:45 AM

[T-S-01] Reliability and testing of PV modules

Tadanori Tanahashi¹, Kengo Morita² (1. National Inst. Advanced Industrial Science and Technology, Japan, 2.PVSQ Management, Japan)

Strong market expansion in the PV sector towards achieving carbon neutrality requires easy access to reliable information on the performance and durability of PV systems. The first part of this session will present the current status of these indicators, as reviewed and reported by the global experts in the International Energy Agency (IEA) PVPS Task 13 (<https://iea-pvps.org/research-tasks/performance-operation-and-reliability-of-photovoltaic-systems/>). And in the following part, the accurate performance evaluation cases in the field for the both total system level and individual module level will be introduced. Additionally, we will discuss the repowering process by replacing the defective facility (PV module etc.), which results in the increase of the generated energy.

1:30 PM - 3:15 PM

[T-S-02] PV power forecasting and its uncertainty

Hideaki Ohtake (National Inst. Advanced Industrial Science and Technology, Japan)

Weather forecasting technology, which is the base technology for PV power forecasting, will be presented. In recent years, large errors in PV power forecasts have become an issue in power grid operations. In the field of PV power forecasting, the uncertainty of the forecast is being discussed. Technical issues related to ensemble forecasting, in which multiple forecasts are made, will also be introduced.

3:15 PM - 5:00 PM

[T-S-03] Promising new applications of photovoltaic– Solar to X, building integrated PV, vehicle integrated PV, agrivoltaic –

Kensuke Nishioka (Univ. Miyazaki, Japan)

PV technologies have evolved rapidly and high-quality products are available at low cost. Challenges to new applications of PV are indispensable for the further spread of PV. This tutorial describes solar to X, building integrated PV, vehicle integrated PV, and agrivoltaic, which are

promising new applications for PV. We hope that you will feel that the basic technologies of PV are useful for the latest applications.

Co-organizers, Co-sponsors, Supporting Organizations

(This list is in no particular order.)

Co-organizers

The Japan Photovoltaic Society (J-PVS)

The Institute of Electrical Engineers of Japan (IEEJ)

Co-sponsors

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The Japan Society for Aeronautical and Space Sciences (JSASS)

The Chemical Society of Japan (CSJ)

The Electrochemical Society of Japan (ECSJ)

JAPAN SOLAR ENERGY SOCIETY (JSES)

Nagoya University

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Photovoltaic Power Generation Technology Research Association (PVTEC)

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Japan Photovoltaic Energy Association (JPEA)

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New Energy Foundation (NEF)

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Aichi Science and Technology Foundation

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Area Chair: Yasuaki Ishikawa (Aoyama Gakuin Univ., Japan)

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Sub-area Chair: Takuya Matsui (AIST, Japan)

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China)

Special Events

(1) NEDO Project Special Exhibition (Event Hall, Nov. 15-16)

We will exhibit the Toyota Prius PHV and Nissan eNV200, which are experimental vehicles equipped with high-efficiency triple-junction compound solar cells developed by Sharp as part of a NEDO project.



June 6, 2022

Sharp achieves world's highest conversion efficiency of 32.65% in a lightweight, flexible, practically sized solar module.



July 4, 2019

NEDO, Sharp, and Toyota to begin public road trials of electrified vehicles equipped with high-efficiency solar batteries.



July 6, 2020

Solar panels manufactured by Sharp (31.17%) for electrified vehicles.

(2) Solar Car Exhibition (Event Hall, Nov. 15-16)

NITech Solar Car Club will exhibit their solar car.

From the applied research at the Umeno Laboratory (Emeritus professor Masayoshi Umeno, Honorary member of PVSEC International Advisory Committee), the NITech Solar Car Club started in 1995.

The solar car they are developing is the ultimate eco-car, which is actually driven by a human and runs solely on the solar energy. However, since the energy of sunlight varies depending on the weather and time of day, the obtained energy is not constant, and the energy consumed by the motor also changes depending on the resistance of the vehicle body and the running speed. When developing a solar car, it is necessary to efficiently convert sunlight into electricity and drive with lower fuel consumption. In general, they aim to meet these requirements by using highly efficient

solar panels, reducing air resistance and vehicle weight.



The solar car race is a so-called "endurance race". Energy management holds the key to victory during the race, and energy management tactics are what make solar car racing so interesting. NITech Solar Car Club participates in the "FIA Electric & New Energy Championship Solar Car Race Suzuka (the highest class in Japan)" held at Suzuka Circuit and the "Bridgestone World Solar Challenge (the world's highest class)" held in Australia.

(3) Networking lunch for women in photovoltaics
(Rooms 431 and 432, Nov. 15, 12:30-13:30)

Admission is charged with pre-registration.

Style: Hybrid (Onsite & Zoom)

Onsite participation includes a lunch box (Regular or Vegetarian).

This event would be good opportunity for young women in this field to feel closer to senior women (role models) working in the field of photovoltaics and also good opportunity for all participants for networking.

Main schedule

- * Presentation from role models (women working in the field of photovoltaics etc.) during lunch time.
- * Free talking with participants (e.g. ~6 persons/group) after lunch time.

(4) Early Career Jobs Fair

(Event Hall, Nov. 15: 10:30-17:00, Nov. 16: 10:30-15:00)

PVSEC-33 provides the opportunity of job hunting for PhD students or young researchers. You can find the information on jobs related with photovoltaics there. PVSEC-33 also provides a place where the company's HR staff can interview job seekers directly.



IEA PVPS workshops at PVSEC-33 –Nagoya, Japan

- Organizer : IEA PVPS
- Supporting organization : NEDO
- Date :Tuesday, 15th Nov., 2022
- Venue : 131/132, 3F, 1st Bldg., Nagoya Congress Center (Onsite only)
- Participants need to register PVSEC-33 For more details : <https://pvsec-33.com/index.html>

10:30 - 12:00 Task 1 Workshop: “Enablers of emerging PV technologies”

Session Chair: Arnulf Jäger-Waldau, EC JRC, Task 1 and Task 14 expert of IEA PVPS

Description: PV cumulative capacity reached 1TW in 2022 and PV is expected contribute the pathway to achieve carbon neutral. In addition to conventional application such as ground mounted PV systems and rooftop PV systems, the markets of emerging application such as BIPV, VIPV, and FPV are expected to grow. However, obstacles and challenges of these application still remains. In this workshop, enablers of these technologies will be discussed from regulatory, policy and technological aspects.

Planned Program:

Gaëtan Masson, IEA PVPS Task 1 Manager/ Becquerel Institute, Belgium, “Trends of global PV market and emerging PV”

Daniel Mugnier, IEA PVPS Chair/TECSOL, France, “French approach to promote BIPV”

Kazuhiko Umeda, Taisei Corporation, Japan, “Architectural issues and introduction of the latest technology of BIPV in Japan”

Izumi KAIZUKA, RTS Corporation, Japan, “Floating PV trends”



15:30 - 17:00 Task 17 Workshop: “PV contribution to the transport sector”

Session Chair: Keiichi Komoto, MHRT, Task 17 Task Manager

Description: A potential of PV market in the transport will be large, and the market will be the next driving force for the further development of PV. In order to mitigate CO₂ emission in the transport sector, promoting electrified vehicles is suggested as an effective option. Taking into account the WTW emissions, a mutual exploitation of PV and electrified vehicles with battery should be a key, as well as for deployment of PV in the transport. In this workshop, expected impacts and requirements for possible options; VIPV (vehicle integrated PV) and PVSC (PV charging station) will be discussed.

Planned Program:

Keiichi Komoto, MHRT, Japan, Introduction

Bonna K. Newman, TNO, the Netherlands, “Status of VIPV Technology in the Netherlands and Beyond”

Benjamin Commault, CEA, France, “On-board photovoltaic kit for Existing Vehicles”

Manuela Sechilariu, UTC, France, “DC microgrid powered EV charging station versus public grid powered EV charging station”

N. J. Ekins-Daukes, UNSW, Australia, “Electric bus charging using PV”

Kenji Araki, University of Miyazaki, Japan, “VIPV – Real performance and real benefit to society”

17:30 - 19:00 Task 12 Workshop: “PV recycling related research from IEA PVPS Task12: PV Sustainability”

Session Chair: Garvin Heath, NREL, Task 12 Task Manager and Keiichi Komoto, MHRT, Task12 expert

Description: With PV deployment increasing exponentially, the number of PV modules that reach the end of useful life will also increase, accumulating proportionately as waste after the time lag of operation. When a product cannot be repaired or reused, recycling is the next preferable option before disposing as waste. PV module recycling has become an important emerging and strategic topic, with numerous global, regional, and country-specific activities conducted and developed by governments, organizations, and companies in recent years. In this workshop, a current status and a challenge to overcome will be discussed.

Garvin Heath, NREL, USA, “PV circularity and high value recycling of c-Si PV modules”

Yansong Shen, UNSW, Australia, “Metallurgy-inspired end of life solar panel recycling: process modelling and optimization”

Nicolas Defrenne, Soren, France, “EOL management of PV module in Europe (TBC)”

Keiichi Komoto, MHRT, Japan, “Current status of PV recycling in PVPS Task12 countries”

More information: Izumi KAIZUKA, Task 1 Deputy Manager kaizuka@rts-pv.com

3rd Asian Nations Joint Workshop on Photovoltaics

Nov. 18th, 2022
Nagoya Nogakudo Noh Theater, Japan

3rd Asian Nations Joint Workshop on PV

【Organizer】The Japan Photovoltaic Society (J-PVS)

【Date】Nov. 18th, 2022

【Venue】[Nagoya Nogakudo Noh Theater](#)

【Registration fee】Free

【Requirement for participation】J-PVS member or Participant of PVSEC-33

| SESSION 1: | | | Chair: Atsushi Masuda (Niigata Univ.) | |
|------------|-----|------|--|---|
| 13:00 | 1.1 | 0:05 | Noritaka Usami (Nagoya Univ., Japan) | Welcome address |
| 13:05 | 1.2 | 0:25 | Izumi Kaizuka (RTS Corporation/Task 1 IEA PVPS, Japan) | Trends of Global PV market and industry |
| 13:30 | 1.3 | 0:25 | Nicholas Ekins–Daukes (UNSW, Australia) | Opportunities to Increase the Efficiency of Solar PV |
| 13:55 | 1.4 | 0:25 | Perumalsamy Ramasamy (SSN Institutions, India) | Current scenario of silicon crystal growth activities in India for PV applications |
| 14:20 | 1.5 | 0:25 | Shigeru Niki (NEDO, Japan) | Japan's Green Growth Strategy and Expectations for Next-Generation Photovoltaic Technology |
| 14:45 | 1.6 | 0:25 | Donghwan Kim (Korea Univ., Korea) | Fabrication of perovskite/silicon tandem solar cells via industry-compatible processing methods |
| 15:10 | | 0:30 | Break | |
| SESSION 2: | | | Chair: Donghwan Kim (Korea Univ.) | |
| 15:40 | 2.1 | 0:25 | Amin Nowshad (Universiti Tenaga Nasional, Malaysia) | The Vertical Growth of PV Activities in Malaysia's New Energy Transition Roadmap |
| 16:05 | 2.2 | 0:25 | Armin Gerhard Aberle (National Univ. Singapore, Singapore) | Research, development and deployment of solar energy in Singapore |
| 16:30 | 2.3 | 0:25 | Chung-Wen Lan (National Taiwan Univ., Chinese Taipei) | My 20-year journey in the global PV rush |
| 16:55 | 2.4 | 0:25 | Amornrat Limmanee (NSTDA, Thailand) | Status and Trends in Solar Power Plants in Thailand |
| 17:20 | 2.5 | 0:05 | | Closing Remarks |

Technical Program

Opening Ceremony, Opening Plenary, Award Ceremony

Session Chairs: Izumi Kaizuka (RTS Corp., Japan), Makoto Konagai (Tokyo City Univ., Japan)

Mon. Nov 14, 2022 1:30 PM - 3:30 PM Shirotori Hall (Bldg. 4, 1F)

Opening Address 1:30 PM - 1:35 PM

Noritaka Usami (General Chair of PVSEC-33, Nagoya Univ.)

Welcome Address 1:35 PM - 1:40 PM

Hideaki Ohmura, Governor of Aichi Prefecture

Opening Plenary 1:40 PM - 2:00 PM

(INVITED) NEDO's photovoltaic R&D activities

Mitsuhiro Yamazaki (New Energy and Industrial Technology Development Organization, Japan)

Opening Plenary 2:00 PM - 2:30 PM

(INVITED) TBD

Yukari Takamura (Univ. Tokyo, Japan)

Award Ceremony 2:30 PM - 3:30 PM

Opening Plenary

Session Chairs: Atsushi Masuda (Niigata Univ., Japan), Akira Yamada (Tokyo Inst. Tech., Japan)
Mon. Nov 14, 2022 4:00 PM - 6:00 PM Shirotori Hall (Bldg. 4, 1F)

Opening Plenary 4:00 PM - 4:30 PM

(INVITED) Activities toward carbon neutrality at Toyota

Koichi Nakata (Toyota Motor Corp., Japan)

Opening Plenary 4:30 PM – 5:00 PM

(INVITED) Towards low cost and sustainable PV systems at the TW scale

Brett Hallam (Univ. New South Wales, Australia)

Opening Plenary 5:00 PM – 5:30 PM

(INVITED) Research directions in perovskite solar cells

Nam-Gyu Park (Sunkyunkwan Univ., Korea)

Opening Plenary 5:30 PM – 6:00 PM

(INVITED) Perovskite/Si tandem solar cells with 30% efficiency

Lars Korte¹, Eike Köhnen¹, Bor Li¹, Silvia Mariotti¹, Marcel Roß¹, Kári Sveinbjörnsson¹, Philipp Tockhorn¹, Philipp Wagner¹, Fengjiu Yang¹, Ke Xu¹, Christiane Becker¹, Eva Unger^{1,2}, Bernd Stannowski¹, Steve Albrecht^{1,3} (1. Helmholtz-Zentrum Berlin für Materialien und Energie, Germany, 2. Humboldt Univ. Berlin, Germany, 3. Technische Univ. Berlin, Germany)

Plenary I

Session Chairs: Keiichi Komoto (Mizuho Research & Technologies, Ltd., Japan), Katsushi Fujii (RIKEN, Japan), Tsutomu Miyasaka (Toin Univ. Yokohama, Japan)

Tue. Nov 15, 2022 8:30 AM - 10:00 AM Shirotori Hall (Bldg. 4, 1F)

Plenary (Sub-area 1-1) 8:30 AM - 9:00 AM

(INVITED) Major innovative trends to address the multi TW challenge

Daniel Mugnier (IEA PVPS, France)

Plenary (Sub-area 2-1) 9:00 AM - 9:30 AM

(INVITED) From solar power to chemicals. System challenges of scaling up CO₂ electrochemical conversion in industry

Andrea Ramirez Ramirez (Delft Univ. Technology, The Netherlands)

Plenary (Sub-area 4-2) 9:30 AM - 10:00 AM

(INVITED) Halide perovskites as a space photovoltaic technology: Evaluating radiation hardness

Joseph M. Luther (National Renewable Energy Lab., USA)

Plenary (Sub-area 1-1) 10:00 AM - 10:15 AM

(INVITED) Indian scenario of photovoltaics

Vineet Saini (Ministry of Science and Technology, India)

Plenary II

Session Chairs: Noren Pan (MicroLink Devices, USA), Takuya Matsui (National Inst. Advanced Industrial Science and Technology, Japan), Shuzi Hayase (Univ. Electro-Communications, Japan), Takaya Kubo (Univ., Tokyo, Japan)

Wed. Nov 16, 2022 8:30 AM - 10:00 AM Shirotori Hall (Bldg. 4, 1F)

Plenary (Sub-area 2-2) 8:30 AM - 9:00 AM

(INVITED) Application of high efficiency lightweight solar cells to stratospheric uninhabited air system (UAS)

Paul Stevens (Voltitude Ltd., UK)

Plenary (Sub-area 3-1) 9:00 AM - 9:30 AM

(INVITED) Passivating contacts for highest efficient silicon solar cells and beyond
Martin Hermle, Armin Richter, Martin Bivour, Jana Isabel Polzin, Jan Benick, Stefan W. Glunz
(Fraunhofer Institute for Solar Energy Systems, Germany)

Plenary (Sub-area 4-1) 9:30 AM - 10:00 AM

(INVITED) Tin perovskite solar cells and photovoltaic CO₂ reduction

Eric Wei-Guang Diau (National Yang Ming Chiao Tung Univ., Taiwan)

Plenary III

Session Chairs: Masakazu Ito (Univ. Fukui, Japan), Hiromi Tobita (Japan Electrical Safety & Environment Technology Labs., Japan), Yoshitaro Nose (Kyoto Univ., Japan)

Thu. Nov 17, 2022 1:30 PM - 3:00 PM Shirotori Hall (Bldg. 4, 1F)

Plenary (Sub-area 1-2) 1:30 PM - 2:00 PM

(INVITED) Evolution of PV power generation and augmented energy management

Hideo Ishii (Waseda Univ., Japan)

Plenary (Sub-area 2-3) 2:00 PM - 2:30 PM

(INVITED) Performance monitoring and inspection of PV modules and strings

Yoshihiro Hishikawa (Ritsumeikan Univ., Japan)

Plenary (Sub-area 3-2) 2:30 PM - 3:00 PM

(INVITED) First principles investigation of defect control in chalcogenide thin film solar cell materials

Su-Huai Wei (Beijing Computational Science Research Center, China)

Area 1: Policy, market, deployment, energy management, and related technologies

Sub-area 1-1: Policy, market and deployment

[TuP-11] Policy, Market and Deployment

Tue. Nov 15, 2022 12:00 PM - 3:00 PM P-11/Event Hall (Bldg. 1, 1F)

[TuP-11-01]

1 TW of photovoltaic system capacity in the European Union by 2030 – Where to install it

Arnulf Jäger-Waldau, Georgia Kakoulaki, Rocio Gonzalez Sanchez, Sandor Szabo (European Commission, Joint Research Center, Italy)

[TuP-11-02]

Forecasting PV installed capacity in Japan toward FY 2030

Koichi Sugibuchi, Haruki Yamaya, Risa Kurihara, Izumi Kaizuka, Osamu Ikki (RTS Corp., Japan)

[TuP-11-03]

Potential evaluation of economic and resiliency in P2P electricity transaction among prosumers with PV and battery

Yuta Nakamura (Nagoya Inst. Tech., Japan)

[TuP-11-04]

Study on the effectiveness of rooftop rental model for PV installation into residential area

Yuki Nishida, Shinji Wakao (Waseda Univ., Japan)

[TuP-11-05]

Changes in energy consumption of residential buildings according to measured lighting and plug load patterns

Ruda Lee, Minjoo Choi, Dongsu Kim, Jongho Yoon (Hanbat National Univ., Korea)

Area 1: Policy, market, deployment, energy management, and related technologies

Sub-area 1-1: Policy, market and deployment

[WeO-11a] Policy, Market and Deployment

Session Chairs: Izumi Kaizuka (RTS Corp., Japan), Annick Anctil (Michigan State Univ., USA)

Wed. Nov 16, 2022 10:30 AM - 12:00 PM 431 (Bldg. 4, 3F)

[WeO-11a-01] 10:30 AM – 11:00 AM

(INVITED) Market developments and challenges in Australia

Linda Koschier¹, Renate Egan² (1. Australian Photovoltaic Inst., Australia, 2. Univ. New South Wales, Australia)

[WeO-11a-02] 11:00 AM – 11:15 AM

The European solar communication – Will it pave the road to achieve 1 TW of photovoltaic system capacity in the European Union by 2030?

Arnulf Jaeger-Waldau, Anatoli Chatzipanagi (European Commission, Joint Research Center, Italy)

[WeO-11a-03] 11:15 AM – 11:30 AM

Comparative techno-economic assessment of PV manufacturing in different Asian countries

Philippe Macé, Monica Aleman, Elina Bosch, André Penas, Eloïse Taurel, Adrien Van Rechem, *Gaëtan Masson (Becquerel Inst., Belgium)

[WeO-11a-04] 11:30 AM – 11:45 AM

Economic and environmental evaluation of the next generation of tandem PV devices

Alessandro Martulli¹, Neethi Rajagopalan^{2,7}, Fabrizio Gota³, Ulrich Wilhelm Paetzold³, Toby Meyer⁴, Cesar Omar Ramirez Quiroz^{5,6}, Robert Malina¹, Bart Vermang^{1,7,8}, Sebastien Lizin¹ (1. Hasselt Univ., Belgium, 2. VITO, Belgium, 3. Karlsruhe Inst. Tech., Germany, 4. Soloronix, Switzerland, 5. FOM Technologies, Denmark, 6. NICE Solar Energy, Germany, 7. IMEC, Belgium, 8. EnergyVille, Belgium)

[WeO-11a-05] 11:45 AM – 12:00 PM

Lifecycle assessment of CO₂ emission and energy payback time of photovoltaic systems in Japan

Yusuke Kumano¹, Shigeru Niki¹, Keiichi Komoto², Naoto Takatsu², Yuzuru Ueda³ (1. New Energy and Industrial Technology Development Organization, Japan, 2. Mizuho Research & Technologies, Ltd., Japan, 3. Tokyo Univ. Science)

Area 1: Policy, market, deployment, energy management, and related technologies

Sub-area 1-1: Policy, market and deployment

[WeP-11] Policy, Market and Deployment

Wed. Nov 16, 2022 12:00 PM - 3:00 PM P-11/Event Hall (Bldg. 1, 1F)

[WeP-11-01]

Trends in PV applications - The latest survey results on PV markets and policies from the IEA PVPS Programme in 2021

Gaetan Masson^{1,2}, Izumi Kaizuka³, Arnulf Jaeger-Waldau⁴, Johan Lindahl⁵, José Donoso⁶ (1. IEA PVPS, 2. Becquerel Inst. Belgium, 3. RTS Corp., Japan, 4. European Commission, Joint Research Center, Italy, 5. Becquerel Sweden, Sweden, 6. UNEF, Spain)

[WeP-11-02]

Potential of non-FIT business models in Japanese PV market: Self consumption and Corporate PPAs

Izumi Kaizuka, Yoshiyuki Ohashi, Koichi Sugibuchi, Haruki Yamaya, Satsuki Kanai, Osamu Ikki (RTS Corp., Japan)

[WeP-11-03]

Electricity price forecasting method for the JEPX spot market based on ARIMA model

Xue Fang¹, Jindan Cui¹, Bo Jie¹, Takashi Oozeki², Yuzuru Ueda¹ (1. Tokyo Univ. Science, Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan)

[WeP-11-04]

Thailand PV policy and PV applications activity in the energy reformation era

Tanokkorn Chenvidhya, Yaowanee Sangpongsanont, Manit Seapan, Ballang Muenpinij, Dhirayut Chenvidhya (King Mongkut's Univ. Technology Thonburi, Thailand)

[WeP-11-05]

Energy reforming and solar growth in Thailand

Dusit Kruangam, Songpakit Kaewniyompanit (Thailand Photovoltaic Industries Association, Thailand)

[WeP-11-06]

International collaboration for standardization (testing and rating) for VIPV

Kenji Araki¹, Liang Ji², George Kelly³, Zi Ouyang⁴, Mauro Pravettoni⁵, Ignacio Antón⁶, Masahiro Yoshita⁷, Joshua Stein⁸, Harald Müllejjans⁹, Daisuke Sato¹⁰, Keizo Asaoka¹¹, Yasuyuki Ota¹, Kensuke Nishioka¹ (1. Univ. Miyazaki, Japan, 2. UL, USA, 3. Sunset Technology, USA, 4. AGG

Energy, China, 5. Solar Energy Research Inst. Singapore, Singapore, 6. Univ. Politécnia de Madrid, Spain, 7. National Inst. Advanced Industrial Science and Technology, Japan, 8. Sandia National Lab., USA, 9. European Solar Test Installation, Italy, 10. Nagaoka Univ. Technology, Japan, 11. Japan Electrical Safety & Environment Technology Lab., Japan)

Area 1: Policy, market, deployment, energy management, and related technologies

Sub-area 1-2: Energy management and related technologies

[TuP-12] PV System and Forecast

Tue. Nov 15, 2022 12:00 PM - 3:00 PM P-12/Event Hall (Bldg. 1, 1F)

[TuP-12-01]

Intelligent lighting control of greenhouses with a PV system with battery energy storage: Forecasting of solar power production

Jorge Solis¹, Dwinanri Egyna¹, Isac Myrén Andersson², Magnus Nilsson², Karl-Johan Bergstrand³
(1. Karlstad Univ., Sweden, 2. Glava Energy Center, Sweden, 3. Swedish Univ. Agricultural Sciences, Sweden)

[TuP-12-02]

Development of photovoltaic power forecasting (PVPF) by deep learning convergence and PVPF research trends

Seungtae Lee, Sang-Won Lee, Ji Seong Hwang, Hae-Seok Lee, Yoonmook Kang, Donghwan Kim (Korea Univ., Korea)

[TuP-12-03]

Estimation of solar radiation using satellite images and a data-driven radiative transfer model

Jun Sasaki, Kenji Utsunomiya, Maki Okada, Shigeyuki Yoshikawa, Koji Yamaguchi (Japan Weather Association, Japan)

[TuP-12-04]

Forecast error estimation of PV power plants based on deep reinforcement learning

Kurumi Itoi¹, Jindan Cui¹, Takashi Oozeki², Yuzuru Ueda¹ (1. Tokyo Univ. Science, Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan)

[TuP-12-05]

Identifying the most relevant meteorological inputs using Pearson correlation coefficient on LSS plant Gambang and LSS plant Sepang, Malaysia

Nabilah Mat Kassim¹, Abdulwahab A. Q. Hasan¹, Sathiswary Santhiran¹, Ammar Ahmed Alkahtani¹, Mohammad Aminul Islam², Tiong Siew Kiong¹, Mohd Yusrizal Mohd Yusof³, Nowshad Amin¹ (1. Univ. Tenaga Nasional, Malaysia, 2. Univ. Malaya, Malaysia, 3. TNB Renewables Sdn. Bhd., Malaysia)

[TuP-12-06]

An accurate nowcast model of solar irradiance retrieval from satellite data

Akira Usami (Central Research Inst. Electric Power Industry, Japan)

[TuP-12-07]

Prediction of large forecast error of solar irradiance by variation of forecast values with different combinations of physical schemes

Misaki Kawai¹, Takeyoshi Kato¹, Fumichika Uno² (1. Nagoya Univ., Japan, 2. Nihon Univ., Japan)

[TuP-12-09]

Day-ahead photovoltaic power forecasting for microgrid system operation

Daigo Usami¹, Yutaka Sasaki¹, Sho Enomoto¹, Yoshifumi Zoka¹, Naoto Yorino^{1,2} (1. Hiroshima Univ., Japan, 2. National Inst. Technology (KOSEN), Kure College, Japan)

[TuP-12-10]

Quantile regression technologies for headroom control of photovoltaic power generation to create flexibility

Takashi Oozeki, Hideaki Ohtake, Takahiro Takamatsu, Koh Nakajima, Jun Hashimoto, Kenji Otani (National Inst. Advanced Industrial Science and Technology, Japan)

[TuP-12-11]

Probabilistic forecast for photovoltaic power generation using ensemble prediction

Daisuke Nohara, Yuuki Kanno (Central Research Inst. Electric Power Industry, Japan)

[TuP-12-13]

Estimation method of PV output forecast error according to PV output forecast and time of UC

Keito Nishida¹, Ryuto Shigenobu¹, Masakazu Ito¹, Norikazu Kanao², Hitoshi Sugimoto² (1. Univ. Fukui, Japan, 2. Hokuriku Electric Power Company, Japan)

[TuP-12-14]

Predicting solar radiation using cloud image analysis and deep learning

Naoki Nishitani¹, Genta Sugiyama¹, Tomonori Honda², Norihiro Itsubo¹ (1. Tokyo City Univ, Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan)

[TuP-12-15]

Estimation method for load and photovoltaic generation systems output in a distribution system using ICA and state estimation

Riku Akasaka¹, Ryoichi Hara¹, Hiroyuki Kita¹, Shuhei Sugimura², Seiya Goto², Toshiharu Kurihara² (1. Hokkaido Univ., Japan, 2. Meidensha Corp., Japan)

[TuP-12-16]

Improved method for solar resource assessment using simulations from the numerical weather prediction model Meso-NH and artificial neural networks

Sara Pereira, Edgar Abreu, Maksim Iakunin, Paulo Canhoto, Rui Salgado (Univ. Évora, Portugal)

[TuP-12-17]

Estimation of GPV-GSM radiation forecast error range by cloud variation

Yuyang Tu¹, Jindan Cui¹, Takashi Oozeki², Yuzuru Ueda¹ (1. Tokyo Univ. Science, Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan)

[TuP-12-18]

A deep learning approach to short-term PV power generation forecasting

Chamnan Limsakul¹, Anawach Sangswang¹, Itsara Masiri², Poj Tangamchit¹, Ballang Muenpinij¹, Gavin Fungtammasan³, Somjet Pattarapanitchai², Dhirayut Chenvidhya¹, Tanokkorn Chenvidhya¹, Sumate Naetiladdanon¹ (1. King Mongkut's Univ. Technology Thonburi, Thailand, 2. Silpakorn Univ., Thailand, 3. Univ. Sydney, Australia)

[TuP-12-19]

A GIS-based applicable location for solar panels installation planning in residential distribution system

Pawita Bunme¹, Atsushi Shiota², Yasunori Mitani¹, Masayuki Watanabe¹ (1. Kyushu Inst. Technology, Japan, 2. City of Kitakyushu, Japan)

[TuP-12-20]

Monitoring of snowfall and snow cover at photovoltaic plant in eastern Hokkaido, Japan

Hideaki Ohtake^{1,3}, Takashi Oozeki¹, Masataka Imai², Masashi Niwano³, Kosuke Ono³ (1. National Inst. Advanced Industrial Science and Technology, Japan, 2. Kyoto Sangyo Univ., Japan, 3. Meteorological Research Inst., Japan)

Area 1: Policy, market, deployment, energy management, and related technologies

Sub-area 1-2: Energy management and related technologies

[WeP-12] Energy Management, Transmission and Distribution

Wed. Nov 16, 2022 12:00 PM - 3:00 PM P-12/Event Hall (Bldg. 1, 1F)

[WeP-12-02]

Optimization bidding strategy on day ahead and balancing market of PV generator considering battery integration

Bo Jie¹, Jindan Cui¹, Xue Fang¹, Takashi Oozeki², Yuzuru Ueda¹ (1. Tokyo Univ. Science, Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan)

[WeP-12-03]

Day-ahead planning of PV power plant with battery for the purpose of creating power reserve under uncertainty

Kenta Minai¹, Jindan Cui¹, Yuzuru Ueda¹, Takashi Oozeki² (1. Tokyo Univ. Science, Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan)

[WeP-12-04]

Effect of using “smart outlets” to suppress storage battery capacity of microgrids

Youichi Hirata, Kent Hama (Suwa Univ. Science, Japan)

[WeP-12-06]

Electricity interchange and operation methodology for realization of sustainable society based on ecological footprint

Kota Imai, Ryuto Shigenobu, Masakazu Ito (Univ. Fukui, Japan)

[WeP-12-08]

Basic analysis of dynamics in PV-originated congestion at distribution substation for realizing local flexibility with distributed energy resources

Ryuji Shitara, Akihisa Kaneko, Yu Fujimoto, Yutaka Iino, Yasuhiro Hayashi (Waseda Univ., Japan)

[WeP-12-09]

Prediction method of surplus electricity using a smart meter for the positive demand response

Takato Kawaura, Ryuto Shigenobu, Masakazu Ito (Univ. Fukui, Japan)

[WeP-12-10]

Practical charging schedule of electrified buses for using local photovoltaic surplus power: Effective utilization of real-time information on surrounding weather and traffic delays

Fumiaki Osaki, Yu Fujimoto, Yutaka Iino, Yuto Ihara, Yasuhiro Hayashi (Waseda Univ., Japan)

[WeP-12-11]

Effective utilization of PV power output by shift of EV charging time according to day cumulative irradiance

Daisuke Saito¹, Masatoshi Watanabe¹, Masaki Imanaka¹, Takeyoshi Kato¹, Toshiyuki Nakamura¹, Toshiyuki Yamamoto¹, Yuko Hoshino², Mitsutaka Konishi² (1. Nagoya Univ., Japan, 2. ENEOS Corp., Japan)

[WeP-12-12]

A study on introducing power storage device in PV systems

Aoi Tanaka, Kazuto Yukita, Kazuki Ikeda, Yuto Iwasaki, Tsuyoshi Nishitani, Toshiya Nanahara, Takuya Goto (Aichi Inst. Technology, Japan)

[WeP-12-13]

Investigating the feasibility of an advanced control system of temperature and humidity of a self-sufficient energy and water agricultural greenhouse in coastal regions

Motaz Mabrouk Salama, František Mikšík, Kyaw Thu, Takahiko Miyazaki (Kyushu Univ., Japan)

[WeP-12-14]

Study on spatio-temporal urban energy balance for improving local self-sufficiency: Prediction of spatial distributions of net-/pure-demand and PV generation utilizing smart metering data

Shogo Akira, Ayumu Miyasawa, Yu Fujimoto, Yasuhiro Hayashi (Waseda Univ., Japan)

[WeP-12-15]

Smart charge controller with deep reinforcement learning MPPT control algorithm

Yew Weng Ho¹, Chau Chien Fat¹, Ahmad Wafi Mahmood Zuhdi¹, Wan Syakirah Wan Abudllah², Nowshad Amin¹ (1. Univ. Tenaga Nasional, Malaysia, 2. TNB Renewables Sdn. Bhd., Malaysia)

[WeP-12-16]

Basic study of an optimized closed-loop volt-var control strategy of PV smart inverters for voltage regulation

Shanghong Xie, Akihisa Kaneko, Yu Fujimoto, Yasuhiro Hayashi (Waseda Univ., Japan)

[WeP-12-17]

On the performance of unit commitment scheduling integrated with PV power forecasts: A case-study on the Kyushu region, Japan

Joao Gari da Silva Fonseca Junior¹, Yuki Nishitsuji², Chiyori T. Urabe¹, Kazuto Kataoka¹, Yusuke Udagawa^{1,2}, Kazuhiko Ogimoto¹ (1. Univ. Tokyo, Japan, 2. Kozo Keikaku Engineering Inc., Japan)

[WeP-12-18]

A voltage control method for distribution systems based on P&Q nodal prices using PV-PCSSs

Ryuta Kubo¹, Naoto Yorino², Hiroyuki Taenaka¹, Yutaka Sasaki¹, Yoshifumi Zoka¹, Satoshi Taoka¹ (1. Hiroshima Univ, Japan, 2. National Inst. Technology (KOSEN), Kure College, Japan)

[WeP-12-19]

Cooperative provision of operating reserves from photovoltaic power, wind power, and thermal power

Chiyori T. Urabe, Joao Gari da Silva Fonseca Junior, Tomoya Takeuchi, Masaki Imanaka, Kazuhiko Ogimoto (Univ. Tokyo, Japan)

[WeP-12-20]

Effect of PV-based grid-forming inverter on the power system stability

Shoya Ogawa¹, Naoto Yorino^{1,2}, Junpei Koishi¹, Yutaka Sasaki¹, Yoshifumi Zoka¹, Shinya Sekizaki¹ (1. Hiroshima Univ., Japan, 2. National Inst. Technology (KOSEN), Kure College, Japan)

[WeP-12-21]

Evaluation of frequency response in bulk power system with grid-forming inverters under generator trip

Akihisa Kaneko¹, Ryosuke Shikuma¹, Hiroshi Suwa¹, Hideo Ishii¹, Yasuhiro Hayashi¹, Tatsuhito Nakajima² (1. Waseda Univ., Japan, 2. Tokyo City Univ., Japan)

Area 1: Policy, market, deployment, energy management, and related technologies

Sub-area 1-2: Energy management and related technologies

[WeO-12a] PV System and Forecast

Session Chairs: Hideaki Ohtake (National Inst. Advanced Industrial Science and Technology, Japan), Yuzuru Ueda (Tokyo Univ. Science, Japan)

Wed. Nov 16, 2022 3:30 PM - 5:30 PM 431 (Bldg. 4, 3F)

[WeO-12a-01] 3:30 PM – 4:00 PM

(INVITED) State of the art solar resource assessments and forecasts /Activities of IEA PVPS Task 16

Jan Remund (Meteotest AG, Switzerland)

[WeO-12a-02] 4:00 PM – 4:15 PM

Hybrid modeling approach using cloud dynamics and deep learning for solar nowcasting

Jun Sasaki, Kenji Utsunomiya, Maki Okada, Shigeyuki Yoshikawa, Koji Yamaguchi (Japan Weather Association, Japan)

[WeO-12a-03] 4:15 PM – 4:30 PM

The prediction of the direction of PV output forecast errors using two numerical weather forecasts with different initial times

Miyu Nakamura¹, Masaki Imanaka¹, Takeyoshi Kato¹, Kosuke Harada², Mitsutaka Konishi² (1. Nagoya Univ., Japan, 2. ENEOS Corp., Japan)

[WeO-12a-04] 4:30 PM – 4:45 PM

Climatic effect on photovoltaic yield prediction with machine learning models

Alba Alcaniz¹, Anders Lindfors², Miro Zeman¹, Hesam Ziar¹, Olindo Isabella¹ (1. Delft Univ. Technology, The Netherlands, 2. Finnish Meteorological Inst., Finland)

[WeO-12a-05] 4:45 PM – 5:00 PM

Absorption of PV power prediction error with headroom control by integrating statistical analysis and machine learning

Jindan Cui¹, Bo Jie¹, Xue Fang¹, Takashi Oozeki², Yuzuru Ueda¹ (1. Tokyo Univ. Science, Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan)

[WeO-12a-06] 5:00 PM – 5:15 PM

Worldwide photovoltaic potential in climate change scenarios: Future projections and associated costs

Alejandra Isaza, Merlinde Kay, Jason P. Evans, Stephen Bremner, Abhnil Prasad (Univ. New South Wales, Australia)

[WeO-12a-07] 5:15 PM – 5:30 PM

Operation scheduling method in an off-grid considering controls for short-term fluctuation

Takuto Ohsawa¹, Ryoichi Hara¹, Hiroyuki Kita¹, Tomokazu Sato², Satoru Akagi³ (1. Hokkaido Univ., Japan, 2. TEPCO Holdings, Japan, 3. TEPCO PowerGrid, Japan)

Area 1: Policy, market, deployment, energy management, and related technologies

Sub-area 1-2: Energy management and related technologies

[ThO-12b] Energy Management

Session Chairs: Satoshi Takayama (Osaka Metropolitan Univ., Japan), Takeyoshi Kato (Nagoya Univ., Japan)

Thu. Nov 17, 2022 8:30 AM - 10:00 AM 431 (Bldg. 4, 3F)

[ThO-12b-01] 8:30 AM – 9:00 AM

(INVITED) The role of grid-forming inverters in future power systems

Benjamin Kroposki (National Renewable Energy Lab., USA)

[ThO-12b-02] 9:00 AM – 9:15 AM

Photovoltaic potential of the Dutch inland shipping fleet: An experimentally validated method to simulate the energy yield of vehicle integrated photovoltaics

Dora de Jong, Vasiliki Sionti, Hesam Ziar (Delft Univ. Technology, The Netherlands)

[ThO-12b-03] 9:15 AM – 9:30 AM

A low-carbon operational plan for commercial electric vehicles utilizing local PV surplus power generation in charging

Ryoji Miyabe, Yu Fujimoto, Yasuhiro Hayashi (Waseda Univ., Japan)

[ThO-12b-04] 9:30 AM – 9:45 AM

Optimal configuration of residential distributed energy system including electric vehicle considering electricity interchange between two residences

Takuya Higashitani, Takashi Ikegami, Atsushi Akisawa (Tokyo Univ. Agriculture and Technology, Japan)

[ThO-12b-05] 9:45 AM – 10:00 AM

Development of an energy management system for a plant factory with artificial lighting

Shigeru Bando¹, Kazuhiro Shoji¹, Tomohiro Jishi¹, Takashi Ishii¹, Norihiko Ito¹, Tomoyuki Yamada¹, Naoto Higa², Shogo Kinjyou³, Fumiyuki Goto⁴ (1. Central Research Inst. Electric Power Industry, Japan, 2. Nextems, Japan, 3. Okinawa Electric Power Company, Japan, 4. Saga Univ., Japan)

Area 1: Policy, market, deployment, energy management, and related technologies

Sub-area 1-2: Energy management and related technologies

[ThO-12c] Transmission and Distribution

Session Chairs: Hiroyuki Hatta (Central Research Inst. Electric Power Industry, Japan), Yusuke Miyamoto (Kandenko Co., Ltd., Japan)

Thu. Nov 17, 2022 10:30 AM - 12:00 PM 431 (Bldg. 4, 3F)

[ThO-12c-01] 10:30 AM – 12:00 PM

(INVITED) Achieving grid stability with high penetration of PVs- R&D of grid forming inverter

Jun Hashimoto (National Inst. Advanced Industrial Science and Technology, Japan)

[ThO-12c-02] 11:00 AM – 11:15 AM

Using aggregated PV systems for transient voltage recovery in utility planning

Olga Lavrova¹, Ransome Egunjobi², Manasseh Obi³ (1. New Mexico State Univ., USA, 2. Lower Colorado River Authority, USA, 3. Portland General Electric, USA)

[ThO-12c-03] 11:15 AM – 11:30 AM

Optimal allocation of curtailment ratio of PV power output in different locations in consideration of reduction in aggregated PV power output fluctuation

Noha Harag, Takeyoshi Kato (Nagoya Univ., Japan)

[ThO-12c-04] 11:30 AM – 11:45 AM

Voltage control performance of OLTC and SVR in Hokuriku area distribution network with PV and EV penetration in Japan

Tatsuki Okuno¹, Akihisa Kaneko¹, Yasuhiro Hayashi¹, Masaaki Ishimaru², Minoru Doi² (1. Waseda Univ., Japan, 2. Hokuriku Electric Power Transmission & Distribution Company, Japan)

[ThO-12c-05] 11:45 AM – 12:00 PM

Resilience considered PV increasing effect by the vertical bifacial PV system

Yuhi Ito, Ryuto Shigenobu, Masakazu Ito (Univ. Fukui, Japan)

Area 2: Advanced applications and core technologies for massive installation

Sub-area 2-1: Solar to X

[TuP-21] Solar to X

Tue. Nov 15, 2022 12:00 PM - 3:00 PM P-21/Event Hall (Bldg. 1, 1F)

[TuP-21-03]

Optimization of a stand-alone PV-electrolysis plant

Victor Arturo Martinez Lopez, Hesam Ziar, Miro Zeman, Olindo Isabella (Delft. Univ. of Technology, The Netherlands)

[TuP-21-04]

Simulation of solar to hydrogen system for dynamic analysis

Toshitaka Iwase, Ryo Mitsui, Yihuang Wang, Yuichiroh Nakashima (Toyota Technical Development Corp., Japan)

[TuP-21-05]

CO₂ electrolysis via surface-engineering electrografted pyridines on silver catalysts

Maryam Abdinejad Abdinejad¹, Thomas Burdyny¹, Ali Seifitokaldani² (1. Delft Univ. Technology, The Netherlands, 2. McGill Univ., Canada)

[TuP-21-06]

Effect of Ag nanoparticle coating on metal electrodes for CO₂ reduction by solar chemical conversion

Kazuki Koike^{1,2}, Takeharu Murakami², Kei Morishita², Miyuki Nara², Satoshi Wada², Atsushi Ogura¹, Katsushi Fujii² (1. Meiji Univ., Japan, 2. RIKEN, Japan)

[TuP-21-07]

The development of visible-light-absorbing semitransparent Ta₃N₅-based photoanodes for solar water splitting cells with a tandem configuration

Tomohiro Higashi¹, Hiroshi Nishiyama², Yuriy Pihosh², Kazunari Domen^{2,3} (1. Univ. Miyazaki, Japan, 2. Univ. Tokyo, Japan, 3. Shinshu Univ., Japan)

[TuP-21-08]

Impedance measurement of anion exchange membrane in solar-powered CO₂ reduction device

Takeharu Murakami¹, Kei Morishita¹, Kazuki Koike^{1,2}, Katsushi Fujii¹, Satoshi Wada¹ (1. RIKEN, Japan, 2. Meiji Univ., Japan)

[TuP-21-09]

Fabrication of photovoltaic-photoelectrochemical-interconnected water splitting
Cu(In,Ga)Se₂ device

Kana Ueda, Mutsumi Sugiyama (Tokyo Univ. Science, Japan)

[TuP-21-10]

Nanoporous Au deposited p-type GaN photoelectrode for efficient CO₂ conversion
reaction

Hyojung Bae¹, Vishal Burungale¹, Chaewon Seong¹, Hyunggu Kim¹, Jiwon Heo¹, Dae-Woo
Jeon², Katsushi Fujii³, Jun-Seok Ha¹ (1. Chonnam National Univ., Korea, 2. Korea Inst. Ceramic
Engineering and Technology, Korea, 3. RIKEN, Japan)

[TuP-21-11]

Co-Fe-B Nanochains for enhanced oxygen evolution reaction at high current
densities

Jin Hyeok Kim, Komal Patil (Chonnam National Univ., Korea)

Area 2: Advanced applications and core technologies for massive installation

Sub-area 2-1: Solar to X

[TuO-21a] Solar to X (1)

Session Chairs: Qian Wang (Nagoya Univ., Japan), Joel W. Ager (Lawrence Berkeley National Lab., USA)

Tue. Nov 15, 2022 3:30 PM - 5:00 PM 432 (Bldg. 4, 3F)

[TuO-21a-01] 3:30 PM – 4:00 PM

(INVITED) Characterizing CO₂ reduction catalysts on gas diffusion electrodes:

Comparing activity, selectivity and stability of transition metal catalysts

Mark Sassenburg¹, Reinier de Rooij¹, Nathan T. Nesbitt¹, Recep Kas^{1,2}, Sanjana Chandrashekar¹, Nienke J. Firet¹, Kailun Yang¹, Kai Liu¹, Marijn A. Blommaert¹, Martin Kolen¹, Davide Ripepi¹, Wilson A. Smith^{1,2}, Thomas Burdyny¹ (1. Delft Univ. Technology, The Netherlands, 2. Univ. Colorado Boulder, USA)

[TuO-21a-02] 4:00 PM – 4:30 PM

(INVITED) Formate production from CO₂ and water using a 1 m²-sized artificial photosynthetic cell with a solar-to-chemical conversion efficiency of 10.5%

Naohiko Kato, Yasuhiko Takeda, Yasuaki Kawai, Natsumi Nojiri, Masahito Shiozawa, Shintaro Mizuno, Ken-ichi Yamanaka, Takeshi Morikawa, Tsuyoshi Hamaguchi (Toyota Central R&D Labs., Inc.)

[TuO-21a-03] 4:30 PM – 4:45 PM

Prediction of potential solar-to-methane conversion efficiency in Japan

Moritaka Oshiro, Soe Htet Wai, Yasuyuki Ota, Kensuke Nishioka (Univ. Miyazaki, Japan)

[TuO-21a-04] 4:45 PM – 5:00 PM

Non-sacrificial photocatalytic H₂O₂ generation by particulate BiVO₄

Zhenhua Pan¹, Tian Liu², Xiaoshan Zheng², Junie Jhon M Vequizo³, Kosaku Kato⁴, Akira Yamakata⁴, Rito Yanagi⁵, Shu Hu⁵, Kenji Katayama¹, Chiheng Chu² (1. Chuo Univ., Japan, 2. Zhejiang Univ., China, 3. Shinshu Univ., Japan, 4. Toyota Technological Inst., Japan, 5. Yale Univ., USA)

Area 2: Advanced applications and core technologies for massive installation

Sub-area 2-1: Solar to X

[TuO-21b] Solar to X (2)

Session Chairs: Shigeru Ikeda (Konan Univ., Japan), Thomas Burdyny (Delft Univ. Technology, The Netherlands)

Tue. Nov 15, 2022 5:30 PM - 7:00 PM 432 (Bldg. 4, 3F)

[TuO-21b-01] 5:30 PM – 6:00 PM

(INVITED) Design and characterization of integrated systems for solar fuel production

Francesca Maria Toma (Lawrence Berkeley National Lab., USA)

[TuO-21b-02] 6:00 PM – 6:15 PM

Scalable photocatalyst sheets for efficient solar-to-fuel conversion

Qian Wang (Nagoya Univ., Japan)

[TuO-21b-03] 6:15 PM – 6:30 PM

Space-resolved mapping of catalytic activity in electrolyzers by infrared imaging

Hugo-Pieter Iglesias van Montfort, Thomas Edward Burdyny (Delft Univ. Technology, The Netherlands)

[TuO-21b-04] 6:30 PM – 6:45 PM

Proposing a new PV-power management system: putting PV as the main power source and producing low-cost CO₂-free hydrogen

Hirofumi Egusa^{1,2}, Takayuki Ichikawa¹ (1. Hiroshima Univ, Japan, 2. Chugoku Regional Innovation Research Center, Japan)

[TuO-21b-05] 6:45 PM – 7:00 PM

Enhancements of photoelectrochemical water reduction properties of CuGaSe₂ thin film-based photocathodes induced by intentional loading of a Cu-deficient layer at the p-n heterointerface

Riku Okamoto¹, Shogo Ishizuka², Shigeru Ikeda¹ (1. Konan Univ., Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan)

Area 2: Advanced applications and core technologies for massive installation

Sub-area 2-1: Solar to X

[WeP-21] Solar to X

Wed. Nov 16, 2022 12:00 PM - 3:00 PM P-21/Event Hall (Bldg. 1, 1F)

[WeP-21-02]

Kesterite-based photocathode for photoelectrochemical CO₂ reduction and NH₃ production

Kaiwen Sun, Shujie Zhou, Rose Amal, Xiaojing Hao (Univ. New South Wales, Australia)

[WeP-21-03]

Photoelectrochemical properties of a highly-mismatched ZnTeO alloys grown by molecular beam epitaxy

Takaki Sonoyama¹, Katsuhiko Saito¹, Qixin Guo¹, Shigeru Ikeda², Tooru Tanaka¹ (1. Saga Univ., Japan, 2. Konan Univ., Japan)

[WeP-21-04]

Identification of the contributing factors to the photoelectric conversion efficiency for hematite photoanodes by using machine learning

Takumi Idei, Yuya Nagai, Zhenhua Pan, Kenji Katayama (Chuo Univ., Japan)

[WeP-21-05]

MBE growth and photochemical properties evaluation of n-ZnS/ZnTe thin films

Ryusuke Tsutsumi¹, Katsuhiko Saito¹, Qixin Guo¹, Shigeru Ikeda², Tooru Tanaka¹ (1. Saga Univ., Japan, 2. Konan Univ., Japan)

[WeP-21-06]

Effect of polymer additives on photocatalytic and photoelectrochemical properties of BiVO₄ prepared from aqueous metal-chelate solution

Sayuri Okunaka¹, Hiroyuki Kameshige², Mariko Hosogai², Kazuhiro Sayama¹, Hiromasa Tokudome² (1. National Inst. Advanced Industrial Science and Technology, Japan, 2. TOTO Ltd., Japan)

[WeP-21-07]

Effect of sulfurization for BiVO₄ thin film grown by RF sputtering deposition

Shukur Gofurov, Namiki Uezono, Jiaqi Liu, Lingga Ghufira Oktariza, Sachin Pawar, Muhammad Monirul Islam, Takeaki Sakurai (Univ. Tsukuba, Japan)

[WeP-21-08]

Machine learning for optimizing cobalt phosphate deposition parameters on thin film α -Fe₂O₃

Siyang Chen, Yuya Nagai, Zhenhua Pan, Kenji Katayama (Chuo Univ., Japan)

[WeP-21-09]

Fabrication of monoclinic-scheelite and tetragonal-zircon BiVO₄ photoelectrode by single target RF sputtering method

Namiki Uezono¹, Jiaqi Liu¹, Shukur Gofurov¹, Lingga Ghufira Oktariza¹, Sachin A. Pawar¹, Muhammad Monirul Islam¹, Shigeru Ikeda², Takeaki Sakurai¹ (1. Univ. Tsukuba, Japan, 2. Konan Univ., Japan)

[WeP-21-10]

Facile one step hydrothermal synthesis of Cr-doped ZnO photoanode with DFT simulation and their excellent photoelectrochemical water splitting

Mohaseen S. Tamboli, Asiya M. Tamboli, Chinho Park (Korea Inst. Energy Technology, Korea)

[WeP-21-11]

Solar light-driven H₂ production by photocatalytic water splitting of Pt decorated α -Bi₂O₃ nanoparticles with preferred (200) crystal facet

Min-Chen Chung, Zhe-Hao Lin, Yuchun Wu (National Cheng Kung Univ, Taiwan)

[WeP-21-12]

FeOOH-induced electronic optimization of metal-organic framework-derived CoNi-ZLDH for efficient oxygen evolution

Zheng Fang, Jin Hyeok Kim (Chonnam National Univ., Korea)

[WeP-21-13]

Colloidal Ni₂P nanocrystals encapsulated in heteroatom-doped graphene nanosheets: A synergy of 0D@2D heterostructure towards overall water splitting

Umesh P. Suryawanshi, Jin Hyeok Kim (Chonnam National Univ., Korea)

Area 2: Advanced applications and core technologies for massive installation

Sub-area 2-2: Advanced applications of photovoltaics

[TuP-22] Advanced Applications of Photovoltaics

Tue. Nov 15, 2022 12:00 PM - 3:00 PM P-22/Event Hall (Bldg. 1, 1F)

[TuP-22-01]

Impact of shunt resistance on the performance of curved CIGS photovoltaic submodules

Takeshi Tayagaki, Ayumi Sasaki, Shogo Ishizuka, Masahiro Yoshita (National Inst. Advanced Industrial Science and Technology, Japan)

[TuP-22-02]

Optimization of an agri-photovoltaic system in different climate regions

Teruya Toyoda, Daisuke Yajima, Kenji Araki, Kensuke Nishioka (Univ. Miyazaki, Japan)

[TuP-22-03]

Agrivoltaic system: Proposal of business best practices by estimating power generation and agricultural growth using one single solar irradiation

Daisuke Yajima, Teruya Toyoda, Masaaki Kirimura, Kenji Araki, Kensuke Nishioka (Univ. Miyazaki, Japan)

[TuP-22-04]

VIPV -Technical requirements- Survey results

Anna J. Carr, Bonna K. Newman (TNO, The Netherlands)

[TuP-22-05]

Carbon neutralization of buses using vehicle-integrated photovoltaics

Koki Nakamura, Kenji Araki, Yasuyuki Ota, Kensuke Nishioka (Univ. Miyazaki, Japan)

[TuP-22-06]

Measurement of vehicle integrated photovoltaic output while driving and reproduction by simulation

Kento Hirata, Kenji Araki, Yasuyuki Ota, Kensuke Nishioka (Univ. Miyazaki, Japan)

[TuP-22-07]

Measurement of solar spectrum for vehicle integrated PV using 4-sensor photodiode spectrometer

Yuki Kawakami, Kenji Araki, Yasuyuki Ota, Kensuke Nishioka (Univ. Miyazaki, Japan)

[TuP-22-09]

Study of AlGa_N as the electron transport layer for wide-gap solar cells

Atsushi Hombe, Shinya Saiki, Tetsuya Mori, Yuji Saito, Tsutomu Tanimoto (Nissan Motor Co., Ltd., Japan)

[TuP-22-10]

In-situ radiation resistance evaluation of perovskite solar cells using 8 MeV proton irradiation

Yu Miyazawa¹, Momoko Kohsaka², Ryoya Ishigami³, Naoyuki Shibayama⁴, Masashi Ikegami⁴, Tsutomu Miyasaka⁴, Shusaku Kanaya¹, Hiroyuki Toyota¹, Kazuyuki Hirose^{1,5} (1. Japan Aerospace Exploration Agency, Japan, 2. AES Corp., Japan, 3. Wakasa Wan Energy Research Center, Japan, 4. Toin Univ. Yokohama, Japan, 5. Waseda Univ., Japan)

[TuP-22-11]

Evaluation of hypervelocity impact of micrometeoroids and orbital debris on next-generation space solar cells

Hiroyuki Toyota¹, Tetsuya Nakamura¹, Shusaku Kanaya¹, Taishi Sumita¹, Takayuki Hirai², Masanori Kobayashi² (1. Japan Aerospace Exploration Agency, Japan, 2. Chiba Inst. Technology, Japan)

[TuP-22-12]

State-of-the-art of concentrating photovoltaic thermal technology

Robert Höller, Alois Resch (Univ. Applied Sciences Upper Austria, Austria)

[TuP-22-13]

Ray tracing of spherical applications of luminescent solar concentrator PV modules

Xitong Zhu¹, Michael G. Debije¹, Angèle H. M. E. Reinders^{1,2} (1. Eindhoven Univ. Technology, The Netherlands, 2. Univ. Twente, The Netherlands)

[TuP-22-14]

Device simulation of CsPbBr₃ optical power converter using nanocrystalline GaN electron transport layer

Yuejie Tan, Hirofumi Shimizu, Shinsuke Miyajima (Tokyo Inst. Technology, Japan)

[TuP-22-15]

Photovoltaic characteristics of GaP based device using a blue laser for optical wireless power transmission

Masakazu Arai, Akira Kushiyama, Koji Maeda (Univ. Miyazaki, Japan)

[TuP-22-16]

Nanocrystalline GaN electron transport layer for CsPbBr₃ optical power converter
Rintaro Fukamizu, Naoki Aso, Shinsuke Miyajima (Tokyo Inst. Technology, Japan)

[TuP-22-17]

Electrode design optimization of InGaAsP photovoltaic device for optical wireless power transmission

Akira Kushiyama, Yuga Motomura, Kensuke Nishioka, Masakazu Arai (Univ. Miyazaki, Japan)

[TuP-22-18]

Increased output power of fly-eye lens based light receiver module with 450 nm-monochromatic beam and GaAs PV for underwater optical wireless power transmission

Yuha Tai, Tomoyuki Miyamoto (Tokyo Inst. Technology, Japan)

[TuP-22-19]

Effects of uniform and non-uniform laser irradiation on conversion efficiency using GaInP solar cells with cross-shaped electrodes

Shunsuke Shibui, Masahiro Koga, Yiu Leung Wong, Taiki Maeda, Kazuki Kurooka, Yuki Komuro, Shiro Uchida (Chiba Inst Technology, Japan)

[TuP-22-20]

Incident laser angle dependence on the conversion efficiency of 3-junction solar cells for optical wireless power transmission

Masahiro Koga, Shunsuke Shibui, Shunsuke Omori, Ryusei Takahashi, Nozomi Matsuoka, Shiro Uchida (Chiba Inst. Technology, Japan)

[TuP-22-21]

Optical wireless power transfer toward applications in implanted and wearable devices

Hoa Dinh Nguyen (Kyushu Univ., Japan)

[TuP-22-22]

Characterization of different c-Si solar cell architectures for use in visible light communication

Mirco Mutillo, Patrizio Manganiello, Olindo Isabella (Delft Univ. Technology, The Netherlands)

[TuP-22-23]

Photovoltaics in war zones: Yemen agrovoltaics case study

Abdulrahman Baboraik¹, Ali Hikmet², Mohammed Almutawakef², Yousef Abutaleb³, Marwan Dhamrin⁴ (1. Kazan State Power Engineering Univ., Russia, 2. Sanaa Univ., Yemen, 3. Yemen Solar Co., Yemen, 4. Osaka Univ., Japan)

Area 2: Advanced applications and core technologies for massive installation

Sub-area 2-2: Advanced applications of photovoltaics

[WeO-22a] Advanced Applications of Photovoltaics

Session Chairs: Tatsuya Takamoto (Sharp Corp., Japan), Noren Pan (MicroLink Devices, USA)

Wed. Nov 16, 2022 10:30 AM - 12:00 PM 432 (Bldg. 4, 3F)

[WeO-22a-01] 10:30 AM – 11:00 AM

(INVITED) High-efficiency commercial multi-junction photovoltaic laser power converters for various power and spectral range applications

Simon Fafard, Denis P. Masson (Broadcom, Canada)

[WeO-22a-02] 11:00 AM – 11:30 AM

(INVITED) Next generation of low-cost solar arrays for space applications

Martin Kroon (Airbus, the Netherlands)

[WeO-22a-03] 11:30 AM – 11:45 AM

Inverted metamorphic photovoltaics for space applications utilizing a novel distributed Bragg reflector compatible with epitaxial lift-off

Robert F. McCarthy, Andree Wibowo, David Rowell, Martin Drees, Mark Osowski, Chris Youtsey, Chris Stender, Noren Pan (MicroLink Devices, Inc., USA)

[WeO-22a-04] 11:45 AM – 12:00 PM

Investigating the performance of non-standard cell configurations for reconfigurable solar modules under varying shading conditions

Marcel Lima, Brendan Wright, Ziv Hameiri (Univ. New South Wales, Australia)

Area 2: Advanced applications and core technologies for massive installation

Sub-area 2-2: Advanced applications of photovoltaics

[WeP-22] BIPV Applications

Wed. Nov 16, 2022 12:00 PM - 3:00 PM P-22/Event Hall (Bldg. 1, 1F)

[WeP-22-01]

Performance of curved PV module - comparison in three approaches; measurement, differential geometry, and ray-tracing

Sho Kuranaga, Kenji Araki, Yasuyuki Ota, Kensuke Nishioka (Univ. Miyazaki, Japan)

[WeP-22-02]

Eco-friendly colorful Cu(In,Ga)Se₂ thin-film solar cells for photovoltaics in buildings

Yong-Duck Chung^{1,2}, Dae-Hyung Cho^{1,2}, Woo-Jung Lee^{1,2}, Sung-Hoon Hong^{1,2}, Woo-Ju Kim¹, Tae-Ha Hwang¹ (1. Electronics and Telecommunications Research Inst., Korea, 2. Korea Univ. Science and Technology Korea)

[WeP-22-03]

Tunable structural coloring of solar cell modules for building-integrated photovoltaic application

Zhihao Xu, Takuya Matsui, Hitoshi Sai (National Inst. Advanced Industrial Science and Technology, Japan)

[WeP-22-04]

Spectrometric characterization of polychromatic BIPV modules

Min Hsian Saw, Erik Birgersson, Mauro Pravettoni (National Univ. Singapore, Singapore)

[WeP-22-05]

Wavelength-selective artificial synapses using metastabilities in thin film chalcogenide solar cells

Kunal J. Tiwari, Pieter Paulissen, Alex Jimenez, Axel Gon Medaille, Sergio Giraldo¹, Marcel Placidi, Edgardo Saucedo, Zacharie Jehl Li-Kao (Polytechnic Univ. Catalonia, Spain)

[WeP-22-06]

Performance analysis of solar cells for see-through windows

Kodai Takachiho¹, Kenji Araki¹, Yasuyuki Ota¹, Akira Nagaoka¹, Kengo Maeda², Akihiko Nakajima², Kensuke Nishioka¹ (1. Univ. Miyazaki, Japan, 2. Kaneka Corp., Japan)

[WeP-22-07]

Integration of solar photovoltaics and urban farming for sustainable built environments

Li Na Chua, Yang He, Stephen En Rong Tay, Chun Liang Tan (National Univ. Singapore, Singapore)

[WeP-22-08]

A GIS-based large-scale visibility assessment tool for urban PV planning on building roofs

Yilong Zhou, Dennis Wilmink, Miro Zeman, Hesam Ziar, Olindo Isabella (Delft Univ. Technology, the Netherlands)

[WeP-22-09]

Towards performance characterization of curved photovoltaic modules with solar simulators

Masahiro Yoshita, Kengo Yamagoe (National Inst. Advanced Industrial Science and Technology, Japan)

Area 2: Advanced applications and core technologies for massive installation

Sub-area 2-2: Advanced applications of photovoltaics

[ThO-22b] BIPV Special Session

Session Chairs: Kenji Araki (Univ. Miyazaki, Japan), Ryouyuke Ishikawa (Tokyo City Univ., Japan)

Thu. Nov 17, 2022 8:30 AM - 10:00 AM 432 (Bldg. 4, 3F)

[ThO-22b-01] 8:30 AM – 9:00 AM

(INVITED) Evolution of sensitization-based photovoltaic cells for diverse applications

Kicheon Yoo, Hyeong Cheol Kang, Jun Yeong Ryu, Jun Hwan Jang, Jae-Joon Lee (Dongguk Univ., Korea)

[ThO-22b-02] 9:00 AM – 9:15 AM

Outdoor verification on power generation and heat shielding created by T-Green® multi solar see-through type

Kazuhiko Umeda¹, Akira Yamaguchi¹, Nobusato Kobayashi¹, Naoki Kadota², Kengo Maeda², Akihiro Kuraoka², Tsukasa Makino², Akihiko Nakajima² (1. Taisei Corp., Japan, 2. Kaneka Corp., Japan)

[ThO-22b-03] 9:15 AM – 9:30 AM

Efficient harvesting of low angle incident light in BIPV module

Jin-Woo Cho¹, Sun-Kyung Kim¹, Jae Hyun Kim² (1. Kyung Hee Univ., Korea, 2. Daegu Gyeongbuk Inst. Science and Technology, Korea)

[ThO-22b-04] 9:30 AM – 9:45 AM

Highly efficient color-control technique for building-integrated photovoltaics

Hiroyuki Wada¹, Genki Hanashi¹, Hitoshi Sai², Michio Kondo^{1,2} (1. Tokyo Inst. Technology, Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan)

[ThO-22b-05] 9:45 AM – 10:00 AM

BIPV for high-rise residential building in Singapore: Demonstration and lesson learned

Tian Shen Liang¹, Kong Fai Tai², Leow Shin Woei¹ (1. National Univ. Singapore, Singapore, 2. Huawei Industrial Base, China)

Area 2: Advanced applications and core technologies for massive installation

Sub-area 2-2: Advanced applications of photovoltaics

[ThO-22c] Vehicle Integrated Photovoltaics

Session Chairs: Nicholas J. Ekins-Daukes (Univ. New South Wales, Australia), Kenji Araki (Univ. Miyazaki, Japan)

Thu. Nov 17, 2022 10:30 AM - 12:00 PM 432 (Bldg. 4, 3F)

[ThO-22c-01] 10:30 AM – 11:00 AM

(INVITED) Demonstration test of EV equipped with a solar power generation system that utilizes solar energy for driving

Tsutomu Tanimoto¹, Yosuke Tomita¹, Masanori Saito¹, Yoshiyuki Nagai¹, Takumi Arai¹, Kimihiro Nishijima² (1. Nissan Motor Co., Ltd., Japan, 2. Sojo Univ., Japan)

[ThO-22c-02] 11:00 AM – 11:15 AM

Optimization of the string configuration of vehicle-integrated photovoltaic module based on the distribution of the partial shading during driving

Yasuyuki Ota, Kenji Araki, Kensuke Nishioka (Univ. Miyazaki, Japan)

[ThO-22c-03] 11:15 AM – 11:30 AM

Assessment of PV module reliability against automobile-specific environment for design and standardization of vehicle-integrated PV

Daisuke Sato¹, Hayato Kobayashi¹, Kenji Araki², Makoto Tanaka³, Noboru Yamada¹ (1. Nagaoka Univ. Technology, Japan, 2. Univ. Miyazaki, Japan, 3. Photovoltaic Power Generation Technology Research Association, Japan)

[ThO-22c-04] 11:30 AM – 11:45 AM

Assessment of required MPPT speed based on measured transient irradiance and dynamic electrical modelling for VIPV applications

Gustav Wetzel¹, Leon Salomon¹, Jan Krügener¹, Robby Peibst² (1. Leibniz Univ., Germany, 2. Inst. Solar Energy Research Hamelin, Germany)

[ThO-22c-05] 11:45 AM – 12:00 PM

Super-efficient colored PV for vehicles

Jessica Yajie Jiang, Yuanxun Liao, Mark Keevers, Ned Ekins-Daukes, Martin Green (Univ. New South Wales, Australia)

Area 2: Advanced applications and core technologies for massive installation

Sub-area 2-3: Field performance of photovoltaic systems and related issues

[MoO-23a] Field Performance and Prediction Model

Session Chairs: Yasuo Chiba (National Inst. Advanced Industrial Science and Technology, Japan), Yoshihito Eguchi (VENA Energy, Nippon Renewable Energy, Japan)

Mon. Nov 14, 2022 8:30 AM - 10:00 AM 432 (Bldg. 4, 3F)

[MoO-23a-01] 8:30 AM – 9:00 AM

(INVITED) Single-axis trackers: More energy with intelligent tracker control

Kyumin Lee (Array Technologies, Inc., USA)

[MoO-23a-02] 9:00 AM – 9:15 AM

Analysis of degradation rates in PV modules and prospective future changes due to climate change

Shukla Poddar, Fiacre Rougieux, Merlinde Kay, Stephen Bremner, Abhnail Prasad, Jason Evans (Univ. New South Wales, Australia)

[MoO-23a-03] 9:15 AM – 9:30 AM

Annual degradation rates of five PV technologies based on over 11 year measurements

Tetsuyuki Ishii¹, Yasuo Chiba², Ritsuko Sato², Sungwoo Choi², Minoru Akitomi², Atsushi Masuda³ (1. Central Research Inst. Electric Power Industry, Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan, 3. Niigata Univ., Japan)

[MoO-23a-04] 9:30 AM – 9:45 AM

Postprocessing of solar irradiance predicted with a numerical weather model

Naoki Moriai¹, Perawut Chinnavornrungrsee², Songkiate Kittisontirak², Nuwong Chollacoop², Sasiwimon Songtra³, Kobsak Sriprapha³, Jun Yoshino¹, Tomonao Kobayashi¹ (1. Gifu Univ., Japan, 2. National Energy Technology Center, Thailand, 3. National Electronics and Computer Technology Center, Thailand)

[MoO-23a-05] 9:45 AM – 10:00 AM

Modeling and rating the impact of partial shading loss affected by distributions of shading objects and orientation of PV modules (including moving PV in transportation), also design improvement of modules against partial and dynamic shading losses

Kenji Araki¹, Yasuyuki Ota, Kensuke Nishioka (Univ. Miyazaki, Japan)

Area 2: Advanced applications and core technologies for massive installation

Sub-area 2-3: Field performance of photovoltaic systems and related issues

[MoO-23b] Field Performance for Bifacial PV Modules

Session Chairs: Tomonao Kobayashi (Gifu Univ., Japan), Tetsuyuki Ishii (Central Research Inst. Electric Power Industry, Japan)

Mon. Nov 14, 2022 10:30 AM - 12:00 PM 432 (Bldg. 4, 3F)

[MoO-23b-01] 10:30 AM – 11:00 AM

(INVITED) Progress in precise and reliable outdoor performance measurements of photovoltaic modules

Masahiro Yoshita (National Inst. Advanced Industrial Science and Technology, Japan)

[MoO-23b-02] 11:00 AM – 11:15 AM

Energy rating for bifacial PV Modules

Malte R. Vogt, Giorgos Pilis, Miro Zeman, Rudi Santbergen, Olindo Isabella (Delft Univ. Technology, The Netherlands)

[MoO-23b-03] 11:15 AM – 11:30 AM

Enhancement in the power generation of bifacial module using light dispersion film

Kazuya Komine¹, Yasushi Shirahige¹, Masahiro Kobayashi¹, Shigehiro Ueno¹, Taiki Takayama¹, Hisashi Nohara², Satoshi Nishiyama² (1. Dai Nippon Printing Co., Ltd., Japan, 2. Nishiyama Sakata Denki Co., Ltd., Japan)

[MoO-23b-04] 11:30 AM – 11:45 AM

Estimation of rear side irradiance of vertically installed bifacial PV modules considering shadow and sky view factor

Amirul Naim¹, Ryuto Shigenobu¹, Masakazu Ito¹, Yuki Tsuno², Takashi Oozeki² (1. Univ. Fukui, Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan)

[MoO-23b-05] 11:45 AM – 12:00 PM

Annual trends of indoor output measurement results of high-efficiency crystalline silicon photovoltaic modules exposed outdoors in Tosu city, Japan

Yasuo Chiba¹, Tetsuyuki Ishii², Ritsuko Sato¹, Sungwoo Choi¹, Minoru Akitomi¹, Atsushi Masuda³ (1. National Inst. Advanced Industrial Science and Technology, Japan, Central Research Inst. Electric Power Industry, Japan, 3. Niigata Univ., Japan)

Area 2: Advanced applications and core technologies for massive installation

Sub-area 2-3: Field performance of photovoltaic systems and related issues

[TuP-23] Field Performance, Prediction Model and PV Recycle/Reuse

Tue. Nov 15, 2022 12:00 PM - 3:00 PM P-23/Event Hall (Bldg. 1, 1F)

[TuP-23-01]

Smart solar energy monitoring system for PV plant using IoT

Kazi Zehad Mostofa¹, Hamid Mohafez², Foo Wah Low³, Mohammad Nur-E-Alam³, Mohammad Aminul Islam¹ (1. Univ. Malaya, Malaysia, 2. Univ. Tunku Abdul Rahman, Malaysia, 3. Edith Cowan Univ., Australia)

[TuP-23-02]

Solar irradiance prediction in tropics using weather forecasting model

Perawut Chinnavornrungrsee¹, Songkiate Kittisontirak¹, Nuwong Chollacoop¹, Sasiwimon Songtra², Kobsak Sriprapha², Piti Uthong³, Jun Yoshino⁴, Tomonao Kobayashi⁴ (1. National Energy Technology Center, Thailand, 2. National Electronics and Computer Technology Center, Thailand, 3. Electricity Generating Authority of Thailand, Thailand, 4. Gifu Univ., Japan)

[TuP-23-03]

Optimization of numerical weather model parameterizations for solar irradiance prediction in tropics

Daiki Harada¹, Perawut Chinnavornrungrsee², Songkiate Kittisontirak², Nuwong Chollacoop², Sasiwimon Songtra³, Kobsak Sriprapha³, Jun Yoshino⁴, Tomonao Kobayashi⁴ (1. JR Central Consultants Company, Japan, 2. National Energy Technology Center, Thailand, 3. National Electronics and Computer Technology Center, Thailand, 4. Gifu Univ., Japan)

[TuP-23-04]

Probability prediction of solar irradiance in tropic by using ensemble forecasting

Daiki Harada¹, Naoki Moriai², Perawut Chinnavornrungrsee³, Songkiate Kittisontirak³, Nuwong Chollacoop³, Sasiwimon Songtra⁴, Kobsak Sriprapha⁴, Jun Yoshino², Tomonao Kobayashi² (1. JR Central Consultants Company, Japan, 2. Gifu Univ., Japan, 3. National Energy Technology Center, Thailand, 4. National Electronics and Computer Technology Center, Thailand)

[TuP-23-05]

Intelligent fault diagnosis of photovoltaic arrays based on deep belief network and extreme learning machine

Kun Ding¹, Zenan Yang¹, Jingwei Zhang¹, Li Feng³, Frank Hamelmann³, Shuai Weng² (1. Hohai Univ., China, 2. Changzhou Key Laboratory of Photovoltaic System Integration and Production Equipment Technology, China, 3. Univ. Applied Science Bielefeld, Germany)

[TuP-23-06]

Periodical evaluation of photovoltaic modules using MLR models

Guillermo Antonio Farias-Basulto¹, Carolin Ulbrich¹, Rutger Schlatmann^{1,2}, Reiner Klenk¹ (1. Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Germany, 2. Univ. Applied Sciences, Germany)

[TuP-23-07]

An improved nonlinear 1D5P model for photovoltaic modules

Sasiwimon Songtraï¹, Songkiate Kittisontirak², Perawut Chinnavornrungsee², Kobsak Sriprapha³, Phassapon Manosukritkul¹, Wisan Tangwongcharoen¹, Rangsak Muanglue¹, Wisut Titiroongruang¹, Surasak Niemcharoen¹ (1. King Mongkut's Inst. Technology Ladkrabang, Thailand, 2. National Energy Technology Center, Thailand, 3. National Electronics and Computer Technology Center, Thailand)

[TuP-23-08]

Model for validating PV models based on one diode and five parameters (1D5P)

Sasiwimon Songtraï¹, Songkiate Kittisontirak², Perawut Chinnavornrungsee², Kobsak Sriprapha³, Phassapon Manosukritkul¹, Rangsak Muanglue¹, Wisut Titiroongruang¹, Surasak Niemcharoen¹ (1. King Mongkut's Inst. Technology Ladkrabang, Thailand, 2. National Energy Technology Center, Thailand, 3. National Electronics and Computer Technology Center, Thailand)

[TuP-23-09]

Reproducible prediction of 3-dimensional solar irradiances onto vehicle-integrated photovoltaic using an aperture matrix

Yasuyuki Ota, Kenji Araki, Kensuke Nishioka (Univ. Miyazaki, Japan)

[TuP-23-10]

Modeling of c-Si PV module performance deterioration based on I-V curve analysis using MATLAB/SIMULINK

Sathiswary Santhiran¹, Nabilah Mat Kassim¹, Mohammad Aminul Islam², Ammar Ahmed Alkahtani¹, Tiong Siew Kiong¹, Mohd Yusrizal Mohd Yusof³, Nowshad Amin¹ (1. Univ. Tenaga Nasional, Malaysia, 2. Univ. Malaya, Malaysia, 3. TNB Renewables Sdn. Bhd., Malaysia)

[TuP-23-11]

Operating power estimation by using the module short circuit current and open circuit voltage

Manit Seapan, Dhirayut Chenvidhya, Ballang Muenpinij, Yaowanee Sangpongsanont, Tanokkorn Chenvidhya (King Mongkut's Univ. Technology Thonburi, Thailand)

[TuP-23-12]

Influence of the solar spectrum variation affected by building shadows on the performance rating of tandem PVs in the actual environment

Yuki Kawakami, Kenji Araki, Yasuyuki Ota, Kensuke Nishioka (Univ. Miyazaki, Japan)

[TuP-23-13]

Calculation of optimal tilt angle of solar arrays on the sloped ground considering the self-shading loss

Koki Nakamura, Kenji Araki, Yasuyuki Ota, Kensuke Nishioka (Univ. Miyazaki, Japan)

[TuP-23-15]

Performance key on maximum power point under temperature coefficient of power and normal operating cell temperature

Ballang Muenpinij, Manit Seapan, Dhirayut Chenvidhya, Yaowanee Sangpongsanont, Tanokkorn Chenvidhya (King Mongkut's Univ. Technology Thonburi, Thailand)

[TuP-23-16]

Measurement error of PV device temperature with a variety of adhesive tapes for covering thermo-sensors

Hiromi Tobita, Tomoya Nakai, Hirofumi Shinohara (Japan Electrical Safety & Environment Technology Labs., Japan)

[TuP-23-17]

Application of Hansen solubility parameters to performance characteristics for anti-soiling coat on photovoltaic-module surface

Riku Kohida¹, Taeko Semba¹, Akihito Hirai², Atsushi Masuda¹ (1. Niigata Univ., Japan, 2. Central Automotive Products, Japan)

[TuP-23-18]

Comparative durability study of commercial inner-pore antireflection coatings and alternative dense coatings

Yiyu Zeng, Ning Song, Martin Green, Yajie Jiang (Univ. New South Wales, Australia)

[TuP-23-19]

Metallurgy engineering-inspired process design and optimisation for efficient solar PV recycling

Yansong Shen (Univ. New South Wales, Australia)

[TuP-23-20]

A new recycling strategy for crystalline silicon PV and CI(G)S thin-film PV modules

Claire Agraffeil¹, Wolfram Palitzsch², Karsten Wambach³ (1. CEA, France, 2. LuxChemtech GmbH, Germany, 3. bifa Environmental Inst., Germany)

[TuP-23-21]

Experimental study of recycling valuable materials from end-of-life PV panels: from thermal treatment to chemical leaching

Yuting Zhuo, Chengsun He, Yansong Shen (Univ. New South Wales, Australia)

Area 2: Advanced applications and core technologies for massive installation

Sub-area 2-3: Field performance of photovoltaic systems and related issues

[WeP-23] PV Array Applications, LCA of PV Modules and Arc Fault Analysis

Wed. Nov 16, 2022 12:00 PM - 3:00 PM P-23/Event Hall (Bldg. 1, 1F)

[WeP-23-01]

A comprehensive study of measurement reproducibility for photovoltaic modules

Xin Huang, Chenhui Nan, Muyang Lu, Hong Yang, He Wang (Xi'an Jiaotong Univ., China)

[WeP-23-02]

Comparative study on temperature coefficient of PERC and HIT solar modules under different injection conditions

Chenhui Nan, Xin Huang, Xiaoqian Li, Hong Yang, He Wang (Xi'an Jiaotong Univ., China)

[WeP-23-03]

Optical simulation of backsheet reflection effect in photovoltaic module with MATLAB

Ji-Seong Hwang, Yoonmook Kang, Donghwan Kim, Hae-Seok Lee (Korea Univ., Korea)

[WeP-23-04]

Energy yield comparison between the mono facial module with mono facial cell and mono facial module with bi facial cell at the carport system

Sungho Hwang¹, Woncheol Jeong¹, Hae-seok Lee¹, Dongchul Suh², Yoonmook Kang¹, Yongseok Jun¹ (1. Korea Univ., Korea, 2. Hoseo Univ., Korea)

[WeP-23-05]

Consideration of MPPT optimization in vehicle integrated photovoltaic

Kento Hirata, Kenji Araki, Yasuyuki Ota, Kensuke Nishioka (Univ. Miyazaki, Japan)

[WeP-23-06]

Solar resource estimation on eight orientations of the building walls with consideration of the spectrum variation

Kodai Takachiho, Kenji Araki, Yasuyuki Ota, Akira Nagaoka, Kensuke Nishioka (Univ. Miyazaki, Japan)

[WeP-23-07]

Power performance evaluation based on one-year empirical data of vertical BIPV facing south

Jaewon Kim, Eunho Kang, Mungyu Choi, Dongsu Kim, Jongho Yoon (Hanbat National Univ., Korea)

[WeP-23-08]

Allocation of future photovoltaic power generation capacity between distribution areas based on municipality statistical data

Masaki Shimura¹, Masaki Imanaka¹, Takeyoshi Kato¹, Manabu Hattori² (1. Nagoya Univ., Japan, 2. Chubu Region Inst. Social and Economic Research, Japan)

[WeP-23-09]

Subchronic toxicity of new solar cell materials intratracheally instilled into rats

Akiyo Tanaka¹, Hyunwoong Seo², Nagisa Matsumura¹, Etsuko Shibata¹, Kazunori Koga^{1,3}, Masaharu Shiratani¹ (1. Kyushu Univ., Japan, 2 Inje Univ., Korea, 3 National Inst. Natural Sciences, Japan)

[WeP-23-10]

Life cycle assessment of thin-film, silicon-based PowerFoil[®] produced in The Netherlands

Gianluca Limodio¹, Seba Makhoulouf¹, Edward Hamers², Arno Smets¹ (1. Delft Univ. Technology, The Netherlands, 2. HyET Solar Netherlands B.V., The Netherlands)

[WeP-23-11]

Machine learning-powered module end-of-life decision making based on luminescence images

Brendan Wright, Ziv Hameiri (Univ. New South Wales, Australia)

[WeP-23-12]

Retrofit solar kit for electric vehicles: Range extender for improved performances and reduced CO₂ impact

Bertrand Chambion, Benjamin Commault, Lionel Serra, Loic Lonardoni, Shehrazade Nassibi, Fathia Karoui, Fabrice Claudon, Aurélien Raddenzati (Univ. Grenoble Alpes, CEA LITEN, National Inst. Solar Energy, France)

[WeP-23-13]

Decision-making tool considering life cycle costing and carbon footprint assessment for PV-powered charging station

Amalie Alchami, Manuela Sechilariu, Fabrice Locment (Univ. Technologie de Compiègne, France)

[WeP-23-14]

Agrivoltaic system: Establishment of PPFD calculation formula under solar panels

Daisuke Yajima, Teruya Toyoda, Masaaki Kirimura, Kenji Araki, Kensuke Nishioka (Univ. Miyazaki, Japan)

[WeP-23-15]

Repurposing decommissioned functional photovoltaic modules for agricultural applications: A pilot project in Thailand

Nopphadol Sitthiphol¹, Aswin Hongsingthong¹, Suttinan Jaroensathainchok¹, Rangson

Pluemkamon¹, Saifon Kotesopa¹, Nuttakarn Udomdachanut¹, Nisa Pakvilai², Amornrat Limmanee¹
(1. National Energy Technology Center, Thailand, 2. Valaya Alongkorn Rajabhat Univ., Thailand)

[WeP-23-16]

Detection technology of short fault of a PV string by monitoring string current

Shogo Nishikawa¹, Aoshi Igarashi¹, Kotaro Tanimura², Yoshihisa Asao² (1. Nihon Univ., Japan, 2. Sumitomo Electric Industries, Ltd. Japan)

[WeP-23-17]

An experimental study on dependence of high-frequency noise occurred by arc fault in PV on arcing current

Akihiro Tsusaka, Jun Kurahashi, Kazuto Yukita, Toshiya Nanahara, Yasuyuki Goto (Aichi Inst. Technology, Japan)

[WeP-23-18]

An experimental study on electrode material dependence of high-frequency noise occurred by arc faults in photovoltaic systems

Jun Kurahashi, Akihiro Tsusaka, Kazuto Yukita, Toshiya Nanahara, Yasuyuki Goto (Aichi Inst. Technology, Japan)

[WeP-23-19]

Electrodynamic dust shield systems to clean soiled solar panel

Hiroyuki Kawamoto (Waseda Univ., Japan)

[WeP-23-20]

Cost-effective waterless cleaning techniques through material and process innovations for mitigation of energy yield loss in photovoltaic systems

Deepanjana Adak, Raghunath Bhattacharyya, Silajit Manna (Indian Inst. Engineering Science and Technology, India)

[WeP-23-21]

Evaluation of cleaning effectiveness and performance of photovoltaic module cleaning systems

Jai Prakash, Birinchi Bora (National Inst. Solar Energy, India)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-1: Wafer-based silicon photovoltaics and related technologies

[MoO-31a] Materials and Characterizations

Session Chairs: Daniel MacDonald (Australian National Univ., Australia), Yasuaki Ishikawa (Aoyama Gakuin Univ., Japan)

Mon. Nov 14, 2022 8:30 AM - 10:00 AM 141+142 (Bldg. 1, 4F)

[MoO-31a-01] 8:30 AM – 8:45 AM

Effect of thermal radiation entropy on the outdoor efficiency limit of single-junction silicon solar cells

Hesan Ziar (Delft Univ. Technology, The Netherlands)

[MoO-31a-02] 8:45 AM-9:00AM

Understanding microscopic mechanisms of LeTID and LID and their unifying feature by electron paramagnetic resonance

Abigail R. Meyer², P. Craig Taylor², Chirag Mule², Sumit Agarwal², Paul Stradins¹ (1. National Renewable Energy Lab., USA, 2. Colorado School of Mines, USA)

[MoO-31a-03] 9:00 AM – 9:15 AM

A hybrid empirical and machine learning method to estimate solar cell fill factor from luminescence images

Gaia Maria Javier, Priya Dwivedi, Yoann Buratti, Thorsten Trupke, Ziv Hameiri (Univ. New South Wales, Australia)

[MoO-31a-04] 9:15 AM – 9:30 AM

Dislocation generation via the formation of higher-order twin boundaries in mono-cast silicon

Yutaka Ohno¹, Kenta Yamakoshi², Takuto Kojima², Hideto Yoshida³, Patricia Krenckel⁴, Stephan Riepe⁴, Koji Inoue¹, Yasuyoshi Nagai¹, Noritaka Usami² (1. Tohoku Univ., Japan, 2. Nagoya Univ., Japan, 3. Osaka Univ., Japan, 4Fraunhofer Inst. Solar Energy Systems, Germany)

[MoO-31a-05] 9:30 AM – 9:45 AM

Quality assessment of photovoltaic manufacturing lines through lag-sequential analysis

Gaia Maria Javier, Rhett Evans, Priya Dwivedi, Yoann Buratti, Thorsten Trupke, Ziv Hameiri (Univ. New South Wales, Australia)

[MoO-31a-06] 9:45 AM – 10:00 AM

Applications of time-resolved photoluminescence decay in characterizing heavily-doped crystalline silicon and amorphous silicon films

Zhuofeng Li, Hang Cheong Sio, Anyao Liu, Rabin Basnet, Daniel Macdonald, Hieu T. Nguyen

(Australian National Univ., Australia)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-1: Wafer-based silicon photovoltaics and related technologies

[MoO-31b] Silicon Heterojunction -1

Session Chairs: Hitoshi Sai (National Inst. Advanced Industrial Science and Technology, Japan), Pauls Stradins (National Renewable Energy Lab., USA)

Mon. Nov 14, 2022 10:30 AM - 12:00 PM 141+142 (Bldg. 1, 4F)

[MoO-31b-01] 10:30 AM – 11:00 AM

(INVITED) Recent development in high efficiency silicon heterojunction solar cell technology

Miao Yang, Xiaoning Ru, Shi Yin, Chengjian Hong, Fuguo Peng, Minghao Qu, Yichun Wang, Junxiong Lu, Liang Fang, Xixiang Xu (LONGi Green Energy Technology Co., Ltd., China)

[MoO-31b-02] 11:00 AM – 11:15 AM

Improvement of contact resistivity by boron delta-doping in p-type amorphous silicon surface

Kazuhiro Gotoh¹, Ryo Ozaki², Motoo Morimura², Aki Tanaka³, Yoshiko Iseki¹, Kyotaro Nakamura², Kazuo Muramatsu³, Yasuyoshi Kurokawa¹, Yoshio Ohshita², Noritaka Usami¹ (1. Nagoya Univ., Japan, 2. Toyota Technological Inst., Japan, 3. Namics Corp., Japan)

[MoO-31b-03] 11:15 AM – 11:30 AM

A novel one-step solution method to fabricate silicon nanopyramid texture and its application to crystalline silicon heterojunction solar cells

Yuqing Li^{1,2}, Hitoshi Sai¹, Takuya Matsui^{1,2}, Noritaka Usami² (1. National Inst. Advanced Industrial Science and Technology, Japan, 2 Nagoya Univ., Japan)

[MoO-31b-04] 11:30 AM – 11:45 AM

Correlation between the stability of silicon heterojunction solar cells and hydrogenated silicon thin film passivation layers

Liping Zhang^{1,2}, Anjun Han^{1,2}, Shihu Lan¹, Hui Zhao¹, Hongyuan Chen¹, Junlin Du^{1,2}, Jianhua Shi^{1,2}, Wenzhu Liu², Fanying Meng^{1,2}, Guoqiang Xing¹, Yi Xie¹, Zhengxin Liu^{1,2} (1. Tongwei Solar (Chengdu) Co., Ltd., China, 2. Shanghai Institute of Microsystem and Information Technology Chinese Academy of Sciences, China)

[MoO-31b-05] 11:45 AM – 12:00 PM

Amorphous/crystalline silicon heterojunction solar cell towards the high reliability

Fanying Meng^{1,2}, Anjun Han^{1,2}, Hongyuan Chen¹, Jianhua Shi^{1,2}, Haoxin Fu¹, Bin Fan¹, Guoqiang Xing¹, Yi Xie¹, Zhengxin Liu^{1,2} (1. Tongwei Solar (Chengdu) Co., Ltd., China, 2. Shanghai Institute of Microsystem and Information Technology Chinese Academy of Sciences, China)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-1: Wafer-based silicon photovoltaics and related technologies

[TuO-31c] Novel Devices

Session Chairs: Wilfried Favre (Univ. Grenoble Alpes, CEA, LITEN, INES, France), Keisuke Ohdaira (Japan Advanced Inst. Science and Technology, Japan)

Tue. Nov 15, 2022 10:30 AM - 12:00 PM 141+142 (Bldg. 1, 4F)

[TuO-31c-01] 10:30 AM – 11:00 AM

(INVITED) Transparent crystalline silicon solar cells and modules

Kwanyong Seo (Ulsan National Inst. Science and Technology, Korea)

[TuO-31c-02] 11:00 AM – 11:15 AM

Recent progress of Rib-Si solar cell and application of Rib techniques to see-through bifacial Si heterojunction solar cells

Makoto Konagai, Yukimi Ichikawa, Daichi Ishii, Ryouyusuke Ishikawa (Tokyo City Univ., Japan)

[TuO-31c-03] 11:15 AM – 11:30 AM

Silicon microwire arrays with nanoscale spacing for radial junction c-Si solar cells with an efficiency of 20.5%

Namwoo Kim¹, Deokjae Choi¹, Hyungwoo Kim¹, Han-Don Um², Kwanyong Seo¹ (1. Ulsan National Inst. Science and Technology, Korea, 2. Kangwon National Univ., Korea)

[TuO-31c-04] 11:30 AM – 11:45 AM

Ultrathin Al-doped SiO_x passivating hole-selective contacts formed by a simple wet process

Hiroki Nakajima, Huynh Thi Cam Tu, Keisuke Ohdaira (Japan Advanced Inst. Science and Technology, Japan)

[TuO-31c-05] 11:45 AM – 12:00 PM

Application of TiO_x/metal bilayer as hole-selective passivating contact in crystalline silicon solar cells

Takuya Matsui¹, Shona McNab², Ruy Sebastian Bonilla², Hitoshi Sai¹ (1. National Inst. Advanced Industrial Science and Technology, Japan, 2 Univ. Oxford, UK)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-1: Wafer-based silicon photovoltaics and related technologies

[TuP-31] Wafer-based Silicon Photovoltaics and Related Technologies

Tue. Nov 15, 2022 12:00 PM - 3:00 PM P-31/Event Hall (Bldg. 1, 1F)

[TuP-31-01]

Assessment on fire and hotspot risk caused by non-uniform rear reflection in bifacial photovoltaic module

Chung Il Kim, Jaehwan Ko, Hyung-Jun Song (Seoul National Univ. Science and Technology, Korea)

[TuP-31-02]

Flexible and light-weight crystalline silicon solar cell modules and reliability performance

Tomihisa Tachibana, Katsuto Tanahashi, Yuji Ino, Katsuhiko Shirasawa (National Inst. Advanced Industrial Science and Technology, Japan)

[TuP-31-03]

Real-time, noncontact estimation method for voltage of one cell in generating module

Yasuyuki Kobayashi, Ngo Doan Hoang Linh (Teikyo Univ., Japan)

[TuP-31-04]

Validation of bifacial PV's irradiance simulation software via *En* score to account for measurement and simulation uncertainties

Tian Shen Liang, Leow Shin Woei, Mauro Pravettoni (National Univ. Singapore, Singapore)

[TuP-31-05]

Study on the inhibition of temperature rise by thermal conducting nanoparticles mixed SiO_x film in crystalline silicon solar cell module without encapsulant layer

Yasushi Sobajima¹, Keigo Shimizu¹, Yudai Hasegawa¹, Yuto Maehara¹, Shinya Tsukamoto¹, Keisuke Ohdaira² (1. Gifu Univ., Japan, 2. Japan Advanced Inst. Science and Technology, Japan)

[TuP-31-06]

PV module structure with sacrificial layer

Jongwon Ko, Soohyun Bae, Yoonmook Kang, Hae-Seok Lee, Donghwan Kim (Korea Univ., Korea)

[TuP-31-07]

Experimental research on curved photovoltaic modules: Effects of hot spots, interconnect schemes and curvature on electrical PV performance

Sachiko Jonai^{1,2}, Haruto Morishita¹, Yasuo Cho³, Diego Bronneberg², Martin Huijzer², Angèle Reinders^{2,4} (1. Niigata Univ., Japan, 2. Eindhoven Univ. Technology, The Netherlands, 3. Tohoku

Univ., Japan, 4. Univ. Twente, The Netherlands)

[TuP-31-08]

Characterization of bifacial one cell mini module with various back sheet

Hyeonwook Park, Mohaseen Tamboli, Meenakshi Sahu, Jae Ho Yun, Chinho Park (Korea Inst. Energy Technology Univ., Korea)

[TuP-31-09]

Crystal growth and resistivity modulation of n-type phosphorus-doped cast mono-like silicon

Jie Huang, Xuegong Yu, Shuai Yuan, Deren Yang (Zhejiang Univ., China)

[TuP-31-10]

3D stress analysis of multicrystalline Si with artificial grain boundaries and evaluation of dislocation cluster distribution

Haruki Tajika¹, Kentaro Kutsukake², Takuto Kojima¹, Xin Liu¹, Hiroyuki Tanaka¹, Noritaka Usami¹ (1. Nagoya Univ., Japan, 2. RIKEN, Japan)

[TuP-31-12]

Experimental investigation on metallic and non-metallic impurities in grown Ge doped mc-silicon ingot for PV applications

Anbu Gopalakrishnan, Srinivasan Manickam, Ramasamy Perumalsamy (Sri Sivasubramaniya Nadar College of Engineering, India)

[TuP-31-13]

Image translation from two optical images and an image of grain boundaries to distribution image of generation points of dislocations clusters in silicon wafer

Hiroaki Kudo¹, Takuto Kojima¹, Kentaro Kutsukake², Tetsuya Matsumoto¹, Noritaka Usami¹ (1. Nagoya Univ., Japan, 2. RIKEN, Japan)

[TuP-31-14]

Reduction of power consumption by retort side modification in directional solidification furnace

Thamocharan Keerthivasan, Manickam Srinivasan, Perumalsamy Ramasamy (Sri Sivasubramaniya Nadar College of Engineering, India)

[TuP-31-15]

Novel chemical etching process used to reduce the reflectance of the as-cut p-type boron-doped mc-silicon wafer for improving solar cell efficiency

Madhesh Raji, Srinivasan Manickam, Perumalsamy Ramasamy (Sri Sivasubramaniya Nadar College of Engineering, India)

[TuP-31-16]

Gettering effect of deep level impurities in silicon wafer using aluminium oxide film
SeungHyeon Oh, MyeongSeob Sim, Donghwan Kim, Yoonmook Kang, Hae-Seok Lee (Korea Univ., Korea)

[TuP-31-17]

Advanced analysis for Si PV using injection dependent lifetime and PL imaging technology

Sungeun Park, Sang Hee Lee, Chelwook Kwon, Hee-eun Song, Min-Gu Kang (Korea Institute of Energy Research, Korea)

[TuP-31-18]

Fill factor loss analysis of industrial silicon solar cells for the elevated temperature condition

Sang Hee Lee, Kwan Hong Min, Min Gu Kang, Hee-eun Song, Kyung Taek Jeong, Sungeun Park (Korea Inst. Energy Research, Korea)

[TuP-31-19]

The impact of an Al₂O₃ dielectric layer on p-type solar cells to reduces potential-induced degradation and improves PV module reliability.

Muhammad Aleem Zahid, Youngkuk Kim, Eun Chel Cho, Junsin Yi (Sungkyunkwan University, Korea)

[TuP-31-20]

Comparison of polarization-type potential-induced degradation in p-type and n-type front-emitter crystalline silicon photovoltaic cell modules

Seira Yamaguchi^{1,2}, Sachiko Jonai², Kyotaro Nakamura³, Kazuhiro Marumoto¹, Yoshio Ohshita³, Atsushi Masuda² (1. Univ. Tsukuba, Japan, 2. Niigata Univ., Japan, 3. Toyota Technological Inst., Japan)

[TuP-31-21]

Acceleration of potential-induced degradation in crystalline Si photovoltaic modules after a lightning impulse strike

Tetsuya Kaneko¹, Suy Kimsong¹, Yukiko Hara², Atsushi Masuda³, Masao Isomura¹ (1. Tokai Univ., Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan, 3. Niigata Univ., Japan)

[TuP-31-22]

Potential-induced degradation of encapsulant-less p-type crystalline Si photovoltaic modules

Shuntaro Shimpo, Huynh Thi Cam Tu, Keisuke Ohdaira (Japan Advanced Inst. Science and Technology, Japan)

[TuP-31-23]

Evaluation of PID characteristic of bifacial p-PERC silicon photovoltaic module by encapsulant types

Jang HongJun, Lee SolHee, Lee SangWon, Kim DongHwan, Kang YoonMook, Lee HaeSeok (Korea Univ., Korea)

[TuP-31-24]

Evaluations of physical properties of glass layer formed on cover glass of photovoltaic modules as a potential-induced degradation suppression technique

Go Sian Huai, Hirokazu Takahashi, Takahiko Haga, Ryo Fuseya, Fumitaka Ohashi, Tetsuji Kume, Shuichi Nonomura (Gifu Univ., Japan)

[TuP-31-25]

Reliability examination of cell-level PID test for rear-side of bifacial PERC silicon solar cells

Shingo Suzuki, Yasuaki Ishikawa (Aoyama Gakuin Univ., Japan)

[TuP-31-26]

Potential-induced degradation of p-type crystalline Si cell modules with a SiN_x film formed by Cat-CVD

Ryoichi Ishikawa¹, Toshiki Itasaka¹, Huynh Thi Cam Tu¹, Tomihisa Tachibana², Keisuke Ohdaira¹ (Japan Advanced Inst. Science and Technology, Japan, National Inst. Advanced Industrial Science and Technology, Japan)

[TuP-31-27]

Comparative analysis of light and elevated temperature-induced degradation in c-Si solar cells

Hasnain Yousuf, Muhammad Aleem Zahid, Yewon Cha, Dhungel Suresh Kumar, Youngkuk Kim, Junsin Yi (Sungkyunkwan Univ, Korea)

[TuP-31-28]

Study on corrosion mechanism at the rear side of bifacial PERC solar cells

Yuanpang Hao, Xin Huang, Xiaocai Ke, Hong Yang, He Wang (Xi'an Jiaotong Univ., China)

[TuP-31-29]

Influence of surface contamination on damp-heat induced degradation in silicon heterojunction cells and modules

Chandany Sen, Catherine Chan, Muhammad Umair Khan, Bram Hoex (Univ. New South Wales, Australia)

[TuP-31-30]

Analysis of carrier induced degradation exhibited on a mono-crystalline wafer by pre-hydrogenation before emitter formation process

MyeongSeob Sim, Dongjin Choi, Yujin Jung, HyunJung Park, Yoonmook Kang, Donghwan Kim,

Hae-Seok Lee (Korea Univ., Korea)

[TuP-31-31]

Real-time, noncontact estimation method for voltage of one cell in generating module

Yasuyuki Kobayashi, Ngo Doan Hoang Linh (Teikyo Univ., Japan)

[TuP-31-32]

Impedance spectroscopy characterization of a-Si:H/c-Si heterojunction solar cells

Jagannath Panigrahi, Ashutosh Pandey, Shrestha Bhattacharya, Sourav Mandal, Vamsi K. Komarala (Indian Inst. Technology, India)

[TuP-31-33]

Si-heterojunction solar cells with a p-layer deposited at low substrate temperatures

Daichi Ishii, Makoto Konagai, Ryouzuke Ishikawa (Tokyo City Univ., Japan)

[TuP-31-34]

Defining specifications for accurate metal/TCO contact resistivity measurements in silicon heterojunction devices

Senami Zogbo^{1,2}, Wilfried Favre¹, Marie-Estelle Gueunier-Farret², Olivier Bonino¹ (1. Univ. Grenoble Alpes, France, 2. Univ. Paris-Saclay, Sorbonne Univ., France)

[TuP-31-35]

Molecular dynamics study of Si:H/c-Si interface using on-the-fly machine learning potential

Takayuki Semba, Ryoji Asahi (Nagoya Univ., Japan)

[TuP-31-36]

Simulation study of boron delta-doping layer on p-type hydrogenated amorphous silicon in silicon heterojunction solar cells

Kazuhiro Gotoh, Yasuyoshi Kurokawa, Noritaka Usami (Nagoya Univ., Japan)

[TuP-31-37]

Calculation model to determine the dopant concentration in doped hydrogenated amorphous silicon

Zhenfei Li^{1,2}, Liping Zhang^{1,2}, Wenzhu Liu^{1,2}, Youlin Yu^{1,2}, Fanying Meng^{1,2}, Zhengxin Liu^{1,2} (1 Shanghai Inst. Microsystem and Information Technology, Chinese Academy of Sciences, China, 2. Univ. Chinese Academy of Sciences, China)

[TuP-31-38]

Post-annealing effects on dual-layered hydrogenated amorphous silicon/crystalline silicon heterointerfaces

Kazuma Inoue¹, Kazuhiro Gotoh¹, Kentaro Kutsukake², Naomi Sawamoto³, Tappei Nishihara³, Yasuyoshi Kurokawa¹, Atsushi Ogura³, Noritaka Usami¹ (1. Nagoya Univ., Japan, 2. RIKEN, Japan,

3. Meiji Univ., Japan)

[TuP-31-39]

Characteristics analysis by bulk lifetime and resistivity of n-type wafer on heterojunction solar cells

Cheolwook Kwon^{1,2}, Sanghee Lee¹, Hee-eun Song¹, Mingu Kang¹, Sungeun Park¹, Hae-seok Lee²
(1. Korea Inst. Energy Research, Korea, 2. Korea Univ., Korea)

[TuP-31-42]

Effect of post-deposition annealing on TiO_x passivation films deposited by reactive sputtering

Riku Sakamoto, Yu Mandai, Issei Nonaka, Koji Arafune (Univ. Hyogo, Japan)

[TuP-31-43]

Passivation quality of In-Ti-O amorphous metal oxide prepared by mist chemical vapor deposition

Atsushi Nakano, Yuta Shinjo, Yuma Ueno, Akihiro Mori, Koji Arafune (Univ. Hyogo, Japan)

[TuP-31-44]

Effect of a lithium fluoride layer on the passivation performance of metalized titanium oxide/silicon oxide/silicon heterostructures

Shohei Fukaya¹, Kazuhiro Gotoh¹, Takuya Matsui², Hitoshi Sai², Yasuyoshi Kurokawa¹, Noritaka Usami¹ (1. Nagoya Univ., Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan)

[TuP-31-45]

Material sustainability of passivating contact schemes for silicon solar cells and modules at the terawatt scale

Moonyong Kim, Yuchao Zhang, Li Wang, Robert Underwood, Brett Hallam (Univ. New South Wales, Australia)

[TuP-31-47]

Enhanced performance of PEDOT:PSS/n-Si solar cells employing inverted pyramidal silicon by one-step copper catalyzed etching

Avritti Srivastava^{1,2}, Ruchi K. Sharma^{1,2}, Premshila Kumari^{1,2}, Prathap Pathi^{1,2}, Sanjay K. Srivastava^{1,2} (1. CSIR-National Physical Lab., India, 2. Academy of Scientific and Innovation Research, India)

[TuP-31-48]

Titanium oxide nanomaterials for photovoltaic devices as an electron selective contact in silicon solar cells

Changhyun Lee¹, Hyunju Lee², Yoonmook Kang¹, Hae-Seok Lee¹, Donghwan Kim¹ (1. Korea Univ., Korea, 2. Meiji Univ., Japan)

[TuP-31-49]

Application of titanium oxide thin film formed by argon/hydrogen mixed gas sputtering to electron selective layers of crystalline silicon solar cells

Tokumo Kuze, Tetsuya Kaneko, Masao Isomura (Tokai Univ., Japan)

[TuP-31-50]

Optimisation of passivating exciton transport layer for singlet fission sensitised silicon solar cell

Alvin Mo, Alexander Baldacchino, Michael Nielsen, Murad Tayebjee, Bram Hoex (Univ. New South Wales, Australia)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-1: Wafer-based silicon photovoltaics and related technologies

[TuO-31d] Metallization

Session Chairs: Daisuke Adachi (Kaneka Corp., Japan), Olindo Isabella (Delft Univ. Technology, The Netherlands)

Tue. Nov 15, 2022 3:30 PM - 5:00 PM 141+142 (Bldg. 1, 4F)

[TuO-31d-01] 3:30 PM – 4:00 PM

(INVITED) Sustainable aluminum metallization processes for photovoltaics terawatt era

Kosuke Tsuji¹, Shota Suzuki¹, Hideaki Minamiyama¹, Dhamrin Marwan^{1,2} (1. Toyo Aluminium K.K., Japan, 2. Osaka Univ., Japan)

[TuO-31d-02] 4:00 PM – 4:15 PM

Progress and current challenges with saving silver in screen-printed metallization of Si solar cells

Sebastian Tepner¹, Timo Wenzel¹, Michael Linse¹, Sebastian Pingel¹, Denis Erath¹, Elmar Lohmüller¹, Yin Cheung Lau², Andreas Lorenz¹, Florian Clement¹ (1. Fraunhofer Institute for Solar Energy Systems, Germany, 2. Asada Mesh Co., Ltd., Japan)

[TuO-31d-03] 4:15 PM – 4:30 PM

Copper paste for silicon heterojunction solar cells

Marwan Dhamrin^{1,2}, Shota Suzuki², Kosuke Tsuji², Hideaki Minamiyama², Johann Jourdan³, Julien Diaz³, Mathieu Debourdeau³, Florent Pernoud³, Bertrand Hladys³, Vincent Barth³, Remi Monna³, Kazunori Ishikawa¹ (1. Osaka Univ., Japan, 2. Toyo Aluminium K.K., Japan, 3. CEA Inst. National de l'Énergie Solaire, France)

[TuP-31d-04] 4:30 PM – 4:45 PM

n-type solar cell technology with aluminum metallization

Radovan Kopecek¹, Thomas Buck¹, Kosuke Tsuji², Shota Suzuki², Marwan Dhamrin^{2,3} (1. ISC Konstanz, Germany, 2. Toyo Aluminium K.K., Japan, 3. Osaka Univ. Japan)

[TuP-31d-05] 4:45 PM – 5:00 PM

Hybrid metallization for high efficiency silicon photovoltaics with low silver consumption

Yuan-Chih Chang¹, Li Wang¹, Sisi Wang¹, Yuchao Zhang¹, Chien-Yu Huang¹, Shaoyuan Li², Jingjia Ji¹, Brett Hallam¹ (1. Univ. New South Wales, Australia, 2. Kunming Univ. Science and Technology, China)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-1: Wafer-based silicon photovoltaics and related technologies

[TuO-31e] Silicon Heterojunction -2

Session Chairs: Zhengxin Liu (Shanghai Institute of Microsystem and Information Technology Chinese Academy of Sciences, China), Tetsuya Kaneko (Tokai Univ., Japan)

Tue. Nov 15, 2022 5:30 PM - 7:00 PM 141+142 (Bldg. 1, 4F)

[TuO-31e-01] 5:30 PM – 6:00 PM

(INVITED) The re-discovery of hot-wire/catalytic CVD for high efficiency silicon solar cells

Kaining Ding, Alexander Eberst, Weiyuan Duan (Research Center Juelich, Germany)

[TuO-31e-02] 6:00 PM – 6:15 PM

Toward TCO-free silicon heterojunction solar cells - Role of front- and rear-side TCO layers in electrical transport and stability

Hitoshi Sai, Takuya Matsui (National Inst. Advanced Industrial Science and Technology, Japan)

[TuO-31e-03] 6:15 PM – 6:30 PM

Effects of (i) a-Si:H deposition temperature and strategies to reduce In-based TCO and Ag use in high-efficiency SHJ solar cells

Yifeng Zhao¹, Can Han¹, Paul Procel^{1,2}, Arno Smets¹, Luana Mazzarella¹, Guangtao Yang¹, Liqi Cao¹, Zhirong Yao¹, Arthur Weeber^{1,3}, Miro Zeman¹, Olindo Isabella¹ (1. Delft Univ. Technology, The Netherlands, 2. San Francisco de Quito Univ., Ecuador, 3. TNO Energy Transition, The Netherlands)

[TuO-31e-04]

Dopant-free interdigitated back contact silicon solar cells with efficiencies over 23.6%
Zhaolang Liu^{1,2}, Hao Lin¹, Zilei Wang¹, Liyan Chen¹, Taojian Wu¹, Yicong Pang¹, Lun Cai¹, Jian He¹, Shanglong Peng², Hui Shen¹, Pingqi Gao¹ (1. Sun Yat-sen Univ., China, 2. Lanzhou Univ., China)

[TuO-31e-05]

The application of ultra-thin MoO_x in silicon heterojunction solar cells

Liqi Cao¹, Luana Mazzarella¹, Paul Procel^{1,2}, Yifeng Zhao¹, Engin Özkol¹, Jin Yan¹, Can Han¹, Guangtao Yang¹, Zhirong Yao¹, Miro Zeman¹, Olindo Isabella¹ (1. Delft Univ. Technology, The Netherlands, 2. San Francisco de Quito Univ., Ecuador)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-1: Wafer-based silicon photovoltaics and related technologies

[WeP-31] Wafer-based Silicon Photovoltaics and Related Technologies

Wed. Nov 16, 2022 12:00 PM - 3:00 PM P-31/Event Hall (Bldg. 1, 1F)

[WeP-31-01]

Enhancement of light absorption in transparent crystalline silicon solar cells using light-harvesting film

Kangmin Lee, Kwanyong Seo (Ulsan National Inst. Science and Technology, Korea)

[WeP-31-02]

Optical confinement in silicon nanowires: A study on electromagnetic field, absorption depth profile and excitation generation rate distributions

Mohammad Kamal Hossain¹, Ayman Wajeih Mukhaimer² (1. King Fahd Univ. Petroleum & Minerals, Saudi Arabia, 2. RMIT Univ., Australia)

[WeP-31-03]

Diminished angular dependency of crystalline silicon microwire solar cells by broadband antireflection effect using transparent spheres

Youri Lee, Kanmin Lee, Kwanyong Seo (Ulsan National Inst. Science and Technology, Korea)

[WeP-31-04]

Anti-reflection coating of crystalline Si solar cells using stacked structures with silicon nanoparticle layers

Shinya Kato¹, Yasuyoshi Kurokawa², Tetsuo Soga¹ (1. Nagoya Inst. Technology, Japan, 2. Nagoya Univ., Japan)

[WeP-31-05]

Revolutionizing antireflection coatings for solar module glass

Ning Song, Yiyu Zeng, Yajie Jiang, Nathan Chang, Angus Gentle, Zibo Zhou, Mark Keevers, Nicholas Ekins-Daukes, Renate Egan, Martin Green (Univ. New South Wales, Australia)

[WeP-31-06]

Investigation of the effect of plasmonic gold nanoparticles on non-textured Si solar cells

Komei Kobayashi, Sachiko Jonai, Kazunari Shinbo, Keizo Kato, Atsushi Masuda, Akira Baba (Niigata Univ., Japan)

[WeP-31-07]

Spatial distribution of absorption depth profile: Influence of silver nanoparticles within absorbing layer

Mohammad Kamal Hossain¹, Ayman Wajeeh Mukhaimer² (1. King Fahd Univ. Petroleum & Minerals, Saudi Arabia, 2. RMIT Univ., Australia)

[WeP-31-08]

Microscopic carrier distribution imaging of black silicon solar cell by scanning nonlinear dielectric microscopy

Yasuo Cho¹, Beniamino Iandolo², Ole Hansen² (1. Tohoku Univ., Japan, 2. Technical Univ. Denmark, Denmark)

[WeP-31-09]

Accelerating the solar energy transition through artificial intelligence

Priya Dwivedi, Yoann Buratti, Zubair Abdullah-Vetter, Grace Liu, Gaia Maria Javier, Thorsten Trupke, Ziv Hameiri (Univ. New South Wales, Australia)

[WeP-31-10]

Super-resolution luminescence imaging of solar cells using deep learning

Priya Dwivedi, Juergen Weber, Robert Lee Chin, Thorsten Trupke, Ziv Hameiri (Univ. New South Wales, Australia)

[WeP-31-11]

A neural network-based estimation of the generation of dislocation clusters in multicrystalline silicon

Kyoka Hara¹, Takuto Kojima¹, Kentaro Kutsukake², Hiroaki Kudo¹, Noritaka Usami¹ (1. Nagoya Univ., Japan, 2. RIKEN, Japan)

[WeP-31-12]

Deep learning accelerated material discovery for Si-based solar cells-passivating contact layers material discovery & synthesis

Tong Xie¹, Yuwei Wan, Bram Hoex, Kit Chunyu² (1. Univ. New South Wales, Australia, 2. City Univ. Hong Kong, China)

[WeP-31-13]

Atomic-scale PECVD process simulations at Si/silicon-germanium interface by reactive force-field molecular dynamics

Naoya Uene¹, Takuya Mabuchi¹, Masaru Zaitsumi², Shigeo Yasuhara², Takashi Tokumasu¹ (1. Tohoku Univ., Japan, 2. Japan Advanced Chemicals Ltd., Japan)

[WeP-31-14]

The fundamental difference in polysilicon crystallinity of p-type and n-type polysilicon contacts

Yalun Cai, Anastasia Soeriyadi, Ran Chen, Brett Hallam, Fiacre Rougieux (Univ. New South Wales, Australia)

[WeP-31-15]

Pulsed laser melting to achieve hyperdoped p-type poly-Si/SiO_x passivating contact structures

Kejun Chen^{1,3}, Enrico Napolitani², Matteo De Tullio², Matilde Siviero², Francesco Sgarbossa², San Theingi³, William Nemeth³, Matthew Page³, Paul Stradins³, Sumit Agarwal^{1,3}, David L. Young³ (1. Colorado School of Mines, USA, 2. Univ. Padova, Italy, 3. National Renewable Energy Lab., USA)

[WeP-31-16]

Passivating contacts based on directly-nitridated ultra-thin silicon nitride films

Yuli Wen, Huynh Thi Cam Tu, Keisuke Ohdaira (Japan Advanced Inst. Science and Technology, Japan)

[WeP-31-17]

Characterization of engineered pinholes in dielectric stacks for high performance silicon passivating contacts

Harvey Guthrey¹, Caroline Lima Salles^{1,2}, William Nemeth¹, Sumit Agarwal², David Young¹, Paul Stradins¹ (1. National Renewable Energy Lab., USA, Colorado School of Mines, USA)

[WeP-31-18]

Application of hydrogenated silicon nanocrystal/silicon oxide compound layer to crystalline silicon solar cells

Masashi Matsumi, Kazuhiro Gotoh, Satoru Miyamoto, Yasuyoshi Kurokawa, Noritaka Usami (Nagoya Univ., Japan)

[WeP-31-19]

Carrier transport pathways in silicon nanocrystal/silicon oxide composite films

Asaki Arata¹, Kazuhiro Gotoh¹, Shigeru Yamada², Yasuyoshi Kurokawa¹, Takashi Itoh², Noritaka Usami¹ (1. Nagoya Univ., Japan, 2. Gifu Univ., Japan)

[WeP-31-20]

Polysilicon passivating contact layer for crystalline silicon solar cells: A dopant-grading approach

Duy Phong Pham, Junsin Yi (Sungkyunkwan Univ. Korea)

[WeP-31-21]

Inhibition of boron in-diffusion in polo structure by deposition heteroepitaxy films

Jun-young Jeong, Hae-seok Lee (Korea Univ., Korea)

[WeP-31-22]

A deep-level transient spectroscopy study of interface states in POLO solar cell

Lei Yang¹, Biao Li¹, Haiyang Xing², Yuheng Zeng², Shuai Yuan¹, Xuegong Yu¹, Deren Yang¹ (1. Zhejiang Univ., 2. Ningbo Inst. Materials Technology and Engineering, Chinese Academy of Sciences, China)

[WeP-31-23]

Analysis the characteristic of TOPCon rear contact with inserted i-polysilicon

Haejung Lee, Dongjin Choi, Dongkyun Kang, MyeongSeob Sim, Heeyeon Lee, Changhyun Lee, Yoonmook Kang, Donghwan Kim, Hae-Seok Lee (Korea Univ., Korea)

[WeP-31-24]

Passivation quality analysis of boron silicate glass on p⁺ polysilicon/silicon oxide layer

Heeyeon Lee, Dongjin Choi, Ji Yeon Hyun, Dongkyun Kang, Hae-Seok Lee, Yoonmook Kang, Donghwan Kim (Korea Univ., Korea)

[WeP-31-25]

Structural and material characteristics of silicon nitride passivation layer for TOPCon solar cells

Yunae Cho, Kyu Hyeon Im, June Sung Park, Min Seo Kim, Sang Hee Lee, Yong Jin Kim, Dohyung Kim, Sungeun Park, Kyung Taek Jeong, Min Gu Kang, Hee-eun Song (Korea Inst. Energy Research, Korea)

[WeP-31-26]

Thermal annealing effects on tunnel oxides for high-efficient passivated hole contacts in crystalline silicon solar cells

Yong-Jin Kim¹, I Se Kweon^{1,2}, Kwan Hong Min¹, Sang Hee Lee¹, Sungjin Choi¹, Kyung Taek Jeong¹, Sungeun Park¹, Hee-eun Song¹, Min Gu Kang¹, Ka-Hyun Kim² (1. Korea Inst. Energy Research, Korea, 2. Chungbuk National Univ., Korea)

[WeP-31-27]

Application of molybdenum oxide front contacts for hole-selectivity of rear junction p-TOPCon solar cells

Dongkyun Kang, Yoonmook Kang, Hae-Seok Lee, Donghwan Kim (Korea Univ., Korea)

[WeP-31-28]

Charge carrier transport properties at the rear side of the TOPCon solar cell structures using P-type and N-type Si substrates

Dohyung Kim¹, Yongjin Kim¹, Kyuhyeon Im¹, Minwoo Lee², Jae Sung Yun^{2,3}, Sang Hee Lee¹, Yunae Cho¹, Kyung Taek Jeong¹, Sungeun Park¹, Min Gu Kang¹, Hee-eun Song¹ (1. Korea Inst. Energy Research, Korea, 2. Univ. New Souths Wales, Australia, 3. Univ. Surrey, UK)

[WeP-31-29]

Study on changes in electrical characteristics of two terminal photovoltaic-thermoelectric generator hybrid device with large size

Kyuhyeon Im^{1,2}, Kyung Taek Jeong², Hee-eun Song², Min Gu Kang², Hae-Seok Lee¹, Ka-Hyun Kim³, Tae Kyung Lee⁴, Sungeun Park² (1. Korea Univ., Korea, 2. Korea Inst. Energy Research, Korea, 3. Chungbuk National Univ., Korea, 4. Gyeongsang National Univ., Korea)

[WeP-31-30]

Series resistance images by single-shot electroluminescence method for silicon solar cells

Kota Sato, Yasuaki Ishikawa (Aoyama Gakuin Univ., Japan)

[WeP-31-31]

Generation of deep level defect related to oxygen by reactive plasma deposition

Tomohiko Hara, Takuma Matsuzuki, Iori Oura, Yoshio Ohshita (Toyota Technological Inst., Japan)

[WeP-31-32]

Impact analysis of metallization design and recombination losses on the performance of crystalline silicon solar cells

Abdulwahab A. Q. Hasan¹, Sathiswary Santhiran¹, Nabilah Mat Kassim¹, Ammar Ahmed Alkahtani¹, Mohammad Aminul Islam², Mohd Yusrizal Mohd Yusof³, Nowshad Amin¹ (1. Univ. Tenaga Nasional, Malaysia, 2. Univ. Malaya, Malaysia, 3. TNB Renewables Sdn. Bhd., Malaysia)

[WeP-31-33]

Passivation of cut edges and surfaces of crystalline silicon by heat treatment in liquid water

Masahiko Hasumi¹, Toshiyuki Sameshima¹, Tomohisa Mizuno² (1. Tokyo Univ. Agriculture and Technology, Japan, 2. Kanagawa Univ., Japan)

[WeP-31-34]

The research of the conversion efficiency degradation and performance improving of the cell during the soldering process

Fei Yang, Weifei Lian, Songmin Liu (Jiangsu Akcome Energy Research Inst. Co., Ltd., China)

[WeP-31-35]

A study on Si-metal contact formation using current-injection firing in crystalline Si solar cells

Dongjin Choi¹, HyunJung Park¹, Soohyun Bae², MeongSeob Sim¹, Donghwan Kim¹, Hae-Seok Lee¹, Yoonmook Kang¹ (1. Korea Univ., Korea, 2. Korea Inst. Energy Research, Korea)

[WeP-31-36]

Silicon nanostructures as bottom cell materials for multijunction solar cells

Bernice Mae Yu Jeco-Espaldon¹, Wipakorn Jevasuwan¹, Yoshitaka Okada², Naoki Fukata^{1,3} (1 National Inst. Materials Science, Japan, 2. Univ. Tokyo, Japan, 3. Univ. Tsukuba, Japan)

[WeP-31-37]

Field-induced radial junction for dopant-free crystalline silicon solar cells with an efficiency of over 20%

Deokjae Choi, Kwanyong Seo (Ulsan National Inst. Science and Technology, Korea)

[WeP-31-38]

Studies on the grains in multi-crystalline silicon (mc-Si) wafer

N. Balamurugan, P. Karuppasamy, P. Ramasamy (Sri Sivasubramaniya Nadar College of Engineering, India)

[WeP-31-39]

Multi-crystalline silicon growth by helium gas spot cooled directional solidification process for photovoltaic applications

Pichan Karuppasamy, Sekar Sugunraj, Manikkam Srinivasan, Perumalsamy Ramasamy (Sri Sivasubramaniya Nadar College of Engineering, India)

[WeP-31-40]

Development and study of high quality mc-silicon crystal and wafers for solar cell applications

Manickam Srinivasan¹, Vineet Saini², Perumalsamy Ramasamy¹ (1. Sri Sivasubramaniya Nadar College of Engineering, India, 2. DST, Government of India, India)

[WeP-31-41]

Influence of helium gas flow under the retort bottom to control the impurities in grown mc-Si ingot by DS process for photovoltaic application: Numerical simulation

S. Sugunraj, Manikkam Srinivasan, Pachan Karuppasamym, Perumalsamy Ramasamy (Sri Sivasubramaniya Nadar College of Engineering, India)

[WeP-31-42]

Numerical simulation approach to investigate the effect of gas tube design on silicon ingot grown by directional solidification process

R. Muthukumar, S. Sanmugavel, K. Aravinth, P. Balaji Bhargav, P. Ramasamy (Sri Sivasubramaniya Nadar College of Engineering, India)

[WeP-31-43]

Fully bottom up growth of epitaxial silicon wafer using a self-releasing seed layer

Ji-Eun Hong¹, Yonghwan Lee², Sung-In Mo¹, Hye-Seong Jeong³, Jeong-Ho An¹, Hee-eun Song¹, Jihun Oh⁴, Junhyeok Bang³, Joon-Ho Oh¹, Ka-Hyun Kim³ (1 Korea Inst. Energy Research, Korea, 2. Gumi Electronics and Information Technology Research Inst., Korea, 3. Chungbuk National Univ., Korea, 4. Korea Advanced Inst. Science and Technology, Korea)

[WeP-31-44]

Effect of heat flux control unit on the achievement of improving a multi-crystalline silicon ingot for photovoltaic applications

Madhesh Raji¹, Kesavan Venkatachalam^{1,2}, Srinivasan Manikkam¹, Ramasamy Perumalsamy¹ (Sri Sivasubramaniya Nadar College of Engineering, India, St. Joseph's College (Autonomous), India)

[WeP-31-45]

Multiscale modeling on the grain evolution of the SMART ingot growing process by the 3D CAFE method

Xin Liu¹, Hiroyuki Tanaka¹, Kentaro Kutsukake², Takuto Kojima¹, Noritaka Usami¹ (1. Nagoya Univ., Japan, 2. RIKEN, Japan)

[WeP-31-46]

Reflection measurement system with telecentric optics for prediction of crystal orientation in large-scale multicrystalline structure

Takuto Kojima¹, Kyoka Hara¹, Kentaro Kutsukake², Tetsuya Matsumoto¹, Hiroaki Kudo¹, Noritaka Usami¹ (1. Nagoya Univ., Japan, 2. RIKEN, Japan)

[WeP-31-47]

First-principles phase-field simulations for vacancy and interstitial aggregates in silicon

Yusuke Noda¹, Riichi Kuwahara², Ryoji Sahara³, Koji Sueoka¹, Kaoru Ohno⁴ (1. Okayama Prefectural Univ., Japan, 2 Dassault Systèmes K. K., Japan, 3. National Inst. Materials Science, Japan, 4. Yokohama National Univ., Japan)

[WeP-31-48]

Influence of saw damage removal and surface modification on the reflectivity and minority carrier lifetime of multicrystalline silicon

Akhil Krishnan, Aravindan Guruswamy, P. Balaji Bhargav, Aravinth K., Balaji C., Balamurugan N., Ramasamy P. (Sri Sivasubramaniya Nadar College of Engineering, India)

[WeP-31-49]

Experimental measurement of growth velocity anisotropy along {100}, {110} and {111} planes of silicon during melt growth process

Shashank Shekhar Mishra, Lu-Chung Chuang, Jun Nozawa, Kensaku Maeda, Haruhiko Morito, Kozo Fujiwara

[WeP-31-50]

Dislocation generation from small-angle grain boundaries during directional solidification of multicrystalline silicon

Lu-Chung Chuang, Kensaku Maeda, Haruhiko Morito, Kozo Fujiwara (Tohoku Univ., Japan)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-1: Wafer-based silicon photovoltaics and related technologies

[WeO-31g] Poly-Si Contact

Session Chairs: Shinsuke Miyajima (Tokyo Inst. Technology, Japan), Verena Mertens (Inst. Solar Energy Research Hamelin, Germany)

Wed. Nov 16, 2022 3:30 PM - 5:30 PM 141+142 (Bldg. 1, 4F)

[WeO-31g-01] 3:30 PM – 4:00 PM

(INVITED) Manufacturing high-efficiency n-type crystalline Si solar cells with poly-Si based passivating contacts

Robert Dumbrell, Xinyu Zhang, Jie Yang, Peiting Zheng, Menglei Xu, Qi Wang (Zhejiang Jinko Solar Co., Ltd., China)

[WeO-31g-02] 4:00 PM – 4:15 PM

Applying galvanic corrosion principles in the fabrication of 21% efficient Si solar cell featuring hole-selective poly-Si passivating contact with $J_0 < 1 \text{ fA/cm}^2$

Caroline Lima Salles de Souza^{1,2}, William Nemeth², Harvey Guthrey², Chun-Sheng Jiang², Sumit Agarwal^{1,2}, Paul Stradins² (1. Colorado School of Mines, USA, 2. National Renewable Energy Lab., USA)

[WeO-31g-03] 4:15 PM – 4:30 PM

High-efficiency low-cost IBC upgrade of existing PERC+ production lines: the POLO IBC with PECVD shadow mask approach

Thorsten Dullweber¹, Verena Mertens¹, Ulrike Baumann¹, Tsuji Kosuke², Marwan Dhamrin^{2,3}, Rolf Brendel^{1,4} (1 Inst. Solar Energy Research Hamelin, Germany, 2. Toyo Aluminium K.K., Japan, 3. Osaka Univ., Japan, 4. Univ. Hanover, Germany)

[WeO-31g-04] 4:30 PM – 4:45 PM

Pathways for above 26% efficiency poly-silicon contacted solar cells in mass production

Peiting Zheng¹, Jie Yang¹, Zhao Wang¹, Jinjin Cheng¹, Chuanwei Jiang¹, Yao Guo¹, Haijie Sun¹, Shi Cheng¹, Xinyu Zhang¹, Hao Jin¹, Sieu Pheng Phang², Er-Chien Wang², Josua Stuckelberger², Hang Cheong Sio², Daniel Macdonald² (1. Jinko Solar, China, 2. Australian National Univ., Australia)

[WeO-31g-05] 4:45PM – 5:00 PM

Inkjet printing for boron-doped polycrystalline silicon passivating contacts

Jiali Wang¹, Thien N. Truong¹, Sieu Pheng Phang¹, Zhuofeng Li¹, Jie Yang², Zhao Wang², Peiting Zheng², Xinyu Zhang³, Hieu T. Nguyen¹, Daniel Macdonald¹, Josua Stuckelberger¹ (1. Australian National Univ., Australia, 2. Zhejiang Jinko Solar Co., Ltd, China, 3. Jinko Solar Co., Ltd, China)

[WeO-31g-06] 5:00 PM – 5:15 PM

Low-area selective screen-printed contacts for high-efficiency PERC and TOPCon solar cells

Yuchao Zhang, Li Wang, Moonyong Kim, Arastoo Teymouri, Ran Chen, Catherine Chan, Brett Hallam (Univ. New South Wales, Australia)

[WeO-31g-07] 5:15 PM – 5:30 PM

Evaluation of passivation layer for TOPCon formed by sputtering and ion implantation

Noboru Yamaguchi^{1,2}, Shinsuke Miyajima¹ (1. Tokyo Inst. Technology, Japan, 2. ULVAC, Inc., Japan)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-1: Wafer-based silicon photovoltaics and related technologies

[ThO-31h] Modules and Reliability

Session Chairs: Akira Terakawa (Photovoltaic Power Generation Technology Research Association, Japan), Marwan Dhamrin (Toyo Aluminium K.K., Japan/Osaka Univ., Japan)

Thu. Nov 17, 2022 8:30 AM - 10:00 AM 141+142 (Bldg. 1, 4F)

[ThO-31h-01] 8:30 AM – 9:00 AM

(INVITED) Challenges for silicon heterojunction technology: from raw materials to energy production

Wilfried Favre, Delfina Muñoz, E. Voroshazi, V. Barth, G. Rey, R. Monna, S. Harrison (Univ. Grenoble Alpes, CEA, LITEN, INES, France)

[ThO-31h-02] 9:00 AM – 9:15 AM

Impact of damp-heat on flexible and light-weight silicon heterojunction solar modules

Kai Zhang^{1,2}, Yilin Zhao¹, Andreas Lambert¹, Oleksandr Mashkov³, Lauterbach Volker¹, Oleksandr Stroyuk³, Weiyuan Duan¹, Kaining Ding¹, Ian Marius Peters³, Uwe Rau^{1,2} (1, Forschungszentrum Jülich GmbH, Germany, 2. Aachen Univ., Germany, 3. Helmholtz-Inst. Erlangen Nürnberg für Erneuerbare Energien, Germany)

[ThO-31h-03] 9:15 AM – 9:30 AM

Determining the sensitivity required for fault detection in modules by magnetic field imaging

Ryan Noek Kelvin Hall, Haoyu Zhong, Oliver Kunz, Thorsten Trupke, Fiacre E. Rougieux (Univ. New South Wales, Australia)

[ThO-31h-04] 9:30 AM – 9:45 AM

Second-stage potential-induced degradation of n-type front-emitter crystalline silicon photovoltaic modules and its recovery

Keisuke Ohdaira¹, Yutaka Komatsu¹, Seira Yamaguchi^{1,2}, Atsushi Masuda³ (1. Japan Advanced Inst. Science and Technology, Japan, 2. Univ. Tsukuba, Japan, 3. Niigata Univ., Japan)

[ThO-31h-05] 9:45 AM – 10:00 AM

Novel concept of crystalline Si photovoltaic modules without encapsulation and their hygrothermal and thermal-cycle tolerance

Nobuhito Imajo¹, Keisuke Ohdaira², Atsushi Masuda¹ (1. Niigata Univ., Japan, 2. Japan Advanced Inst. Science and Technology, Japan)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-2: Organic and inorganic thin-film photovoltaics, III-V high-efficiency devices and related technologies

[MoO-32a] Organic and Dye-synthesized Solar Cells I

Session Chairs: Keisuke Tajima (RIKEN, Japan), Masatoshi Yanagida, (National Inst. Materials Science, Japan)

Mon. Nov 14, 2022 8:30 AM - 10:00 AM 133+134 (Bldg. 1, 3F)

[MoO-32a-01] 8:30 AM – 9:00 AM

(INVITED) Organic solar cells processed from green solvents

Thuc-Quyen Nguyen (Univ. California, Santa Barbara, USA)

[MoO-32a-02] 9:00 AM – 9:15 AM

Why is Y6 a good electron-acceptor for organic photovoltaics?

Kyohei Nakano¹, Kosuke Terado², Yumiko Kaji¹, Hiroyuki Yoshida², Keisuke Tajima¹ (1. RIKEN, Japan, 2. Chiba Univ., Japan)

[MoO-32a-03] 9:15 AM – 9:30 AM

A novel π -conjugated polymer enabling small voltage loss and high charge carrier generation in nonfullerene-based organic photovoltaics

Tsubasa Mikie¹, Shota Suruga¹, Yuuki Sato², Takumi Ishikawa², Hyung Do Kim², Hideo Ohkita², Itaru Osaka¹ (1. Hiroshima Univ., Japan, 2. Kyoto Univ., Japan)

[MoO-32a-04] 9:30 AM – 9:45 AM

Using donor-acceptor conjugated block copolymers as single-component photoactive materials or as compatibilizers in organic photovoltaics

Yu-Cheng Tseng¹, Aoto Kato², Jia-Fu Chang¹, Tomoya Higashihara², Chu-Chen Chueh^{1,3} (1. National Taiwan Univ., Taiwan, 2 Yamagata Univ., Japan, 3. Advanced Research Center for Green Materials Science and Technology, Taiwan)

[MoO-32a-05] 9:45 AM – 10:00 AM

Facile fabrication and characterization of solid-state dye-sensitized solar cells utilizing iodine-based redox electrolyte

Yuki Kurokawa, Shyam S. Pandey (Kyusyu Inst. Technology, Japan)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-2: Organic and inorganic thin-film photovoltaics, III-V high-efficiency devices and related technologies

[MoO-32b] Organic and Dye-synthesized Solar Cells II

Session Chairs: Itaru Osaka (Hiroshima Univ., Japan), Kazuhiro Marumoto (Univ. Tsukuba, Japan)

Mon. Nov 14, 2022 10:30 AM - 12:00 PM 133+134 (Bldg. 1, 3F)

[MoO-32b-01] 10:30 AM – 10:45 AM

Molecular orientation of planar-zigzag shaped polymer semiconductors in organic solar cells

Fengkun Chen, Kyohei Nakano, Yumiko Kaji, Keisuke Tajima (RIKEN, Japan)

[MoO-32b-02] 10:45 AM – 11:00 AM

Rigid and coplanar thiazole-containing π -conjugated polymers for nonfullerene-based organic photovoltaics

Yoshikazu Teshima, Masahiko Saito, Tsubasa Mikie, Itaru Osaka (Hiroshima Univ., Japan)

[MoO-32b-03] 11:00 AM – 11:15 AM

Exciton dynamics of fused ring conjugated nonfullerene acceptors based on dithienonaphthobisthiadiazole

Yuki Sato¹, Hiroya Yamada¹, Tsubasa Mikie², Itaru Osaka², Hideo Ohkita¹ (1. Kyoto Univ., Japan, 2. Hiroshima Univ., Japan)

[MoO-32b-04] 11:15 AM-11:30 AM

A theoretical study on dynamical processes of charge transfer excitons at the interface of organic thin-film solar cells

Sumire Ikeyama, Megumi Mineshita, Yuzuka Minami, Azusa Muraoka (Japan Women's Univ., Japan)

[MoO-32b-05] 11:30 AM – 11:45 AM

Air-stable ultrathin organic photovoltaics

Sixing Xiong^{1,2} Kenjiro Fukuda¹ Yinhua Zhou² Takao Someya^{1,3} (1. RIKEN, Japan, 2. Huazhong Univ. Science and Technology, China, 3. Univ. Tokyo, Japan)

[MoO-32b-06] 11:45 AM – 12:00 PM

12-year outdoor working test of dye-sensitized solar cell modules using an ionic liquid electrolyte

Naohiko Kato¹, Hiromitsu Tanaka¹, Yasuhiko Takeda¹, Kazuo Higuchi¹, Junji Nakajima² (1. Toyota Central R&D Labs., Inc., Japan, 2 Aisin Corp., Japan)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-2: Organic and inorganic thin-film photovoltaics, III-V high-efficiency devices and related technologies

[TuO-32c] III-V Materials and Multi-junction Solar Cells

Session Chairs: Kentaroh Watanabe (Univ. Tokyo, Japan), Arno H. M. Smets (Delft Univ. Technology, The Netherlands)

Tue. Nov 15, 2022 10:30 AM - 12:00 PM 133+134 (Bldg. 1, 3F)

[TuO-32c-01] 10:30 AM – 10:45 AM

III-V multi-junction solar cells grown by hydride vapor phase epitaxy

Yasushi Shoji¹, Ryuji Oshima¹, Kikuo Makita¹, Akinori Ubukata², Takeyoshi Sugaya¹ (1. National Inst. Advanced Industrial Science and Technology, Japan, 2. Taiyo Nippon Sanso Corp., Japan)

[TuO-32c-02] 10:45 AM – 11:00 AM

Use of back reflectors in multi junction solar cells: A case study on micromorph configuration tandem solar cells

Govind Padmakumar¹, Gianluca Limodio¹, Thierry de Vrijer¹, Federica Saitta¹, Edward Hamers², Arno Smets¹ (1. Delft Univ. Technology, The Netherlands, 2. HyET Solar Netherlands B.V., The Netherlands)

[TuO-32c-03] 11:00 AM – 11:15 AM

Influence of filter temperature in reference cells for multi-junction photovoltaic devices

Haruya Shimura, Takashi Ueda, Kengo Yamagoe, Ayumi Sasaki, Masahiro Yoshita (National Inst. Advanced Industrial Science and Technology, Japan)

[TuO-32c-04] 11:15 AM – 11:30 AM

Rear-heterojunction AlGaAs solar cell with p-type absorber

Gan Li, Hassanet Sodabanlu, Kentaroh Watanabe, Masakazu Sugiyama, Yoshiaki Nakano (Univ. Tokyo, Japan)

[TuO-32c-05] 11:30 AM – 11:45 AM

Electroluminescence analysis of InGaP solar cells grown in a planetary MOVPE with TBP

Hassanet Sodabanlu, Gan Li, Kentaroh Watanabe, Yoshiaki Nakano, Masakazu Sugiyama (Univ. Tokyo, Japan)

[TuO-32c-06] 11:45 AM – 12:00 PM

Enhancement of carrier lifetime in ZnSnP₂ bulk crystals by control of conditions during crystal growth

Isshin Sumiyoshi, Yoshitaro Nose (Kyoto Univ., Japan)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-2: Organic and inorganic thin-film photovoltaics, III-V high-efficiency devices and related technologies

[TuO-32d] Chalcogenide Solar Cells I - Absorber Materials and Processing

Session Chairs: JunHo Kim (Incheon National Univ., Korea), Takahito Nishimura (Tokyo Inst. Technology, Japan)

Tue. Nov 15, 2022 10:30 AM - 12:00 PM 432 (Bldg. 4, 3F)

[TuO-32d-01] 10:30 AM – 10:45 AM

Towards high efficiency kesterite solar cells

Xiaojing Hao, Jialiang Huang, Jianjun Li, Kaiwen Sun, Mingrui He, Jialin Cong, Ao Wang, Martin Green (Univ. New South Wales, Australia)

[TuO-32d-02] 10:45 AM – 11:00 AM

Over 12% efficient $\text{CuIn}(\text{S,Se})_2$ solar cell with the absorber fabricated from dimethylformamide solution by doctor-blading in ambient air

Chengfeng Ma, Hao Xin, Chunxu Xiang (Nanjing Univ. Posts & Telecommunications, China)

[TuO-32d-03] 11:00 AM – 11:15 AM

Roadmap to achieve over 16% power conversion efficiency with wide band-gap $\text{Cu}(\text{In,Ga})\text{S}_2$ solar cell

Mohit Sood¹, Damilola Adeleye¹, Adam Hultqvist², Tobias Törndahl², Susanne Siebentritt¹ (1. Univ. Luxembourg, Luxembourg, 2. Uppsala Univ., Sweden)

[TuO-32d-04] 11:15 AM – 11:30 AM

10.3% efficient green Cd-free $\text{Cu}_2\text{ZnSnS}_4$ solar cells enabled by liquid-phase promoted grain growth

Xiaojie Yuan, Jianjun Li, Jialiang Huang, Xin Cui, Chang Yan, Kaiwen Sun, Jialin Cong, Mingrui He, Ao Wang, Guojun He, Arman Mahboubi Soufiani, Junjie Jiang, Shujie Zhou, John A. Stride, Bram Hoex, Martin Green, Xiaojing Hao (Univ. New South Wales, Australia)

[TuO-32d-05] 11:30 AM – 11:45 AM

Effects of insertion of Ag-doped layer on high efficiency aqueous sprayed CZTSSe solar cells

Temujin Enkhbat, Enkhjargal Enkhbayar, Namuundari Otgontamir, Md Salahuddin Mina, JunHo Kim (Incheon National Univ., Korea)

[TuO-32d-06] 11:45 AM – 12:00 PM

Control of electronic structure in $(\text{Cu,Ag})(\text{Ga,In})\text{Se}_2$ for high efficiency solar cells

Takahiro Wada, Tsuyoshi Maeda, Reina Yano, Tomoya Ishida, Nao Kawano (Ryukoku Univ. Japan)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-2: Organic and inorganic thin-film photovoltaics, III-V high-efficiency devices and related technologies

[TuP-32] Organic and Inorganic Thin-film Photovoltaics, III-V High-efficiency Devices and Related Technologies

Tue. Nov 15, 2022 12:00 PM - 3:00 PM P-32/Event Hall (Bldg. 1, 1F)

[TuP-32-01]

Novel nonfullerene acceptors based on benzimidazole moieties for organic photovoltaics

Shohei Ohno, Tsubasa Mikie, Itaru Osaka (Hiroshima Univ., Japan)

[TuP-32-02]

The effects of recombination dynamics and phase-separated structures on fill factor in all-polymer solar cells

Jihun Jeon, Hyung Do Kim, Hideo Ohkita (Kyoto Univ., Japan)

[TuP-32-03]

Interplay between π -conjugated polymer donors and acceptors determines crystalline order of their blends and photovoltaic performance

Kodai Yamanaka, Masahiko Saito, Itaru Osaka (Hiroshima Univ., Japan)

[TuP-32-04]

Investigation of organic solar cells as photodetectors

Jiaxun You, Md. Shahiduzzaman, Masahiro Nakano, Makoto Karakawa, Kohichi Iiyama, Tetsuya Taima (Kanazawa Univ., Japan)

[TuP-32-05]

Effect of DMSO on the morphology of PEDOT:PSS thin films for applications in hybrid solar cells

Aditya Saha¹, Takahiko Sasaki¹, Daisuke Ohori¹, Keisuke Itoh², Seiji Samukawa^{1,3} (1. Tohoku Univ., Japan, 2. ITIM, Japan, 3. National Yang Ming Chiao Tung Univ., Taiwan)

[TuP-32-06]

Screening the triphenylamine functionalized perylene based sensitizers for dye sensitized solar cell applications – A theoretical approach

D. Nickson Sebastin, Prasath Manivannan (Periyar University, India)

[TuP-32-07]

Controlling the dye adsorption on TiO₂ for bifacial dye-sensitized solar cells: Implication of bilayer vs. mixed dyes adsorption

Suraya Shaban¹, Ajendra Kumar Vats², Shyam Pandey¹ (1. Kyushu Inst. Technology, Japan, 2. Nara Advanced Inst. Science and Technology, Japan)

[TuP-32-08]

Screening the influence of methoxy and anisyl groups to perylene based sensitizers for dye sensitized solar cell applications – A computational approach

D. Nicksonsebastin¹, Devendiran Shobana Priyanka², B. Sathya², M. Srinivasan², M. Prasath¹, P. Ramasamy² (1. Periyar Univ., India, 2. SSN College of Engineering, India)

[TuP-32-09]

Improvement of organic solar cells by using the localized surface plasmon resonance effect of metal nanoparticles

Yuting Miao, Sachiko Jonai, Kazunari Shinbo, Keizo Kato, Akira Baba (Niigata Univ., Japan)

[TuP-32-10]

Surface passivation and carrier separation effects of $Zn_{1-x}Ge_xO_y$ interlayers for $BaSi_2$ solar cells

Kaori Takayanagi, Yudai Yamashita, Kaoru Toko Takashi Suemasu (Univ. Tsukuba, Japan)

[TuP-32-11]

Improvement of characteristics of Cu_2SnS_3 thin-film solar cells by adding alkali metals

Hideaki Araki¹, Naiwei Zhang¹, Takeshi Tasaki¹, Daiki Motai¹, Yoji Akaki² (1. National Inst. Technology, Nagaoka College, Japan, 2. National Inst. Technology, Miyakonojo College, Japan)

[TuP-32-12]

Rear surface passivation of superstrated Sb_2Se_3 solar cells via selenium post-deposition annealing treatment and hole-transport layer application

Yazi Wang, Seunghwan Ji, Byungha Shin (Korea Advanced Inst. Science and Technology, Korea)

[TuP-32-13]

Grain boundary structures and energetics in CdTe: An artificial-neural-network interatomic potential and first-principles approach

Tatsuya Yokoi¹, Kosuke Adachi¹, Yu Oshima¹, Katsuyuki Matsunaga^{1,2} (1. Nagoya Univ., Japan, 2. Japan Fine Ceramics Center, Japan)

[TuP-32-14]

Novel MXenes based carrier selective contact for Sb_2Se_3 & c-Si based solar cells

Axel Gon Medaille¹, Francesc Xavier Capella², Eloi Ros², Kunal Tiwari¹, Sergio Giraldo², Marcel Placidi², Joaquim Puigdollers², Edgardo Saucedo², Zacharie Jehl Li-Kao² (1. Catalanian Inst. Energy Research, Spain, 2. Polytechnic Univ. Catalonia, Spain)

[TuP-32-15]

Control of conduction type in SnS by cation doping

Haruki Watari¹, Kohei Ishigai¹, Yoshitaro Nose¹, Ikumi Osawa¹, Akira Nagaoka², Kensuke Nishioka²
(1. Kyoto Univ., Japan, 2. Univ. Miyazaki, Japan)

[TuP-32-16]

Feasibility study of magnetic scattering holography using polarized neutrons

Tomoya Kanno¹, Motoki Takano¹, Shota Hoshi¹, Yodai Kobayashi¹, Yuka Tomimatsu¹, Koki Aizawa¹, Shuta Kawakami¹, Yuto Fukui², Kota Yamakawa², Hajime Nakada², Shingo Takahashi¹, Takuya Okudaira^{3,4}, Takayuki Oku^{1,3}, Keisuke Sato⁵, Masahide Harada³, Kenichi Oikawa³, Koichi Hayashi², Kenji Ohoyama¹ (1. Ibaraki Univ., Japan, 2. Nagoya Inst. Technology, Japan, 3. Japan Proton Accelerator Research Complex, Japan, 4. Nagoya Univ., Japan, 5. National Inst. Technology, Ibaraki College, Japan)

[TuP-32-17]

Mechanism of thermal runaway in solar cells

Tetsuya Nakamura¹, Mitsuru Imaizumi¹, Kazuya Murai², Ryuta Kawamura², Ikuo Nanno² (1. Japan Aerospace Exploration Agency, Japan, 2. National Inst. Technology, Ube College, Japan)

[TuP-32-18]

Investigation of basic physical properties in $\text{Cu}_2\text{Sn}_{1-x}\text{Ge}_x\text{S}_3$ by observation of photoluminescence

Ryoma Hata¹, Ayaka Kanai¹, Mutsumi Sugiyama², Kunihiko Tanaka¹ (1. Nagaoka Univ. Technology, Japan, 2. Tokyo Univ. Science, Japan)

[TuP-32-19]

Observation of photoluminescence in $\text{Cu}_2\text{Sn}_{1-x}\text{Si}_x\text{S}_3$ bulk crystals

Kazuhiro Iwasaki, Ayaka Kanai, Kunihiko Tanaka (Nagaoka Univ. Technology, Japan)

[TuP-32-20]

Effect of copper doping and cadmium chloride treatment on the CdS/CdTe thin films

Ipsita Jena, Udai P Singh (Kalinga Inst. Industrial Technology, India)

[TuP-32-21]

Numerical modelling and performance analysis of SnSSe thin film solar cell using SCAPS-1D

Arindam Basak, Sankha Subhra Jana, Udai P Singh (Kalinga Inst. Industrial Technology, India)

[TuP-32-22]

Characterization of Sb_xSe_y films grown from Sb and Se precursors via chemical-molecular beam deposition (CMBD) for use in solar cells

T. M. Razykov¹, J. Bekmirzoev¹, Bobur Avazugli Ergashev¹, D. Isakov¹, Ramozan Ravshanovich Khurramov¹, K. M. Kouchkarov¹, M. A. Makhmudov¹, A. A. Mavlonov², M. S. Tivanov³, D. S. Bayko³, N. I. Poliak³, O. V. Korolik³ (1. Physical-Technical Inst., Uzbekistan, 2. Ritsumeikan Univ., Japan, 3. Belarusian State Univ., Belarus)

[TuP-32-23]

Influence of deposition conditions and thermal annealing on properties of nickel oxide films

Ryuya Ito, Yuto Ebata, Yuta Nagase, Shigeru Yamada, Takashi Itoh (Gifu Univ., Japan)

[TuP-32-24]

Dislocation-induced gap states in CdTe: A first-principles study

Sena Hoshino¹, Yu Oshima¹, Tatsuya Yokoi¹, Atsutomo Nakamura², Katsuyuki Matsunaga^{1,3} (1. Nagoya Univ., Japan, 2. Osaka Univ., Japan, 3. Japan Fine Ceramics Center, Japan)

[TuP-32-25]

Ultrathin film of tungsten, tungsten oxide and tungsten nitride: A study on growth and characterizations

Mohammad Kamal Hossain, Faisal Ali Alamr (King Fahd Univ. Petroleum & Minerals, Saudi Arabia)

[TuP-32-26]

A challenge of observing hydrogen atoms in metals using white neutron holography

Yuka Tomimatsu¹, Yodai Kobayashi¹, Tomoya Kanno¹, Motoki Takano¹, Shouta Hoshi¹, Kohki Aizawa¹, Shuta Kawakami¹, Masahide Harada², Kenichi Oikawa², Yasuhiro Inamura², Saya Ajito³, Eiji Akiyama³, Shinichi Orimo³, Koichi Hayashi⁴, Kenji Ohoyama¹ (1. Ibaraki Univ., Japan, 2. Japan Proton Accelerator Research Complex, Japan, 3. Tohoku Univ., Japan, 4. Nagoya Inst. Technology, Japan)

[TuP-32-27]

Structural and optical properties of Ga₂O₃ films RF magnetron sputtered on various substrates

Vijay B. Patil, Jin Hyeok Kim (Chonnam National Univ., Korea)

[TuP-32-28]

10.7% efficient Cd-free Cu₂ZnSnS₄ solar cell with over 800 mV open-circuit voltage enabled by Ge incorporation

Ao Wang, Kaiwen Sun, Jialiang Huang, Martin A Green, Xiaojing Hao (Univ. New South Wales, Australia)

[TuP-32-29]

Controlling device instabilities with i-ZnO oxygen content in chalcogenide solar cells

Alejandro Navarro¹, Kunal J. Tiwari², Alex Jimenez², Sergio Giraldo¹, Edgardo Saucedo¹, Zacharie Jehl¹, Marcel Placidi^{1,2} (1. Polytechnic Univ. Catalonia, Spain, 2. Inst. Recerca en Energia de Catalunya, Spain)

[TuP-32-30]

Improved device performances of CIGS solar cells induced by Ag treatment

Kihwan Kim¹, Jihseon Hwang^{1,2}, Inyoung Jeong¹, Donghyeop Shin¹, Inchan Hwang¹, Hyo Sik Chang², Jae Ho Yun³, Jihye Gwak¹ (1. Korea Inst. Energy Research, Korea, 2. Chungnam National Univ., Korea, 3. Korea Inst, Energy Technology, Korea)

[TuP-32-31]

Growth mechanism and fabrication of pure sulfide CuIn(Ga)S₂ solar cell by sulfurization

Yota Suzuki, Dwinanri Eglyna, Tomoki Shibata, Takahito Nishimura, Akira Yamada (Tokyo Inst. Technology, Japan)

[TuP-32-32]

Radiation tolerance of Cu(In,Ga)Se₂ solar cells irradiated by proton beam

Jiro Nishinaga¹, Manabu Togawa², Shogo Ishizuka¹ (1. National Inst. Advanced Industrial Science and Technology, Japan, 2. High Energy Accelerator Research Organization, Japan)

[TuP-32-33]

Fabrication of high efficient narrow bandgap CuInSe₂ (CIS) solar cell via alkaline treatment

Md Salahuddin Mina, Enkhjargal Enkhbayar, Namuundari Otgontamir, JunHo Kim (Incheon National Univ., Korea)

[TuP-32-34]

Investigation of electrical properties of (Cu_{1-x}Ag_x)₂ZnSnS₄

Kouichi Okamoto, Akira Nagaoka, Katsuma Nagatomo, Kenji Yoshino, Kenji Nishioka (Univ. Miyazaki, Japan)

[TuP-32-35]

Zn-Ge-O thin-films as alternative n-type layers for chalcogenide solar cells

Dwinanri Eglyna, Satoru Ito, Takahito Nishimura, Akira Yamada (Tokyo Inst. Technology, Japan)

[TuP-32-36]

Precursor solution chemistry modification via eco-friendly additive enabling CZTSSe solar cell with 12.07% efficiency

Fangyang Liu, Xiangyun Zhao, Yining Pan (Central South Univ., China)

[TuP-32-37]

Effect of NaF addition to precursor for fabricating Cu₂ZnSnSe₄ thin films on alkali-free substrates by selenization

Yuta Tamura, Katsuhiko Saito, Qixin Guo, Tooru Tanaka (Saga Univ., Japan)

[TuP-32-38]

Study of surface etchants for ink-based Cu-rich CuIn(S,Se)₂ thin film solar

Sunil Suresh, Alexander R. Uhl (Univ. British Columbia, Canada)

[TuP-32-39]

Investigation of potential-induced degradation (PID) mechanism in CIGS thin film solar cells

Solhee Lee, Soohyun Bae, Se Jin Park, Yoonmook Kang, Donghwan Kim, Hae-Seok Lee (Korea Univ., Korea)

[TuP-32-40]

Back contact engineering in CZTSSe thin-film solar cells: A strategy to reduce the open-circuit voltage loss

Myeong Cheol Baek, Jin Hyeok Kim (Chonnam National Univ., Korea)

[TuP-32-41]

Performance improvement of flexible $\text{Cu}_2\text{ZnSn}(\text{S}, \text{Se})_4$ thin film solar cells by Ge doping

Hojun Choi, Jinhyeok Kim (Chonnam National Univ., Korea)

[TuP-32-42]

Effect of post laser annealing on stacked structure of CZTS thin film solar cells

Hikomichi Tamaki, Kazuo Jimbo, Yosuke Shimamune (National Inst. Technology, Nagaoka College, Japan)

[TuP-32-43]

$\text{Cu}_2\text{ZnSnX}_4$ (X: S, Se and SSe) kesterite-based photovoltaic devices

Meenakshi Sahu^{1,2}, Chinho Park², Pratibha Sharma¹ (1. Indian Inst. Technology, India, 2 Korea Inst. Energy Technology, Korea)

[TuP-32-44]

Dual function improvement of back contact and absorption layer quality of CZTSSe solar cells by a Na_2Se interlayer

Lingling Wang, Yanqin Wang, Yawei Wang, Xintong Zhang (Northeast Normal Univ., China)

[TuP-32-45]

Silver influence on physical properties of $(\text{Ag,Cu})(\text{In,Ga})\text{S}_2$ thin films

Hiroki Mori, Jakapan Chantana, Yu Kawano, Takayuki Negami, Takashi Minemoto (Ritsumeikan Univ., Japan)

[TuP-32-46]

Charge carrier transport in flexible $\text{Cu}(\text{In,Ga})\text{Se}_2$ thin film solar cells with heavy alkali incorporation

Ha Kyung Park¹, Juran Kim¹, Jiyeon Lee¹, Mijeong Kim¹, Kihwan Kim², Jae Ho Yun³, Jihye Gwak², William Jo¹ (1. Ewha Womans Univ., Korea, 2. Korea Inst. Energy Research, Korea, 3. Korea Inst. Energy Technology, Korea)

[TuP-32-47]

Engineering of Interface and bulk properties in $\text{Cu}_2\text{ZnSn}(\text{S,Se})_4$ thin-film solar cells with ultrathin CuAlO_2 intermediate layer and Ge doping

Kuldeep Singh Gour¹, Jae Ho Yun¹, Jin Hyeok Kim² (1. Korea Inst. Energy Technology, Korea, 2. Chonnam National Univ., Korea)

[TuP-32-48]

Hydride vapor phase epitaxy growth of GaInAsP cells for two-terminal III-V//Si triple-junction structures

Yasushi Shoji¹, Ryuji Oshima¹, Kikuo Makita¹, Akinori Ubukata², Takeyoshi Sugaya¹ (1. National Inst. Advanced Industrial Science and Technology, Japan, 2 Taiyo Nippon Sanso Corp., Japan)

[TuP-32-49]

Rapid growth of SiGe thin-films by pulsed laser annealing of Al-Ge alloyed pastes on silicon

Takeshi Sato¹, Satoru Miyamoto¹, Shota Suzuki^{2,3}, Marwan Dhamrin^{2,3}, Noritaka Usami¹ (1. Nagoya Univ., Japan, 2. Toyo Aluminium K.K., Japan, 3. Osaka Univ., Japan)

[TuP-32-50]

Passivation effect of a-SiC on BaSi_2 films for solar cell applications

Rui Du¹, Hayato Hasebe¹, Kazuki Kido¹, Masami Mesuda², Kaoru Toko¹ Takashi Suemasu¹ (1. Univ. Tsukuba, Japan, 2. Tosoh Corp., Japan)

[TuP-32-51]

Simple back-contact silicon heterojunction solar cells using polycrystalline silicon formed by FLA on Cat-CVD a-Si:H films

Zheng Wang, Huynh Thi Cam Tu, Keisuke Ohdaira (Japan Advanced Inst. Science and Technology, Japan)

[TuP-32-52]

Relationships between the distribution of dislocation glide planes and electrical properties of lattice-mismatched InGaAs solar cells

Junya Okubo¹, Akio Ogura², Masahiro Kawano¹, Shogo Harada¹, Kosuke Morita¹, Hiroki Ohyama¹, Tomoki Harada¹, Tetsuo Ikari¹, Atsuhiko Fukuyama¹, Mitsuru Imaizumi², Hidetoshi Suzuki¹ (1. Univ. Miyazaki, Japan, 2. Japan Aerospace Exploration Agency, Japan)

[TuP-32-53]

Photoluminescence imaging of III-V solar cells fabricated using hydride vapor phase epitaxy

Daisuke Nagumo^{1,2}, Yasushi Shoji¹, Takeshi Tayagaki¹, Ryuji Oshima¹, Kikuo Makita¹, Yoshinobu Okano², Takeyoshi Sugaya¹ (1. National Inst. Advanced Industrial Science and Technology, Japan, 2. Tokyo City Univ., Japan)

[TuP-32-54]

Antimony surfactant-mediated epitaxy of GaP-based diluted nitride alloys for III-V/Si solar cells

Keisuke Yamane, Masashi Hikosaka, Akihiro Wakahara (Toyohashi Univ. Technology, Japan)

[TuP-32-55]

Formation and characterizations of sputter-deposited p-type polycrystalline BaSi₂ films using B-doped Si targets

Hayato Hasebe¹, Kazuki Kido¹, Haruki Takenaka¹, Masami Mesuda², Kaoru Toko¹, Takashi Suemasu¹ (1. Univ. Tsukuba, Japan, 2. Tosoh Corp., Japan)

[TuP-32-56]

Formation of p-NiO/n-BaSi₂ hetero junction solar cells on glass substrates by radio-frequency sputtering

Haruki Takenaka¹, Hayato Hasebe¹, Kazuki Kido¹, Masami Mesuda², Kaoru Toko¹, Takashi Suemasu¹ (1. Univ. Tsukuba, Japan, 2. Tosoh Corp., Japan)

[TuP-32-57]

Mobility improvement of CBE-grown InGaAsN by using vicinal GaAs(001) substrate

Hiroataka Tamashiro, Nobuaki Kojima, Yoshio Ohshita (Toyota Technological Inst., Japan)

[TuP-32-58]

Fabrication and characterizations of mono- and duo-doped alumina for thin-film solar cell applications

Faisal Ali Alamr, Mohammad Kamal Hossain (King Fahd Univ. Petroleum & Minerals, Saudi Arabia)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-2: Organic and inorganic thin-film photovoltaics, III-V high-efficiency devices and related technologies

[TuO-32e] Inorganic Tandem Solar Cells

Session Chairs: Yukiko Kamikawa (National Inst. Advanced Industrial Science and Technology, Japan), Xiaojing Hao (Univ. New South Wales, Australia)

Tue. Nov 15, 2022 3:30 PM - 5:00 PM 133+134 (Bldg. 1, 3F)

[TuO-32e-01] 3:30 PM – 4:00 PM

(INVITED) Development and prospects of Cu₂O tandem solar cells

Soichiro Shibasaki, Naoyuki Nakagawa, Yuya Honishi, Yukitami Mizuno, Mutsuki Yamazaki, Atsushi Wada, Sara Yoshio, Yasutaka Nishida, Kanta Sugimoto, Junji Sano, Maho Hayase, Kazushige Yamamoto (Toshiba Corp., Japan)

[TuO-32e-02] 4:00 PM – 4:15 PM

Approaches for high-efficiency and low-cost Si tandem solar cells

Masafumi Yamaguchi, Kyotaro Nakamura, Ryo Ozaki, Nobuaki Kojima, Yoshio Ohshita (Toyota Technological Inst., Japan)

[TuO-32e-03] 4:15 PM – 4:30 PM

Development of modulated surface texturing for high-efficiency, thin-film, flexible, silicon-based tandem solar cells in a roll-to-roll industrial environment

Gianluca Limodio¹, Govind Padmakumar¹, Jimmy Melskens², Chinmaya Rath¹, Rajat Subramanian¹, Mohammed El Makkaoui², Edward Hamers², Arno Smets¹ (1. Delft Univ. Technology, The Netherlands, 2HyET Solar Netherlands B.V., The Netherlands)

[TuO-32e-04] 4:30 PM – 4:45 PM

GaAs/Si tandem solar cell with optically transparent InAlAs/GaAs dislocation filter layers towards to cost-effective and high performance triple junction on Si solar cell

Yeonhwa Kim^{1,2}, Rafael Chu^{1,2}, Eunkyo Ju², May Angelu Madarang^{1,2}, Tae Soo Kim^{2,3}, Won Jun Choi², Daehwan Jung^{1,2} (1. Univ. Science and Technology, Korea, 2. Korea Inst. Science and Technology, Korea, 3. Yonsei Univ., Korea)

[TuO-32e-05] 4:45 PM – 5:00 PM

Advances in ACIGS thin film photovoltaics for bifacial flexible and tandem applications

Shih-Chi Yang, Shiro Nishiwaki, Maximilian Krause, Huagui Lai, Severin Siegrist, Radha K. Kothandaraman, Ramis Hertwig, Fan Fu, Romain Carron, Ayodhya N. Tiwari (Empa-Swiss Federal Labs. for Materials Science and Technology, Switzerland)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-2: Organic and inorganic thin-film photovoltaics, III-V high-efficiency devices and related technologies

[TuO-32f] Characterization and Analysis

Session Chairs: Shogo Ishizuka (National Inst. Advanced Industrial Science and Technology, Japan), Yoshitaro Nose (Kyoto Univ.)

Tue. Nov 15, 2022 5:30 PM - 7:00 PM 133+134 (Bldg. 1, 3F)

[TuO-32f-01] 5:30 PM – 6:00 PM

(INVITED) Grain boundaries and dislocations in various inorganic photovoltaic materials

Daniel Abou-Ras (Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Germany)

[TuO-32f-02] 6:00 PM – 6:15 PM

Analysis of EBIC time-variation using 2D simulation including charge states in $V_{Se}-V_{Cu}$ divacancy complex

Ryotaro Fukuda, Shinkai Shimizu, Takahito Nishimura, Akira Yamada (Tokyo Inst. Technology, Japan)

[TuO-32f-03] 6:15 PM – 6:30 PM

On the origin of tail states in $Cu(In,Ga)Se_2$: bulk vs grain boundaries

Omar Ramírez¹, Jiro Nishinaga², Susanne Siebentritt¹ (1. Univ. Luxembourg, Luxembourg, 2. National Inst. Advanced Industrial Science and Technology, Japan)

[TuO-32f-04] 6:30 PM – 6:45 PM

How band tail recombination and quasi-fermi level splitting influence the open-circuit voltage loss in CIGS solar cells

Hamidou Tangara¹, Yulu He¹, Muhammad Monirul Islam¹, Shogo Ishizuka², Takeaki Sakurai¹ (1 Univ. Tsukuba, Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan)

[TuO-32f-05] 6:45 PM – 7:00 PM

Unveiling microscopic carrier loss mechanisms in 12% efficient $Cu_2ZnSnSe_4$ solar cells

Jianjun Li¹, Jialiang Huang¹, Fajun Ma¹, Thomas Unold², Martin A. Green¹, Xiaojing Hao¹ (1. Univ. New South Wales, Australia, 2. Helmholtz-Zentrum für Materialien und Energie, Germany)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-2: Organic and inorganic thin-film photovoltaics, III-V high-efficiency devices and related technologies

[WeO-32g] Si-related Materials for Thin-film Solar Cells

Session Chairs: Hitoshi Sai (National Inst. Advanced Industrial Science and Technology, Japan), Olindo Isabella (Delft Univ. Technology, The Netherlands)

Wed. Nov 16, 2022 10:30 AM - 12:00 PM 133+134 (Bldg. 1, 3F)

[WeO-32g-01] 10:30 AM – 10:45 AM

Effect of annealing ambient on SiGe layer formation using Al-Ge paste for III-V solar cell application

Shota Suzuki^{1,3}, Kaito Kitaura³, Moeko Matsubara¹, Hideaki Minamiyama¹, Marwan Dhamrin^{1,2}, Yasufumi Fujiwara², Yukiharu Uraoka³ (1. Toyo Aluminium K.K., Japan, 2. Osaka Univ., Japan, 3. Nara Inst. Science and Technology, Japan)

[WeO-32g-02] 10:45 AM – 11:00 AM

Hydrogen passivation on SiGe solar cells grown on silicon substrates using amorphous silicon layers

Zhenyu Sun, Zhuangyi Zhou, Hao Luo, Brett Hallam, Li Wang (Univ. New South Wales, Australia)

[WeO-32g-03] 11:00 AM – 11:15 AM

Atomic hydrogen passivation effect on BaSi₂ films containing interstitial silicon atoms

Sho Aonuki¹, Kaoru Toko¹, Dmitri B. Migas^{2,3}, Takashi Suemasu¹ (1. Univ. Tsukuba, Japan, 2. Belarusian State Univ. Informatics and Radioelectronics, Belarus, 3. National Research Nuclear Univ., Russia)

[WeO-32g-04] 11:15 AM – 11:30 AM

Host-crystal orientation effects on SiGe epitaxial films grown by annealing Al-Ge alloyed pastes

Keisuke Fukuda¹, Satoru Miyamoto¹, Shota Suzuki^{2,3}, Masahiro Nakahara^{1,2}, Marwan Dhamrin^{2,3}, Kensaku Maeda⁴, Kozo Fujiwara⁴, Noritaka Usami¹ (1. Nagoya Univ., Japan, 2. Toyo Aluminium K.K., Japan, 3. Osaka Univ., Japan, 4. Tohoku Univ., Japan)

[WeO-32g-05] 11:30 AM – 11:45 AM

Evaluation of EPR-sensitive B-related defects in BaSi₂ by density functional theory approach

Yuguang Cao^{1,2}, Jean-Marie Mouesca², Serge Gambarelli², Takashi Suemasu¹ (1. Univ. Tsukuba, Japan, 2Univ. Grenoble Alpes, CNRS, CEA, INAC-SyMMES, France)

[WeO-32g-06] 11:45 AM – 12:00 PM

Impact of copper clusters in thin film solar cell: A study on simulation and fabrication

thereof

Mohammad Kamal Hossain, Faisal Ali Alamr (King Fahd Univ. Petroleum & Minerals, Saudi Arabia)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-2: Organic and inorganic thin-film photovoltaics, III-V high-efficiency devices and related technologies

[WeP-32] Organic and Inorganic Thin-film Photovoltaics, III-V High-efficiency Devices and Related Technologies

Wed. Nov 16, 2022 12:00 PM - 3:00 PM P-32/Event Hall (Bldg. 1, 1F)

[WeP-32-01]

Impact of halogenation on properties and photovoltaic performances in dithienonaphthobisthiadiazole-based π -conjugated polymers

Shota Suruga, Tsubasa Mikie, Itaru Osaka (Hiroshima Univ., Japan)

[WeP-32-02]

Modulation spectroscopies for the characterization of the electronic transport properties in inverted organic photovoltaics

Atsushi Okada¹, Yuuki Okuno¹, Takashi Kobayashi², Takashi Nagase², Hiroyoshi Naito² (1. Osaka Prefecture Univ., Japan, 2. Osaka Metropolitan Univ., Japan)

[WeP-32-03]

Solution-plasma-induced oxygen vacancy enhances MoO₃/Pt electrocatalytic counter electrode for bifacial dye-sensitized solar cells

Yanan Li, Yinglin Wang, Xintong Zhang (Northeast Normal Univ., China)

[WeP-32-04]

Highly photostable benzoindolenine-based squaraine dyes for organic photovoltaic

Yuya Yamada¹, Yuki Uehashi¹, Seiichiro Izawa^{2,3}, Tomohiro Agou⁴, Toshiyasu Inuzuka¹, Yasuhiro Kubota¹, Masahiro Hiramoto^{2,3}, Kazumasa Funabiki¹ (1. Gifu Univ., Japan, 2. Inst. Molecular Science, Japan, 3. Graduate Univ. Advanced Studies, Japan, 4. Ibaraki Univ., Japan)

[WeP-32-05]

High-transparence template-electrodeposited CoS_x catalytic electrode for dye-sensitized solar cells

Kuangyu Zhu, Jian fei Lin, Yinglin Wang, Xintong Zhang (Northeast Normal Univ., China)

[WeP-32-06]

Enhancing output power of polymer electrolytes DSSCs with V-shape low-concentrated light systems

Tika Erna Putri¹, Fadzai Lesley Chawarambwa¹, Pankaj Attri¹, Kunihiro Kamataki^{1,2}, Naho Itagaki^{1,2}, Kazunori Koga^{1,2}, Masaharu Shiratani^{1,2} (Kyushu Univ., Japan, 2. National Inst. Natural Sciences, Japan)

[WeP-32-07]

Functionalization of dyes using different organic donors for dye-sensitized solar cell applications – Theoretical investigation

R. Anandha Krishnan, R. Govindaraj, P. Ramasamy (Sri Sivasubramaniya Nadar College of Engineering, India)

[WeP-32-08]

Optimization of P3HT:PC₆₁BM based organic solar cell

Joseph Baki Kaore, Akira Baba, Kazunari Shinbo, Keizo Kato (Niigata Univ., Japan)

[WeP-32-09]

Effects of He ion and electron beam irradiations on CdTe solar cell dosimeter in substrate configuration

Tamotsu Okamoto¹, Fumiya Furumaki¹, Eiku Sato¹, Ippei Isogai¹, Yuji Kurimoto¹, Yasuki Okuno², Mitsuru Imaizumi³, Masafumi Akiyoshi⁴, Takeshi Ohshima⁵ (1. National Inst. Technology, Kisarazu College, Japan, 2. Kyoto Univ., Japan, 3. Japan Aerospace Exploration Agency, Japan, 4. Osaka Metropolitan Univ., Japan, 5. National Inst. Quantum Science and Technology, Japan)

[WeP-32-11]

N-type SnS and its application to homojunction solar cells

Issei Suzuki¹, Sakiko Kawanishi¹, Sage R. Bauers², Andriy Zakutayev², Minseok Kim^{3,4}, Hiroshi Yanagi⁴, Takahisa Omata¹ (1. Tohoku Univ., Japan, 2. National Renewable Energy Lab., USA, 3. Hanyang Univ., Korea, 4. Univ. Yamanashi, Japan)

[WeP-32-12]

Rapid thermal synthesis of GeSe and investigation of its photoelectrochemical properties

Girish Kamble, Jin Hyeok Kim (Chonnam National Univ., Korea)

[WeP-32-13]

Influence of Ge/(Ge+Sn) ratio on morphology and structure properties of Cu₂(Sn_{1-x}Ge_x)S₃ film

Ayaka Kanai¹, Ryoma Hata¹, Mutsumi Sugiyama², Kunihiro Tanaka¹ (1. Nagaoka Univ. Technology, Japan, 2. Tokyo Univ. Science, Japan)

[WeP-32-14]

Fabrication of solar cell using Ge-Sn-S thin film prepared by co-evaporation

Daiki Motai, Takeshi Tasaki, Hideaki Araki (National Inst. Technology, Nagaoka College, Japan)

[WeP-32-15]

Dislocation structures and photoconductive properties in TiO₂

Anna Takagi¹, Yu Oshima¹, Tatsuya Yokoi¹, Atsutomo Nakamura², Katsuyuki Matsunaga^{1,3} (1. Nagoya Univ., Japan, 2. Osaka Univ., Japan, 3. Japan Fine Ceramics Center, Japan)

[WeP-32-16]

Optical and electronic properties of aluminum-doped indium zinc magnesium oxide transparent conductive oxide prepared by co-sputtering under room temperature

Taichi Ishida¹, Jakapan Chantana¹, Yu Kawano¹, Takahito Nishimura², Abdurashid Mavlonov¹, Takayuki Negami¹, Takashi Minemoto¹ (1. Ritsumeikan Univ., Japan, 2. Tokyo Inst. Technology, Japan)

[WeP-32-17]

Novel atomic imaging technique for doped functional materials: White neutron holography

Kenji Ohoyama¹, Tomoya Kanno¹, Motoki Takano¹, Shouta Hoshi¹, Youdai Kobayashi¹, Yuka Tomimatsu¹, Yuki Aizawa¹, Shuta Kawakami¹, Masahide Harada², Yasuhiro Inamura², Kenichi Oikawa², Naohisa Happo³, Kouichi Hayashi⁴ (1. Ibaraki Univ., Japan, 2. Japan Proton Accelerator Research Complex, Japan, 3. Hiroshima City Univ., Japan, 4. Nagoya Inst. Technology, Japan)

[WeP-32-18]

Deposition of CdSnP₂ thin films by molecular beam epitaxy for n-type buffer material

Hayato Miura, Isshin Sumiyoshi, Yoshitaro Nose (Kyoto Univ., Japan)

[WeP-32-19]

Fabrication and characterizations of copper-doped zinc oxide for thin-film solar cell applications

Mohammad Kamal Hossain (King Fahd Univ. Petroleum & Minerals, Saudi Arabia)

[WeP-32-20]

Investigation of cover annealing of Cu₂SnS₃ thin films prepared by dual-source fine channel mist CVD method

Kazuya Okamura, Ren Saito, Ayaka Kanai, Kunihiko Tanaka (Nagaoka Univ. Technology, Japan)

[WeP-32-21]

Fabrication of Cu₂Sn_{1-x}Si_xS₃ thin films by thermal evaporation method

Kazuhiro Sugai, Ayaka Kanai, Kunihiko Tanaka (Nagaoka Univ. Technology, Japan)

[WeP-32-22]

Formation and characterization of ZnS and CdZnS films using open-air chemical vapor deposition for buffer layers of compound semiconductor solar cells

Yuji Kurimoto, Daiki Kobayashi, Naoki Asou, Tamotsu Okamoto (National Inst. Technology, Kisarazu College, Japan)

[WeP-32-23]

Influence of buffer layer on copper doped tin sulfide solar cell: A numerical approach

Rajeshwari Mannu, Arindam Basak, Udai P Singh (Kalinga Inst. Industrial Technology, India)

[WeP-32-24]

Enhancement of grain growth in Cu_2SnS_3 thin films prepared by the addition of Au and the fabrication of solar cells using the Au-added CTS thin films

Takeshi Tasaki, Hideaki Araki (National Inst. Technology, Nagaoka College, Japan)

[WeP-32-25]

Importance of fine control of Se flux for improving performances of Sb_2Se_3 solar cells prepared by vapor transport deposition

Seunghwan Ji¹, Jiwoon Choi¹, Sung-Wook Nam², Byungha Shin¹ (1. Korea Advanced Inst. Science and Technology, Korea, 2. Kyungpook National Univ., Korea)

[WeP-32-26]

Effects of annealing for Ag-rich Ag-Sn-S thin films by an evaporation method

Yoji Akaki¹, Sayaka Toyama¹, Tomohiro Uchimura¹, Shigeyuki Nakamura², Hideaki Araki³ (1. National Inst. Technology, Miyakonojo College, Japan, 2. National Inst. Technology, Tsuyama College, Japan, 3. National Inst. Technology, Nagaoka College, Japan)

[WeP-32-27]

Peierls stresses of basal and pyramidal dislocations in ZnO: First-principles approach

Takazumi Tanaka¹, Yu Oshima¹, Tatsuya Yokoi¹, Atsutomo Nakamura², Katsuyuki Matsunaga^{1,3} (1. Nagoya Univ., Japan, 2. Osaka Univ., Japan, 3. Japan Fine Ceramics Center, Japan)

[WeP-32-28]

Study of local atomic fluctuation in RB_6 with cage type structure by neutron holography

Yodai Kobayashi¹, Yuka Tomimatsu¹, Tomoya Kanno¹, Motoki Takano¹, Shota Hoshi¹, Fumitoshi Iga¹, Masahide Harada², Kenichi Oikawa², Yasuhiro Inamura², Koichi Hayashi³, Kenji Ohoyama¹ (1. Ibaraki Univ., Japan, 2. Japan Proton Accelerator Research Complex, Japan, 3. Nagoya Inst. Technology, Japan)

[WeP-32-29]

Expansion of white neutron holography into powder samples for observation of isolated hydrogen in materials

Motoki Takano¹, Shota Hoshi¹, Tomoya Kanno¹, Widyanisa Keiko¹, Yodai Kobayashi¹, Yuka Tomimatsu¹, Yuki Aizawa¹, Shuta Kawakami¹, Mariko Segawa², Makoto Maeda², Yosuke Toh², Shoji Nakamura², Atsushi Kimura², Shunsuke Endo², Masahide Harada³, Koichi Hayashi⁴, Kenji Ohoyama¹ (1. Ibaraki Univ., Japan, 2. Japan Atomic Energy Agency, Japan, 3. Japan Proton Accelerator Research Complex, Japan, 4. Nagoya Inst. Technology, Japan)

[WeP-32-30]

Innovative post-deposition treatment for local doping control in $\text{Cu}_2\text{ZnSnSe}_4$ by a combined temperature-voltage method

Alex Jimenez-Arguijo^{1,2}, Ivan Cano², Joaquim Puigdollers², Zacharie Jehl Li-Kao², Edgardo

Saucedo², Sergio Giraldo² (1.Inst. Recerca Energètica de Catalunya, Spain, 2. Univ. Politècnica de Catalunya, Spain)

[WeP-32-31]

Direct experimental confirmation of the reciprocity theorem in CIGS solar cells

Hajime Shibata¹, Jiro Nishinaga¹, Yukiko Kamikawa¹, Hitoshi Tampo¹, Takehiko Nagai¹, Takashi Koida¹, Shogo Ishizuka¹, Toshimitsu Mochizuki¹, Masafumi Yamaguchi² (1. National Inst. Advanced Industrial Science and Technology, Japan, 2. Toyota Technological Inst., Japan)

[WeP-32-32]

Detection of rubidium in high-bandgap Cu(In,Ga)Se₂ solar cells with RbF-PDT

Xiaowei Jin¹, Reinhard Schneider¹, Setareh Zahedi-Azad², Matthias Maiberg², Paul Pistor², Heiko Kempa², Roland Scheer², Di Wang¹, Christian Kübel¹, Dagmar Gerthsen¹ (1. Karlsruhe Inst. Technology, Germany, 2. Martin Luther Univ. Halle-Wittenberg, Germany)

[WeP-32-33]

Optimum back junction utilizing P-type MoSe₂:Nb layer for Cu(In,Ga)Se₂ solar cells

Takahito Nishimura, Akira Yamada (Tokyo Inst. Technology, Japan)

[WeP-32-35]

Heat-induced structural changes in CIGS thin film fabricated by MOCVD

Jiyeon Nam, SeungHoon Lee, Hae-Seok Lee, Donghwan Kim, Yoonmook Kang (Korea University, Korea)

[WeP-32-36]

Fabrication of Cu₂ZnSn(S,Se)₄ thin film solar cell by 3S process with high temperature sulfurization

Mitsuki Nakashima¹, Kaisei Ueda¹, Jumpei Maeda¹, Toshiyuki Yamaguchi², Khoo Pei Loon³, Masanobu Izaki³ (1. National Inst. Technology, Wakayama College, Japan, 2. National Inst. Technology, Oita College, Japan, 3. Toyohashi Univ. Technology, Japan)

[WeP-32-37]

Optical management in enhancing the efficiency of Cd-free CZTS solar cells by wide bandgap oxides

Xin Cui, Kaiwen Sun, Bram Hoex, Xiaojing Hao (Univ. New South Wales, Australia)

[WeP-32-38]

Impact of grain-boundary on thermal conductivity in the quaternary compound Cu₂ZnSnS₄ crystals

Katsuma Nagatomo, Akira Nagaoka, Kensuke Nishioka (Univ. Miyazaki, Japan)

[WeP-32-39]

High performance double graded CIGS solar cells with MoS₂ as inter-layer diffusion

limiter

Rajendra Prasad, Rajarshi Pal, Udai P. Singh (Kalinga Inst. Industrial Technology, India)

[WeP-32-40]

Study of local delamination of absorber layer in solution-processed CIGS_{Se} solar modules

Seung Hoon Lee¹, Min Kyu Kim², Soohyun Bae¹, Jiyeon Nam¹, HyunJung Park¹, Sang-Won Lee¹, Yun Jung Jang^{1,2}, Byoung Koun Min², Yoonmook Kang¹, Hae-Seok Lee¹, Donghwan Kim¹ (1. Korea Univ. Korea, 2. Korea Inst. Science and Technology, Korea)

[WeP-32-41]

Extrinsic doping of ink-based Cu(In,Ga)(S,Se)₂-absorbers for photovoltaic applications

Sunil Suresh¹, David J. Rokke², Amandine A. Drew¹, Essam Alruqobah³, Rakesh Agrawal², Alexander R. Uhl¹ (1. Univ. British Columbia, Canada, 2. Purdue Univ., USA, 3. Kuwait Univ., Kuwait)

[WeP-32-42]

A study on property improvement according to various heating time during RTA process of Cu₂ZnSn(S, Se)₄ (CZTSSe) absorber layer

Sang Woo Park, Hyeok Jin Kim (Chonnam National Univ., Korea)

[WeP-32-43]

All-dry sputtering oxygen-rich Zn(O,S) buffer for Cd-free Cu(In,Ga)(S,Se)₂ solar cells to optimize interface properties and device performance

Yuxian Li¹, Chen Wang¹, Hao Tong⁴, Liangzheng Dong¹, Ming Zhao^{1,2,3}, Daming Zhuang^{1,2,3} (1. Tsinghua Univ., China, 2. Key Lab. Advanced Materials Processing Technology of Ministry of Education, China, 3. State Key Lab. New Ceramics and Fine Processing, China, 4. Taiyuan Univ. Technology, China)

[WeP-32-44]

Influence of annealing of Mo/SLG structure on CZTS thin film solar cells

Motoki Yamanouchi, Kazuo Jimbo, Yosuke Shimamune (National Inst. Technology, Nagaoka College, Japan)

[WeP-32-45]

A Strategic approach to combat nonradiative recombination losses in Cu₂ZnSn(S,Se)₄: Double cation incorporation

Vijay C. Karade, Jin Hyeok Kim (Chonnam National Univ., Korea)

[WeP-32-46]

Development of CZTS solar cells on graphite

Kazuo Jimbo, Yosuke Shimamune (National Inst. Technology, Nagaoka College, Japan)

[WeP-32-47]

Fabrication of high-efficiency Cu(In,Ga)Se₂ solar cells using flexible ultra-thin glass

Donghyeop Shin¹, Awet Mana Amare¹, Inyoung Jeong¹, Inchan Hwang¹, Soomin Song¹, Young-Joo Eo¹, Ara Cho¹, Jun-Sik Cho¹, Joo Hyung Park¹, Seung Kyu Ahn¹, Jinsu Yoo¹, SeJin Ahn¹, Jihye Gwak¹, Jae Ho Yun², Kihwan Kim¹ (1. Korea Inst. Energy Research, Korea, 2. Korea Inst. Energy Technology, Korea)

[WeP-32-48]

Pin-type second optical element for spherical lens micro-tracking concentrator photovoltaic with wide angle of incidence.

Masakazu Nakatani^{1,2} (1. Osaka Univ., Japan, 2. Sun Marion Co., Ltd., Japan)

[WeP-32-49]

Tolerance to hygrothermal stress for thin-film silicon photovoltaic modules with polyvinyl butyral encapsulants

Atsushi Masuda¹, Kinichi Ogawa², Yasuo Chiba², Hirotaka Yasuda³, Shinichi Muguruma³ (1. Niigata Univ., Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan, 3. Kuraray Co., Ltd., Japan)

[WeP-32-50]

Analysis of irradiation influence using photo-induced currents of pA order in InGaP solar cells

Yasuki Okuno¹, Mitsuru Imaizumi², Takeshi Ohshima³ (1. Kyoto Univ., Japan, 2. Japan Aerospace Exploration Agency, Japan, 3. National Inst. Quantum Science and Technology, Japan)

[WeP-32-51]

Computational material screening for charge transport layers of BaSi₂ solar cells

Kosuke O. Hara (Univ. Yamanashi, Japan)

[WeP-32-52]

High-temperature post-annealing effect on BaSi₂ solar cells grown by molecular beam epitaxy

Shunsuke Narita, Sho Aonuki, Kaori Takayanagi, Kaoru Toko, Takashi Suemasu (1. Univ. Tsukuba, Japan)

[WeP-32-53]

Effect of initial growth process on residual strain in GaAs/Si

Yuito Yasukochi, Nobuaki Kojima, Yoshio Ohshita (Toyota Technological Inst., Japan)

[WeP-32-54]

Epitaxial lift-off for inverted metamorphic four-junction (IMM4J) solar cells

Xin Wang, Bin Li, Lihua Zhou, Xianglei Shi, Lijie Sun, Xunchun Wang (Shanghai Inst. Space Power-Sources, China)

[WeP-32-55]

Mechanical stacking for High efficiency III-V/Si tandem solar cell

Seungyong Han, Youngkuk Kim, Young Hyun Cho, Suresh Kumar Dhungel, Heonmin Lee, Matheus de Assis Rabelo, Junsin Yi (Sungkyunkwan Univ., Korea)

[WeP-32-56]

Constructing the composition ratio prediction model using machine learning for BaSi₂ thin films deposited by thermal evaporation

Ryuto Ueda, Keisuke Arimoto, Junji Yamanaka, Kosuke O. Hara (Univ. Yamanashi, Japan)

[WeP-32-57]

Optical optimization of the Intermediate layer for III-V/Si tandem solar cells by simulation

Caixia Li, Ziheng Liu, Pengfei Zhang, Xiaojing Hao (Univ. New South Wales, Australia)

[WeP-32-58]

In-situ XRD measurement of crystal growth process of SiGe layer on Si using Al-Ge paste for III-V solar cell application

Shota Suzuki^{1,3}, Moeko Matsubara¹, Hideaki Minamiyama¹, Marwan Dhamrin^{1,2}, Yukiharu Uraoka³
(1. Toyo Aluminium K.K., Japan, 2. Osaka Univ., Japan, 3. Nara Inst. Science and Technology, Japan)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-2: Organic and inorganic thin-film photovoltaics, III-V high-efficiency devices and related technologies

[WeO-32h] Chalcogenide Solar Cells II - Interfaces and Related Materials

Session Chairs: Takahito Nishimura (Tokyo Inst. Technology, Japan), Jiro Nishinaga (National Inst. Advanced Industrial Science and Technology, Japan)

Wed. Nov 16, 2022 3:30 PM - 5:30 PM 133+134 (Bldg. 1, 3F)

[WeO-32h-01] 3:30 PM – 3:45 PM

13% record efficiency CZTSSe solar cell: New insight into kesterite/CdS interface

Hao Xin, Yuancai Gong, Qiang Zhu, Bingyan Li, Chunxu Xiang (Nanjing Univ. Posts & Telecommunications, China)

[WeO-32h-02] 3:45 PM – 4:00 PM

High-efficiency Cd-free kesterite solar cells with organic molecular semiconductor buffer layer

Yawei Wang, Lingling Wang, Xintong Zhang (Northeast Normal Univ., China)

[WeO-32h-03] 4:00 PM – 4:15 PM

Multiple factors of Al₂O₃/CIGS interface and impacts on CIGS solar cells

Yukiko Kamikawa¹, Marco Nardone², Hajime Shibata¹, Shogo Ishizuka¹ (1. National Inst. Advanced Industrial Science and Technology, Japan, 2. Bowling Green State Univ., USA)

[WeO-32h-04] 4:15 PM – 4:30 PM

Excitation and temperature dependent investigation by photoluminescence from the backside of industrial Cu(In,Ga)(S,Se)₂ absorbers

Aubin Jean-Claude Mireille Prot¹, Susanne Siebentritt¹, Anastasia Zelenina², Hossam Elanzeery², Thomas Dalibor² (1. Univ. Luxembourg, Luxembourg, 2. Avancis, Germany)

[WeO-32h-05] 4:30 PM – 4:45 PM

Development of n-type ZnS buffer layer deposited by atmospheric pressure MOCVD method for Cu(In,Ga)Se₂ solar cells

Akihiro Funaki, Fumiya Furumaki, Takahito Nishimura, Akira Yamada (Tokyo Inst. Technology, Japan)

[WeO-32h-06] 4:45 PM – 5:00 PM

CuGaSe₂ absorber on FTO transparent back contacts

Angelica Thomere¹, Marcel Placidi^{1,2}, Maxim Guc¹, Yudania Sánchez¹, Robert Fonoll-Rubio¹, Victor Izquierdo-Roca¹, Zacharie Jehl Li-Kao², A. Perez-Rodriguez¹ (1. Catalonia Inst. Energy Research, Spain, 2. Polytechnic Univ. Catalonia, Spain)

[WeO-32h-07] 5:00 PM – 5:15 PM

Kesterite $\text{Cu}_2\text{ZnSn}(\text{S},\text{Se})_4$ thin-film solar cells with 10.12% efficiency via enhanced photoelectrical properties of TCO window layer

Suyoung Jang, Jin Hyeok Kim (Chonnam National Univ., Korea)

[WeO-32h-08] 5:15 PM – 5:30 PM

Electron transport layer modification for high-efficiency $\text{Sb}_2(\text{S},\text{Se})_3$ planar solar cells

Jianmin Li (Wuhan Univ., China)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub-area 3-2: Organic and inorganic thin-film photovoltaics, III-V high-efficiency devices and related technologies

[ThO-32i] Technology for New Directions I - Advanced Techniques

Session Chair: Yoshitaro Nose (Kyoto Univ., Japan)

Thu. Nov 17, 2022 8:30 AM - 10:00 AM 133+134 (Bldg. 1, 3F)

[ThO-32i-01] 8:30 AM – 8:45 AM

Advances in lightweight and flexible thin-film silicon PV module technology

Gianluca Limodio¹, Thierry de Vrijer¹, Federica Saitta¹, Govind Padmakumar¹, Jimmy Melskens², Mohammed El Makkaoui², Ravi Vasudevan², Edward Hamers², Arno H. M. Smets¹ (1. Delft Univ. Technology, The Netherlands, 2. HyET Solar NL, The Netherlands)

[ThO-32i-02] 8:45 AM – 9:00 AM

Flexible, all-dry process, and Cd-free Cu(In,Ga)(S,Se)₂ solar cell on stainless steel substrate through surface modification induced by air-annealing

Jakapan Chantana, Yu Kawano, Abdurashid Mavlonov, Takayuki Negami, Takashi Minemoto (Ritsumeikan Univ., Japan)

[ThO-32i-03] 9:00 AM – 9:15 AM

TBD

[ThO-32i-04] 9:15 AM – 9:30 AM

Smart-stack InGaP/GaAs//CuIn_{1-y}Ga_ySe₂ three-junction solar cells using an area current matching technique

Kikuo Makita¹, Yukiko Kamikawa¹, Hidenori Mizuno¹, Ryuji Oshima¹, Yasushi Syoji¹, Shogo Ishizuka¹, Tatsuya Takamoto², Takeyoshi Sugaya¹ (1. National Inst. Advanced Industrial Science and Technology, Japan, 2. Sharp Corp., Japan)

[ThO-32i-05] 9:30 AM – 9:45 AM

Effectively transparent contacts for concentrator solar cell design using a refraction layer

Anastasia H. Soeriyadi¹, Mengdi Liu¹, Stefan W. Tabernig², Udo Römer¹, Andreas Pusch¹, Michael P. Nielsen¹, Dimitry Lamers³, Albert Polman², Nicholas J. Ekins-Daukes¹ (1. Univ. New South Wales, Australia, 2. NWO-Institute AMOLF, The Netherlands, 3. SRON Netherlands Institute for Space Research, The Netherlands)

[ThO-32i-06] 9:45 AM – 10:00 AM

High-speed growth of GaAs solar cells via atmospheric pressure hydride vapor phase epitaxy

Ryuji Oshima¹, Akio Ogura², Yasushi Shoji¹, Kikuo Makita¹, Akinori Ubukata³, Mitsuru Imaizumi²,

Takeyoshi Sugaya¹ (1. National Inst. Advanced Industrial Science and Technology, Japan, 2. Japan Aerospace Exploration Agency, Japan, 3. Taiyo Nippon Sanso Corp., Japan)

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Sub area 3-2: Organic and inorganic thin-film photovoltaics, III-V high-efficiency devices and related technologies

[ThO-32j] Technology for New Directions II - Machine Learning and Modelling

Session Chair: Takashi Minemoto (Ritsumeikan Univ., Japan)

Thu. Nov 17, 2022 10:30 AM - 12:00 PM 133+134 (Bldg. 1, 3F)

[ThO-32j-01] 10:30 AM – 11:00 AM

(INVITED) Machine learning and fast experimental screening-assisted development of next-generation solar cell

Akinori Saeki (Osaka Univ., Japan)

[ThO-32j-02] 11:00 AM – 11:15 AM

A machine-learning study for the determination of electronic transport properties of inverted organic solar cells from their current – voltage characteristics

Yuki Okuno¹, Takashi Nagase², Takashi Kobayashi², Hiroyoshi Naito² (1. Osaka Prefecture Univ., Japan, 2. Osaka Metropolitan Univ., Japan)

[ThO-32j-03] 11:15 AM – 11:30 AM

Modelling the dynamics of charge extraction transients from organic photovoltaic devices using generative representation learning

Brendan Wright¹, Ziv Hameiri¹, Attila Mozer² (1. Univ. New South Wales, Australia, 2. Univ. Wollongong, Australia)

[ThO-32j-04] 11:30 AM – 11:45 AM

Smart determination of process window for MBE deposition of ZnSnP₂ assisted by machine learning

Yoshitaro Nose¹, Ryoji Katsube, Kei Terayama^{2,3}, Ryo Tamura^{3,4,5} (1. Kyoto Univ., Japan, 2. Yokohama City Univ., Japan, 3. RIKEN, Japan, 4. National Inst. Materials Science, Japan, 5. Univ. Tokyo, Japan)

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

Sub-area 4-1: Perovskite photovoltaics and related technologies

[MoO-41a] High Efficiency

Session Chair: Hideo Ohkita (Kyoto Univ., Japan)

Mon. Nov 14, 2022 8:30 AM - 10:00 AM Shirotori Hall (Bldg. 4, 1F)

[MoO-41a-01] 8:30 AM – 8:45 AM

Assisted crystallization and healed defects via interface engineering with NH_4^+ for stable and highly efficient perovskite solar cells

Jihyun Kim¹, Joonho Park², Ahreum Lee¹, Yong-Hoon Kim², William Jo¹ (1. Ewha Womans Univ., Korea, 2. Korea Advanced Inst. Science and Technology, Korea)

[MoO-41a-02] 8:45 AM – 9:00 AM

Efficient inverted perovskite solar cells enabled by multipodal hole-collecting monolayers based on triazatruxene skeleton

Minh Anh Truong¹, Tsukasa Funasaki¹, Lucas Ueberricke¹, Wataru Nojo², Richard Murdey¹, Takumi Yamada¹, Shuaifeng Hu¹, Tomoya Nakamura¹, Nobutaka Shioya¹, Takeshi Hasegawa¹, Yoshihiko Kanemitsu¹, Takanori Suzuki², Atsushi Wakamiya¹ (1. Kyoto Univ., Japan, 2. Hokkaido Univ., Japan)

[MoO-41a-03] 9:00 AM – 9:15 AM

Interfacial modifications for efficient tin–lead perovskite solar cells

Shuaifeng Hu¹, Pei Zhao², Kyohei Nakano³, Jorge Pascual¹, Minh Anh Truong¹, Richard Murdey¹, Nobutaka Shioya¹, Takeshi Hasegawa¹, Masahiro Ehara², Keisuke Tajima³, Yoshihiko Kanemitsu¹, Atsushi Wakamiya¹ (1. Kyoto Univ., Japan, 2. Inst. Molecular Science, Japan, 3. RIKEN, Japan)

[MoO-41a-04] 9:15 AM – 9:30 AM

High- V_{oc} all-inorganic CsPbX_3 perovskite solar cells

Zhanglin Guo, Ajay Kumar Jena, Tsutomu Miyasaka (Toin Univ. Yokohama, Japan)

[MoO-41a-05] 9:30 AM – 9:45 AM

Interfacial engineering and homojunction design for efficient and stable perovskite solar cells

Peng Cui, Shujie Qu, Benyu Liu, Luyao Yan, Xinxin Wang, Shuxian Du, Hao Huang, Jun Ji, Meicheng Li (North China Electric Power Univ., China)

[MoO-41a-06] 9:45 AM – 10:00 AM

High mobility spin coated MoO_3 thin film for highly efficient lead free perovskite solar cell application

Ihsan Ahmad Siddiquee¹, H. Mohafez¹, Yasmin Abdul Wahab¹, Foo Wah Low², Aziz Ahamed³, Mohammad Aminul Islam¹ (1. Univ. Malaya, Malaysia, 2. Univ. Tunku Abdul Rahman, Malaysia, 3.

Nippon Crucible Ltd., Japan)

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

Sub-area 4-1: Perovskite photovoltaics and related technologies

[MoO-41b] Fundamentals/Analysis/Characterization

Session Chair: Shuzi Hayase (Univ. Electro-Communications, Japan)

Mon. Nov 14, 2022 10:30 AM - 12:00 PM Shirotori Hall (Bldg. 4, 1F)

[MoO-41b-01] 10:30 AM – 10:45 AM

High power-per-weight ultralight flexible perovskite solar cells by low temperature process

Ching Chang Lin, Motoshi Nakamura, Takeru Bessho, Hiroshi Segawa (Univ. Tokyo, Japan)

[MoO-41b-02] 10:45 AM – 11:00 AM

Combination of the sputtered NiO_x and SAM layer for efficient perovskite solar cells

Yasuhiro Shirai, Dhruva B. Khadka, Masatoshi Yanagida, Kenjiro Miyano (National Inst. Materials Science, Japan)

[MoO-41b-03] 11:00 AM – 11:15 AM

Photoconductivity-based exploration of Bi, Sb-materials and their application for photovoltaic and sensing use

Ryosuke Nishikubo¹, Hiroyuki Kanda², Inés García-Benito², Agustín Molina-Ontoria³, Gianluca Pozzi⁴, Abdullah M. Asiri⁵, Mohammad K. Nazeeruddin², Akinori Saeki¹ (1. Osaka Univ., Japan, 2. EPFL, Switzerland, 3. IMDEA-Nanociencia, Spain, 4. SCITEC-CNR, Italy, 5. King Abdulaziz Univ., Saudi Arabia)

[MoO-41b-04] 11:15 AM – 11:30 AM

Microscopic interfacial charge transfer at perovskite/hole transport layer interfaces clarified by the pattern-illumination time-resolved phase microscopy

Kenji Katayama, Zhenhua Pan, Tatsuya Chugenji (Chuo Univ., Japan)

[MoO-41b-05] 11:30 AM – 11:45 AM

Surface/interface structures of perovskite films studied by electron spectroscopies

Hiroyuki Yoshida¹, Abduheber Mirzehmet¹, Peter Kruger¹, Muhammad Akmal Kamarudin², Shuzi Hayase² (1Chiba Univ., Japan, 2. Univ. Electro-Communications, Japan)

[MoO-41b-06] 11:45 AM – 12:00 PM

Influence of the planar-SnO₂ electron transport layer on perovskite solar cell characteristics under low-light intensity

Tomoki Asada, Fumihiko Murata, Yasuaki Ishikawa (Aoyama Gakuin Univ., Japan)

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

Sub-area 4-1: Perovskite photovoltaics and related technologies

[TuO-41c] New Materials

Session Chair: Yutaka Matsuo (Nagoya Univ., Japan)

Tue. Nov 15, 2022 10:30 AM - 12:00 PM Shirotori Hall (Bldg. 4, 1F)

[TuO-41c-01] 10:30 AM – 11:00 AM

(INVITED) Device operation mechanism and high efficiency design of perovskite solar cells

Takashi Minemoto, Jakapan Chantana (Ritsumeikan Univ., Japan)

[TuO-41c-02] 11:00 AM -11:15 AM

Performance of inverted planar device configured perovskite solar cells with an inorganic hole extraction layer

Pandiyarajan Mariyappan^{1,2}, Shanthy Subashchandran¹, Ashrafal Islam² (1. Anna Univ., India, 2. National Inst. Materials Science, Japan)

[TuO-41c-03] 11:15 AM – 11:30 AM

Triarylamine/bithiophene copolymer with enhanced quinoidal character as hole-transporting material for perovskite solar cells

Hao-Sheng Lin¹, Takahiro Doba², Wataru Sato², Rui Shang², Eiichi Nakamura², Yutaka Matsuo¹ (1. Nagoya Univ., Japan, 2 Univ. Tokyo, Japan)

[TuO-41c-04] 11:30 AM – 11:45 AM

Silver bismuth halides and silver bismuth sulfides as Pb-free absorbers for perovskite solar cells

Ajay Kumar Jena, Zhanglin Guo, Naoyuki Shibayama, Tsutomu Miyasaka (Toin Univ. Yokohama, Japan)

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

Sub-area 4-1: Perovskite photovoltaics and related technologies

[TuP-41] Perovskite Photovoltaics and Related Topics / Area 3 and 4 Joint Session

Tue. Nov 15, 2022 12:00 PM - 3:00 PM P-41/Event Hall (Bldg. 1, 1F)

[TuP-41-01]

Near-infrared light management in silicon heterojunction solar cells for perovskite/silicon tandem cell application

Hyunju Lee¹, Tappei Nishihara¹, Shiyu Zhang¹, Yoshio Ohshita², Atsushi Ogura¹ (1. Meiji Univ., Japan, 2. Toyota Technological Inst., Japan)

[TuP-41-02]

Enhancing photovoltaic performances and stability of inverted perovskite solar cells using a facile organic halide treatment and its application to tandem

Huyen Tran^{1,2}, Sungjun Hong^{1,2}, SeJin Ahn^{1,2}, Jihye Gwak^{1,2}, Inyoung Jeong¹ (1. Korea Inst. Energy Research, Korea, 2. Univ. Science & Technology, Korea)

[TuP-41-03]

Analysis of metal-TCO contacts for low-temperature screen-printed metallization of silicon heterojunction and perovskite-based tandem solar cells

Pradeep Padhamnath, Chuan Seng Tan, Selvaraj Venkataraj, Nitin Nampalli, Armin G. Aberle (National Univ. Singapore, Singapore)

[TuP-41-04]

Bandgap engineering of mixed halide perovskite thin film using ion exchange method for tandem solar cells

Sujin Cho, Jae-Keun Hwang, Seok Hyun Jeong, Ji-Seong Hwang, Ji Yeon Hyun, Wonkyu Lee, Solhee Lee, Hae-Seok Lee, Donghwan Kim, Yoonmook Kang (Korea Univ., Korea)

[TuP-41-05]

Two terminal monolithic perovskite-carrier selective contact silicon tandem solar cells using molybdenum oxide as a hole selective layer

Hoyoung Song¹, Changhyun Lee¹, Jiyeon Hyun¹, Sang-Won Lee¹, Dongjin Choi¹, Dowon Pyun¹, Jiyeon Nam¹, Seok-Hyun Jeong¹, Soohyun Bae², Hyunju Lee³, Yoonmook Kang¹, Donghwan Kim¹, Hae-Seok Lee¹ (1. Korea Univ., Korea, 2. Korea Inst. Science and Technology, Korea, 3. Meiji Univ., Japan)

[TuP-41-06]

Efficient carrier recombination of perovskite/Si tandem solar cells interlayer via Ag nanocrystallite

Minji Choi, Dongjin Choi, Dowon Pyun, Hoyoung Song, MyeongSeob Sim, Changhyun Lee, Ji Yeon

Hyun, Yoonmook Kang, Hae-Seok Lee, Donghwan Kim (Korea Univ., Korea)

[TuP-41-07]

Fabrication of thin c-Si substrates for perovskite/silicon-heterojunction tandem solar cells

Kimihiko Saito, Hirotaka Shishido, Ryousuke Ishikawa (Tokyo City Univ., Japan)

[TuP-41-08]

Potential of *in-situ* formed titanium silicide as a recombination layer for 2-terminal perovskite/silicon tandem solar cells

Dowon Pyun¹, Dongjin Choi¹, Soohyun Bae², Seok Hyun Jeong¹, Sang-Won Lee¹, Jiryang Kim¹, Solhee Lee¹, Hoyoung Song¹, Dongkyun Kang¹, Ha Eun Lee¹, Ji Yeon Hyun¹, Changhyun Lee¹, JaeKeun Hwang¹, HyunJung Park¹, Wonkyu Lee¹, Yoonmook Kang¹, Donghwan Kim¹, Hae-Seok Lee¹ (1. Korea Univ., Korea, 2. Korea Inst. Energy Research, Korea)

[TuP-41-09]

Optimization of wide-bandgap perovskite solar cells for Si/perovskite tandem cells

Ryuji Kaneko, Ai Shimazaki, Noboru Ohashi, MinhAnh Truong, Tomoya Nakamura, Richard Murdey, Atsushi Wakamiya (Kyoto Univ., Japan)

[TuP-41-10]

Semi-transparent perovskite solar cells by low temperature process for tandem application

Gakuto Matsuo, Ryo Sato, Daisuke Ieki, Kimihiko Saito, Ryousuke Ishikawa (Tokyo City Univ., Japan)

[TuP-41-11]

Two-step sequential dry process for perovskite film deposition on large area textured silicon surface

Jae-Keun Hwang, Wonkyu Lee, Solhee Lee, Ji Yeon Hyun, Seok Hyun Jeong, Sujin Cho, Sang-Won Lee, Donghwan Kim, Yoonmook Kang, Hae-Seok Lee (Korea Univ., Korea)

[TuP-41-12]

Ultrathin flexible perovskite solar cells using internal stress-controlled bilayer indium tin oxide electrode

Noboru Ohashi, Ryuji Kaneko, Chikako Sakai, Kenji Yazawa, Hirokazu Tahara, Taketo Handa, Tomoya Nakamura, Richard Murdey, Yoshihiko Kanemitsu, Atsushi Wakamiya (Kyoto Univ., Japan)

[TuP-41-13]

Next generation cylindrical solar cell

Masahiro Hayashi, Takatoshi Nomura, Takahiro Hayami (CKD Corp., Japan)

[TuP-41-14]

Effect of anti-solvent in perovskite thin films: CsBi₃I₁₀

Keigo Aida, Shinya Kato, Naoki Kishi, Tetsuo Soga (Nagoya Inst. Technology, Japan)

[TuP-41-15]

Optimization of porous TiO₂ electron transport layer in carbon-based perovskite solar cells

Takaya Shioki, Ryuki Tsuji, Kouta Oishi, Seigo Ito (Univ. Hyogo, Japan)

[TuP-41-16]

Fabrication of all-inorganic CsPbI_{2.5}Br_{0.5} perovskite solar cells with CuSCN as hole transporting material

Bicui Li, Huifang Han, Huijing Liu, Jia Xu, Jianxi Yao (North China Electric Power Univ., China)

[TuP-41-17]

Fabrication of for all-inorganic carbon-based CsPbBr₃ perovskite solar cells with Co₃O₄ nanocrystals as hole transporting material

Xin Tong, Hui jing Liu, Jia Xu, Jian xi Yao (North China Electric Power Univ., China)

[TuP-41-18]

Reduction of graphene oxide films on flexible PET substrate by plasma process at near-room temperature

Golap Kalita, Balaram Paudel Jaisi, Masayoshi Umeno (C's Techno Inc., Japan)

[TuP-41-19]

Realization of ultra-flat perovskite films with surprisingly large-grain distribution using high-pressure cooking

Hanhong Zhang, Fan Zhang (Shenzhen Univ., China)

[TuP-41-20]

A novel low temperature curing screen printing conductive paste for perovskite photovoltaic applications

Dayi Tsou¹, Kaien Chang¹, Qijie Guo² (1. Solamet Electronic Materials Ltd., Hong Kong, 2. Solamet Electronic Materials Ltd., China)

[TuP-41-21]

The solvent annealing treatment for improving crystallization of perovskite films and performance of perovskite solar cells

Aoxi He, Meng Wang, Weijian Tang, Xia Hao, Jingquan Zhang (Sichuan Univ., China)

[TuP-41-22]

TiO₂/SnO₂ electron transport layer by evaporation method for perovskite solar cell application

Xianhuan Yu, Itaru Raifuku, Michael Paul A. Jallorina, Yukiharu Uraoka (Nara Inst. Science and

Technology, Japan)

[TuP-41-23]

Process and structure analysis of preparing perovskite solar cells by slot-die coating based on COMSOL simulation

Qiang Guo, Shiyi Tang, Xia Hao, Jingquan Zhang (Sichuan Univ., China)

[TuP-41-24]

Enhanced optical and electrical properties of perovskite and electron transfer layer using interlayer with MACl on solution processed tin oxide

Seok-Hyun Jeong, Wonkyu Lee, Solhee Lee, Sang-Won Lee, Jae-Keun Hwang, Hae-Seok Lee, Donghwan Kim, Yoonmook Kang (Korea Univ., Korea)

[TuP-41-25]

Vacuum deposition of lead iodide precursor and its conversion to perovskite

Wonkyu Lee, Sang-won Lee, JaeKeun Hwang, Solhee Lee, Ji Yeon Hyun, Donghwan Kim, Yoonmook Kang, Hae-Seok Lee (Korea Univ., Korea)

[TuP-41-26]

Fabrication and characterization of perovskite solar cells added with copper and alkali metals

Ayu Enomoto¹, Atsushi Suzuki¹, Takeo Oku¹, Masanobu Okita², Sakiko Fukunishi², Tomoharu Tachikawa², Tomoya Hasegawa² (1. Univ. Shiga Prefecture, Japan, 2. Osaka Gas Chemicals Co., Ltd., Japan)

[TuP-41-27]

Fabrication and characterization of lanthanide-doped perovskite solar cells

Atsushi Suzuki¹, Kyo Kishimoto¹, Takeo Oku¹, Masanobu Okita², Sakiko Fukunishi², Tomoharu Tachikawa², Tomoya Hasegawa² (1. Univ. Shiga Prefecture, Japan, 2. Osaka Gas Chemicals Co., Ltd., Japan)

[TuP-41-28]

Fabrication and characterization of CH₃NH₃PbI₃ perovskite solar cells inserted with CuPcX₄-TCNQ layer

Atsushi Suzuki¹, Ryota Hasegawa¹, Kai Funayama¹, Takeo Oku¹, Masanobu Okita², Sakiko Fukunishi², Tomoharu Tachikawa², Tomoya Hasegawa² (1. Univ. Shiga Prefecture, Japan, 2. Osaka Gas Chemicals Co., Ltd., Japan)

[TuP-41-29]

Wet-processable eDIPS-based single-walled carbon nanotubes for replacing ITO in perovskite solar cells

Mizuki Yagisawa¹, Hao-Sheng Lin¹, Daisuke Miyata¹, Satoru Hashimoto², Takeshi Hashimoto², Yutaka Matsuo¹ (1. Nagoya Univ., Japan, 2. Meijo Nano Carbon Co., Ltd, Japan)

[TuP-41-30]

Photostability enhancement of a Br-rich wide-bandgap lead-halide perovskite with additives

Youhei Numata¹, Naoyuki Shibayama², Tsutomu Miyasaka^{1,2} (1. Univ. Tokyo, Japan, 2. Toin Univ. Yokohama, Japan)

[TuP-41-31]

Ionic liquid-assisted stable perovskite solar cells

Md. Shahiduzzaman, Tetsuya Taima (Kanazawa Univ., Japan)

[TuP-41-32]

Improved operational stability of perovskite solar cells at high temperature

Yuki Fujita, Ganbaatar Tumen-Ulzii, Toshinori Matsushima, Chihaya Adachi (Kyushu Univ., Japan)

[TuP-41-33]

In-situ observation of photo-induced halide segregation in mixed halide perovskite

Hyunhwa Lee¹, Passarut Boonmongkolras², Seongmoon Jun², Yujin Park^{1,2}, Jaehyuk Ko², Yong-Hoon Cho², Byungha Shin², Jeong Young Park^{1,2} (1. Institute for Basic Science, Korea, 2. Korea Advanced Inst. Science and Technology, Korea)

[TuP-41-34]

Complete inorganic stable perovskite single crystal growth by slow evaporation using antisolvent atmosphere

Muthu Gomathy M. Pandian, Saritha K. Ratnakaran, Shanthi Subashchandran, Jوسفل Flora (Anna Univ., India)

[TuP-41-35]

A massive attack on PSC stability: High-throughput MPP-ageing and machine learning

Hans Koebler, Mark Khenkin, Paolo Graniero, Titan Hartono (Helmholtz-Zentrum-Berlin, Germany)

[TuP-41-36]

Defect passivation in perovskite solar cells using an amino-functionalized BODIPY fluorophore

Abd. Rashid bin Mohd Yusoff (Pohang Univ. Science and Technology, Korea)

[TuP-41-37]

Effect of TbCl₃ doping on thermal evaporation of CsPbBr₃

Naoki Aso, Haruto Tani, Shinsuke Miyajima (Tokyo Inst. Technology, Japan)

[TuP-41-38]

Surface modification of NiO_x as hole transport layer for the perovskite solar cells

Masatoshi Yanagida¹, Tensho Nakamura², Tsukasa Yoshida², Dhruva B. Khadka¹, Yasuhiro Shirai¹,

Kenjiro Miyano¹ (1. National Inst. Materials Science, Japan, 2. Yamagata Univ., Japan)

[TuP-41-39]

Mixed halide double perovskite $\text{Cs}_2\text{CuFeCl}_{6-x}\text{Br}_x$ with tunable properties

Thiri Htun, Hytham Elbohy, Amr Elattar, Hiroo Suzuki, Takeshi Nisikawa, Yasuhiko Hayashi (1. Okayama Univ., Japan)

[TuP-41-40]

Investigation of self-assembled monolayer (SAM) as the hole transport layers in the perovskite solar cells

Takuma Chigira¹, Takashi Funaki², Hiroyuki Yaguchi¹, Atsushi Kogo², Masayuki Chikamatsu², Takurou N. Murakami² (1. Saitama Univ., Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan)

[TuP-41-41]

The effect of tin(IV) oxide mixing on the carbon back electrode for multi-porous-layered-electrode perovskite solar cells

Kota Oishi, Ryuki Tsuji, Takaya Shioki, Seigo Ito (Univ. Hyogo, Japan)

[TuP-41-42]

Fabrication of inverted planar perovskite solar cells using the iodine/ethanol solution method for copper iodide as a hole transport layer

Belal Mahdy, Masao Isomura, Tetsuya Kaneko (Tokai Univ., Japan)

[TuP-41-43]

Defect-free two-dimensional Ruddlesden Popper perovskite films

Jonathan Quoc-Nam Bui, Yian-Tai (National Taiwan Univ. Science and Technology, Taiwan)

[TuP-41-44]

Conversion efficiency improvement of perovskite solar cells using ZnO nanoparticles-modified electron transport layers

Xiaoci Xiong, Weijie Du, Yiwen Zhang (Shanghai Normal Univ., China)

[TuP-41-45]

Passivation effects of PCBM on inverted planar MAPbI_3 perovskite solar cells fabricated by vapor-phase process

Satoru Seto (National Inst. Technology, Ishikawa College, Japan)

[TuP-41-46]

Composition-property mapping in bromide-containing tin perovskite using high purity starting materials

Tomoya Nakamura, Kento Otsuka, Shuaifeng Hu, Ruito Hashimoto, Tarou Morishita, Taketo Handa, Takumi Yamada, Minh Anh Truong, Richard Murdey, Yoshihiko Kanemitsu, Atsushi Wakamiya

(Kyoto Univ., Japan)

[TuP-41-47]

Analysis of PL peak shift after Au evaporation in perovskite solar cells

Yulu He^{1,2}, Muhammad Monirul Islam¹, Hamidou Tangara¹, Ashraful Islam², Takeaki Sakurai¹ (1. Univ. Tsukuba, Japan, 2. National Inst. Materials Science, Japan)

[TuP-41-48]

Electron-phonon interaction and Fröhlich polaron diffusion of perovskite materials for photovoltaics

Koichi Yamashita, Masanori Kaneko (Yokohama City Univ., Japan)

[TuP-41-49]

Analyses of *I-V* curve hysteresis in perovskite solar cells using circuit simulator

Takayuki Negami, Kousei Sawaki, Abdurashid Mavlonov, Yu Kawano, Yoshihiro Hishikawa, Takashi Minemoto (Ritsumeikan Univ., Japan)

[TuP-41-50]

Operando ESR study on charge transfer mechanism at the interface of tin-based perovskite solar cells with mixed spacer cations

Yizhou Chen, Seira Yamaguchi, Atsushi Sato, Dong Xue, Kazuhiro Marumoto (Univ. Tsukuba, Japan)

[TuP-41-51]

The impacts of grain size variation, distribution, and recombination losses in halide perovskites: From thin-film model to solar cells

Gede W.P. Adhyaksa (Univ. Pertamina, Indonesia)

[TuP-41-52]

Slow shallow energy states as the origin of hysteresis in perovskite solar cells

Paul Procel, Rik van Heerden, Luana Mazzarella, Rudi Santbergen, Olindo Isabella (Delft Univ. Technology, The Netherlands)

[TuP-41-53]

Theoretical verification of photovoltaics; amorphous silicon photovoltaics (a-Si), and cadmium telluride photovoltaics (CdTe), gallium arsenide photovoltaics (GaAs), and perovskite solar cells

Shozo Yanagida¹, Masatoshi Yanagida², Susumu Yanagisawa³, Hiroshi Segawa⁴ (1. Osaka Univ., Japan, 2. National Inst. Materials Science, Japan, 3. Univ. Ryukyus, Japan, 4. Univ. Tokyo, Japan)

[TuP-41-54]

Light generated charge carrier dynamics of metal halide perovskite

Yasuhiro Tachibana^{1,2} (1. RMIT Univ., Australia, 2. Osaka Univ., Japan)

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

Sub-area 4-1: Perovskite photovoltaics and related technologies

[TuO-41d] Large Area/Fabrication/Processes

Session Chair: Masashi Ikegami (Toin Univ. Yokohama, Japan)

Tue. Nov 15, 2022 3:30 PM - 5:00 PM Shirotori Hall (Bldg. 4, 1F)

[TuO-41d-01] 3:30 PM – 4:00 PM

(INVITED) Highly efficient large-area perovskite solar cells using modified new electron transfer layer

Dong Suk Kim (Ulsan National Inst. Science and Technology, Korea)

[TuO-41d-02] 4:00 PM – 4:15 PM

Strategies to manipulate AVT and PCE in wide bandgap perovskite solar cells for BIPV

Diego Di Girolamo¹, Jessica Barichello¹, Francesco Di Giacomo¹, Fabio Matteocci¹, Aldo Di Carlo^{1,2}
(1. Univ. Rome Tor Vergata, Italy, 2. National Research Council, Italy)

[TuO-41d-03] 4:15 PM – 4:30 PM

Photovoltaic modules specifically designed to drive artificial photosynthetic reactors

Yasuhiko Takeda, Ken-ichi Yamanaka, Takeshi Morikawa, Naohiko Kato (Toyota Central R&D Labs., Inc., Japan)

[TuO-41d-04] 4:30 PM – 4:45 PM

Understanding drying processes in perovskite solution films for establishing scalable dynamic printing of homogeneous perovskite thin-films with tilted slot-jet gas quenching

Simon Ternes, Philip Scharfer, Wilhelm Schabel, Bryce S. Richards, Ulrich W. Paetzold (Karlsruhe Inst. Technology, Germany)

[TuO-41d-05] 4:45 PM – 5:00 PM

Tin perovskite solar cells with over 10% efficiency and 1 cm² size enabled by the two step deposition method

Xiao Liu¹, Takeru Bessho¹, Liyuan Han^{1,2}, Hiroshi Segawa¹ (1. Univ. Tokyo, Japan, 2 Shanghai Jiao Tong Univ., China)

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

Sub-area 4-1: Perovskite photovoltaics and related technologies

[TuO-41e] High Performance Related Topics

Session Chair: Seigo Ito (Univ. Hyogo, Japan)

Tue. Nov 15, 2022 5:30 PM - 7:00 PM Shirotori Hall (Bldg. 4, 1F)

[TuO-41e-01] 5:30 PM – 5:45 PM

Reliable performance testing of single-junction and tandem perovskite cells and modules

Nikos Kopidakis, Tao Song, Dan Friedman, Rafell Williams, Charles Mack, Jeremy Brewer, Josh Gallon, Allan Anderberg, Larry Ottoson (National Renewable Energy Lab., USA)

[TuO-41e-02] 5:45 PM – 6:00 PM

Evaluation of hysteresis behavior in perovskite solar cells in comparison with solar technologies

Satoshi Uchida¹, Masumi Saito¹, Ludmila Cojocar², Piyankarage Viraj Vishwakantha Jayaweera³, Shoji Kaneko³, Hiroshi Segawa¹ (1. Univ. Tokyo, Japan, 2. Univ. Bordeaux, France, 3. SPD Lab., Inc., Japan)

[TuO-41e-03] 6:00 PM – 6:15 PM

Impact of terminal configuration on silver and indium consumption for terawatt scale perovskite/Si tandem solar cell production

Li Wang, Yuchao Zhang, Moonyong Kim, Brett Hallam (Univ. New South Wales, Australia)

[TuO-41e-04] 6:15 PM – 6:30 PM

Efficient monolithic perovskite/perovskite/Si triple-junction tandem solar cells

Jianghui Zheng^{1,2}, Guoliang Wang¹, Anita Ho-Baillie^{1,2} (1. Univ. Sydney, Australia, 2. Univ. New South Wales, Australia)

[TuO-41e-05] 6:30 PM – 6:45 PM

Compositional and interfacial engineering for improved efficiency in wide bandgap tin perovskite solar cells

SungWon Cho, Padmini Pandey, Saemon Yoon, Jun Ryu, Dong-Gun Lee, Dong-Won Kang (Chung-Ang University, Korea)

[TuO-41e-06] 6:45 PM – 7:00 PM

Structure stability and optical properties of tin-based iodide perovskite

Satoshi Iikubo¹, Atsuko Ide², Kumiko Yamamoto², Qing Wang¹, Qing Shen³, Kenji Yoshino⁴, Takashi Minemoto⁵, Shuzi Hayase³ (1. Kyushu Univ., Japan, 2. Kyushu Inst. Technology, Japan, 3. Univ. Electro-Communications, Japan, 4. Univ. Miyazaki, Japan, 5. Ritsumeikan Univ., Japan)

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

Sub-area 4-1: Perovskite photovoltaics and related technologies

[WeP-41] Perovskite Photovoltaics and Related Topics

Wed. Nov 16, 2022 12:00 PM - 3:00 PM P-41/Event Hall (Bldg. 1, 1F)

[WeP-41-01]

Synthesis and properties of methylammonium bismuth iodide thin films via space-confined crystallization

Taito Kato, Shinya Kato, Naoki Kishi, Tetsuo Soga (Nagoya Inst. Technology, Japan)

[WeP-41-02]

Manipulate energy transport via fluorinated spacers towards record efficiency 2D Dion-Jacobson CsPbI₃ solar cells

Yutian Lei, Zhenhua Li, Haoxu Wang, Zhiwen Jin (Lanzhou Univ., China)

[WeP-41-03]

Enhanced efficiency and stability of quasi-2D/3D perovskite solar cells by blade coating method

Kun-Mu Lee^{1,2}, Seoungjun Ahn, Ming-Chung Wu^{1,2} (1. Chang Gung Univ., Taiwan, 2. Chang Gung Memorial Hospital, Taiwan)

[WeP-41-04]

Understanding drying processes in perovskite solution films for establishing scalable dynamic printing of homogeneous perovskite thin-films with tilted slot-jet gas quenching

Simon Ternes, Philip Scharfer, Wilhelm Schabel, Bryce S. Richards, Ulrich W. Paetzold (Karlsruhe Inst. Technology, Germany)

[WeP-41-05]

Enhancement of charge carrier extraction with CH₃NH₃PbI₃: NiO NPs composite for efficient carbon-based perovskite solar cells

R. Isaac Daniel, N. Santhosh, K. R. Acchutharaman, B. Vasanth, R. Govindaraj, M. Senthil Pandian, P. Ramasamy (Sri Sivasubramaniya Nadar College of Engineering, India)

[WeP-41-06]

Improved optoelectronic properties of rutile TiO₂ through strontium doping for the application in perovskite solar cells

K. R. Acchutharaman, N. Santhosh, R. Isaac Daniel, N. Balagowtham, M. Senthil Pandian, P. Ramasamy (Sri Sivasubramaniya Nadar College of Engineering, India)

[WeP-41-07]

Orientation control of two-dimensional perovskite (CH₃(CH₂)₃NH₃)₂(CH₃NH₃)_{n-1}Pb_nI_{3n+1}

(n=2) thin films by thermal annealing

Yuya Futamura, Fumiya Sano, Haruki Yasuda, Shoichiro Hino, Yasushi Sobajima, Norimitsu Yoshida (Gifu Univ., Japan)

[WeP-41-08]

Computational screening of Cs based vacancy-ordered double perovskites for optoelectronic applications

Xinyu Ye¹, Anmin Liu², Yue Zhao¹, Jiaying Zhang¹, Tingli Ma^{1,3}, (1. Kyushu Inst. Technology, Japan, 2. Dalian Univ. Technology, China, 3. China Jiliang Univ., China)

[WeP-41-09]

Crystallographic analysis on copper (I) iodide as hole transporting layer at low-temperature condition

Omsri Vinasha Aliyasevram¹, Faiz Arith¹, Puvaneswaran Chelvanathan², Nowshad Amin³ (1. Univ. Teknikal Malaysia Melaka, Malaysia, 2. Univ. Kebangsaan Malaysia, Malaysia, 3. Univ. Tenaga Nasional, Malaysia)

[WeP-41-10]

Stabilization of FAPbI₃ films using formamide based additive

Itaru Raifuku^{1,2}, Yu-Hsien Chiang², Cheng-Hung Hou³, Ming-Hsien Li^{2,4}, Chen-Fu Lin², Pei-Ying Lin², Jing-Jong Shyue³, Peter Chen^{2,5} (1. Nara Inst. Science and Technology, Japan, 2. National Cheng Kung Univ., Taiwan, 3. Academia Sinica, Taiwan, 4. National Chi Nan Univ., Taiwan, 5. Hi-GEM Research Center, Taiwan)

[WeP-41-11]

Solvent and antisolvent co-engineering to enhance the stability of MAPbI₃-based perovskite solar cells fabricated in air ambient

Abdurashid Mavlonov, Yu Kawano, Jakapan Chantana, Yoshihiro Hishikawa, Takayuki Negami, Takashi Minemoto (Ritsumeikan Univ., Japan)

[WeP-41-12]

Neutron irradiation resistance of perovskite solar cells

Yasuki Okuno¹, Tomohiro Kobayashi², Mitsuru Imaizumi³ (1. Kyoto Univ., Japan, 2. RIKEN, Japan, 3. Japan Aerospace Exploration Agency, Japan)

[WeP-41-13]

Effect of SiN_x gas barrier films on the protection of perovskite layers

Wenbo Cao¹, Peng Liu², Huynh Thi Cam Tu¹, Md. Shahiduzzaman², Tetsuya Taima², Keisuke Ohdaira¹ (1. Japan Advanced Inst. Science and Technology, Japan, 2. Kanazawa Univ., Japan)

[WeP-41-14]

Improving efficiency and stability of wide-bandgap perovskite solar cells through PEABF₄ passivation layer

Jaehyuk Koh, Byungha Shin (Korea Advanced Inst. Science and Technology, Korea)

[WeP-41-15]

The mechanisms of the light-induced degradation of perovskite solar cells

Hiroataka Sano, Kohei Fujita, Yayoi Nemoto, Ryo Sato, Tomofumi Honjo and Yasuhiro Matsubara (Kyocera Corp., Japan)

[WeP-41-16]

Sonochemically synthesized MAPbI₃ microcrystals for efficient and economic carbon based perovskite solar cells

N. Balagowtham, K. R. Accutharaman, N. Santhosh, Muthu Senthil Pandian, P. Ramasamy (Sri Sivasubramaniya Nadar College of Engineering, India)

[WeP-41-17]

Effects of mechanical bending strength on flexible perovskite solar cells

Nuth Sophal, Tetsuya Kaneko, Tetsuhiro Katsumata, Koji Tomita, Masao Isomura (Tokai Univ., Japan)

[WeP-41-18]

Elemental distribution of organometal halide perovskite photo absorber in perovskite solar cell

Kei Ito, Takeru Bessho, Miwako Furue, Ryota Kan, Keishi Tada, Jotaro Nakazaki, Hiroshi Segawa (Univ. Tokyo, Japan)

[WeP-41-19]

Investigation of electroluminescence image capturing conditions for perovskite solar cells toward on-site evaluation technology

Masaya Hamada, Ryo Washiashi, Yasuaki Ishikawa (Aoyama Gakuin Univ., Japan)

[WeP-41-20]

Influence of electroluminescence measurement on the characteristics of perovskite solar cells

Ryo Washiashi, Tomoki Shinada, Masaya Hamada, Yasuaki Ishikawa (Aoyama Gakuin Univ., Japan)

[WeP-41-21]

Maximum power point tracking (MPPT) integrated PV power analyzing system for overcome evaluation challenges of perovskite solar cells

Viraj Piyankarage¹, Shoji Kaneko¹, Ludmila Cojocar², Satoshi Uchida³, Hiroshi Segawa³ (1. SPD Lab, Inc., Japan, 2. Univ. Bordeaux, France, 3. Univ. Tokyo, Japan)

[WeP-41-22]

First-principles calculation analysis and photovoltaic properties of copper compound-

added perovskite solar cells

Riku Okumura¹, Takeo Oku¹, Atsushi Suzuki¹, Masanobu Okita², Sakiko Fukunishi², Tomoharu Tachikawa², Tomoya Hasegawa² (1. Univ. Shiga Prefecture, Japan, 2. Osaka Gas Chemicals Co., Ltd., Japan)

[WeP-41-23]

The effect of chloride atoms induced to the formation of organometal halide perovskite intermediate phase crystal

Saemi Takahashi^{1,2}, Satoshi Uchida², Abhijit Chatterjee³, Takumi Kinoshita², Hiroshi Segawa^{1,2} (1. Research Association for Technology Innovation of Organic Photovoltaics, Japan, 2. Univ. Tokyo, Japan, 3. Dassault Systèmes K.K., Japan)

[WeP-41-24]

Degradation mechanism of halide perovskite crystals due to exposure to light and humidity

Kazuma Sakaki¹, Nao Saito¹, Naoyuki Shibayama¹, Yuiga Nakamura², Masashi Ikegami¹, Tsutomu Miyasaka¹ (1. Toin Univ. Yokohama, Japan, 2. Japan Synchrotron Radiation Research Inst./SPring-8, Japan)

[WeP-41-25]

Observation of halide perovskite crystal growth process by *in situ* heating WAXS measurements

Nao Saito¹, Kazuma Sakaki¹, Naoyuki Shibayama¹, Yuiga Nakamura², Masashi Ikegami¹, Tsutomu Miyasaka¹ (1. Toin Univ. Yokohama, Japan, 2. Japan Synchrotron Radiation Research Inst./SPring-8, Japan)

[WeP-41-26]

In situ infrared MAIRS study of GASnI_3 formation from vacuum-deposited GAI and SnI_2 bi-layer thin films

Kazuki Shimada¹, Shingo Maruyama¹, Tetsuhiko Miyadera², Kenichi Kaminaga¹, Yuji Matsumoto¹ (1. Tohoku Univ., Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan)

[WeP-41-27]

Characterization of carrier and thermal transport properties of $\text{CH}_3\text{NH}_3\text{PbX}_3$ (X=Br, I) single crystals using photoacoustic technique

Ding Liu¹, Hua Li¹, Yusheng Li¹, Chao Ding¹, Taro Toyoda¹, Koji Miyazaki², Shuzi Hayase¹, Qing Shen¹ (1. Univ. Electro-Communications, Japan, 2. Kyushu Inst. Technology, Japan)

[WeP-41-28]

Role of monovalent cation in the dielectric relaxation processes and correlation of defects with the thermal stability of hybrid metal halide perovskite solar cells

Kashimul Hossain, Shivam Singh, Dinesh Kabra (Indian Inst. Technology, India)

[WeP-41-29]

Fabrication of perovskite/CI(G)S tandem solar cells by the integration of bottom and top cell processes

SeongYeon Kim, Dong-Hwan Jeon, Soo-Kwan Kim, Jaebaek Lee, Hyo Jeong Jo, Van Quy Hoang, Si-Nae Park, Dae-Ho Son, Jongmin Choi, Shi-Joon Sung, Kee-Jeong Yang, Dae-Kue Hwang, Jin-Kyu Kang, Dae-Hwan Kim (Daegu Gyeongbuk Inst. Science and Technology, Korea)

[WeP-41-30]

A study on capacitance generation layers for perovskite devices

Masumi Saito¹, Satoshi Uchida¹, Piyankarage Viraj Vishwakantha Jayaweera², Shoji Kaneko², Hiroshi Segawa¹ (1. Univ. Tokyo, Japan, 2. SPD Lab., Inc., Japan)

[WeP-41-31]

Investigation for defect suppression of high-performance perovskite solar cells via SCAPS simulation

Siliang Cao¹, Muhammad Monirul Islam¹, Shaoqiang Chen², Takeaki Sakurai¹ (1. Univ. Tsukuba, Japan, 2. East China Normal Univ., China)

[WeP-41-32]

Wide bandgap organic-inorganic halide perovskite solar cells for the application of transparent photovoltaic devices

Mijoung Kim, Jaegwan Sin, Gisung Kim, Hyojung Kim, JungYup Yang (Kunsan National Univ., Korea)

[WeP-41-33]

Toward high efficiency perovskite solar cells by doping cesium iodide into Pbl₂ film via two-step deposition method

Seoungjun Ahn¹, Kun-Mu Lee^{1,2}, Wei-Hao Chiu¹ (1. Chang Gung Univ., Taiwan, 2. Chang Gung Memorial Hospital, Taiwan)

[WeP-41-35]

Perovskite solar cells on film with current-collection holes

Ryousuke Ishikawa, Naoki Suyama, Makoto Konagai (Tokyo City Univ., Japan)

[WeP-41-36]

Solvent-additive coordination effect on lead-iodide precursor for enlarging grain size of perovskite film

Sol-i Bae, Hyungwoo Kim, Kwanyong Seo (Ulsan National Inst. Science and Technology, Korea)

[WeP-41-37]

Surface passivation of p-i-n perovskite solar cell with spin coated perovskite/ETL layers

Toshimitsu Mochizuki¹, Shota Araki¹, Hidetaka Takato¹, Katsuto Tanahashi¹, Yutaka Okuyama², Takeshi Sano² (1. National Inst. Advanced Industrial Science and Technology, Japan, 2. Yamagata

Univ., Japan)

[WeP-41-38]

Laser molecular beam deposition of functional materials for halide metal perovskite solar cells

Nobuyuki Matsuki, Tomomasa Sato (Kanagawa Univ., Japan)

[WeP-41-39]

Process insights into scalable perovskite thin-film fabrication using unsupervised machine learning of in situ luminescence data

Felix Laufer¹, Sebastian Ziegler², Fabian Schackmar¹, Edwin A. Moreno Viteri¹, Markus Götz¹, Charlotte Debus¹, Fabian Isensee², Ulrich W. Paetzold¹ (1. Karlsruhe Inst. Technology, Germany, 2. German Cancer Research Center, Germany)

[WeP-41-40]

Lead free perovskite single crystal growth by slow evaporation with an anti-solvent atmosphere

Saritha K. Ratnakaran, Muthu Gomathy M. Pandian, Shanthi Subashchandran, Jوسفل Flora (Anna Univ., India)

[WeP-41-41]

Fabrication of cost-effective carbon electrode-based planar perovskite solar cells

Yang, Hongxia Wang (Queensland Univ. Technology, Australia)

[WeP-41-42]

Enhanced efficiency and stability in Sn-based perovskite solar cells by trimethylsilyl halide surface passivation

Zheng Zhang, Qing Shen, Shuzi Hayase (Univ. Electro-Communications, Japan)

[WeP-41-43]

A review of low-dimensional perovskite and its use for defect passivation

Natalia B. Correa Guerrero^{1,2}, Naoyuki Shibayama², Masashi Ikegami², Tsutomu Miyasaka² (1. Inst. Nanociencia y Nanotecnología, CNEA-CONICET, Argentina, 2. Toin Univ. Yokohama, Japan)

[WeP-41-44]

Degradation kinetics of perovskite solar cells exposed to H₂O or O₂

Said Kazaoui, Ivan Turkevych (National Inst. Advanced Industrial Science and Technology, Japan)

[WeP-41-45]

Factors affecting the stability and efficiency of tin-lead perovskite solar cells

Gaurav Kapil^{1,2}, Takeru Bessho², Qing Shen¹, Hiroshi Segawa², Shuzi Hayase¹ (1. Univ. Electro-communications, Japan, 2. Univ. Tokyo, Japan)

[WeP-41-46]

Effect of vapor sources for atomic layer deposition of SnO₂ on photovoltaic performance of perovskite solar cells

Sang-Uk Lee, Hyunjung Shin, Nam-Gyu Park (Sungkyunkwan Univ., Korea)

[WeP-41-47]

Cat-CVD SiN_x for film encapsulation of mixed cation-halide CsFAMAPbI₃Br perovskite cell structures

Huynh Thi Cam Tu¹, Ai Shimazaki², Ryuji Kaneko², Atsushi Wakamiya², Keisuke Ohdaira¹ (1. Japan Advanced Inst. Science and Technology, Japan, 2. Kyoto Univ., Japan)

[WeP-41-48]

Optimization of the tunnel recombination junction of 2-terminal perovskite/silicon tandems using advanced semiconductor analysis (ASA) simulations

Carlos Ruiz Tobon, Raiyan Shaikh, Paul Procel Moya, Malte Ruben Vogt, Rudi Santbergen, Miro Zeman, Olindo Isabella (Delft Univ. Technology, The Netherlands)

[WeP-41-50]

Effect of solar spectral shape on the ANN performance in the prediction of the output power density of 2-terminal perovskite/silicon tandem solar cells under realistic conditions

Dong C. Nguyen, Yasuaki Ishikawa (Aoyama Gakuin Univ., Japan)

[WeP-41-51]

Low temperature aluminum paste for perovskite/heterojunction tandem solar cell applications

Marwan Dhamrin^{1,2}, Shota Suzuki², Kosuke Tsuji², Hideaki Minamiyama², Kazunori Ishikawa¹ (1. Osaka Univ., Japan, 2. Toyo Aluminium K.K., Japan)

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

Sub-area 4-1: Perovskite photovoltaics and related technologies

[WeO-41g] Green Innovation Special Session

Session Chairs: Takaya Kubo (Univ. Tokyo, Japan), Takayuki Negami (Ritsumeikan Univ., Japan)

Wed. Nov 16, 2022 3:30 PM - 5:30 PM Shirotori Hall (Bldg. 4, 1F)

[WeO-41g-01] 3:30 PM – 4:10 PM

(INVITED) Materials and interfaces engineering for perovskite solar cells

Takuro N. Murakami (National Inst. Advanced Industrial Science and Technology, Japan)

[WeO-41g-02] 4:10 PM – 4:50 PM

(INVITED) Materials chemistry for commercialization of perovskite photovoltaics

Atsushi Wakamiya^{1,2} (1. Kyoto Univ., Japan, 2. EneCoat Technologies, Co. Ltd., Japan)

[WeO-41g-03] 4:50 PM – 5:30 PM

(INVITED) Materials and process development for efficient module perovskite solar cells toward commercialization

Takeru Bessho, Hiroshi Segawa (Univ. Tokyo, Japan)

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

Sub-area 4-1: Perovskite photovoltaics and related technologies

[ThO-41h] New Materials and Stability

Session Chair: Atsushi Wakamiya (Kyoto Univ., Japan)

Wed. Nov 17, 2022 8:30 AM - 10:00 AM Shirotori Hall (Bldg. 4, 1F)

[ThO-41h-01] 8:30 AM – 9:00 AM

(INVITED) Flexible perovskite solar cells for power sources in a low carbon society

Senol Öz, David Forgacs, Cristina Teixeira (Saule Technologies, Poland)

[ThO-41h-02] 9:00 AM – 9:15 AM

Synthesis and characterization of manganese-doped organic metal halide perovskite thin films

Kosei Tsutsumi, Hytham Elbohy, Amr Elattar, Hiroo Suzuki, Takeshi Nisikawa, Yasuhiko Hayashi (Okayama Univ., Japan)

[ThO-41h-03] 9:15 AM – 9:30 AM

Sn-based perovskite solar cells with inorganic contact layer

Liang Wang, Qing Shen, Shuzi Hayase (Univ. Electro-Communications, Japan)

[ThO-41h-04] 9:30 AM – 9:45 AM

Operational stability and low light performance of wide-bandgap perovskite solar cells

Richard Murdey, Minh Anh Truong, Ai Shimazaki, Ryuji Kaneko, Tomoya Nakamura, Atsushi Wakamiya (Kyoto Univ., Japan)

[ThO-41h-05] 9:45 AM – 10:00 AM

Interface modification with a novel multifunctional dynamically cross-linked polyurethanepolymer for highly efficient and stable FAPbI₃ based solar cell

Mei Lyu, Henda Yao, Jun Zhu (Hefei Univ. Technology, China)

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

Sub-area 4-1: Perovskite photovoltaics and related technologies

[ThO-41j] Stability and Related Topics

Session Chair: Takurou N. Murakami (National Inst. Advanced Industrial Science and Technology, Japan)

Wed. Nov 17, 2022 10:30 AM - 12:00 PM Shirotori Hall (Bldg. 4, 1F)

[ThO-41j-01] 10:30 AM – 10:45 AM

Thermal stability improvement in tin-lead perovskite solar cells realized via doping engineering

Shahrir Razey Sahamir, Qing Shen, Shuzi Hayase (Univ. Electro-Communications, Japan)

[ThO-41j-02] 10:45 AM- 11:00 AM

Attenuating defects for efficient and stable tin-based perovskite solar cells with hydrazide functional additives

Dhruba B. Khadka, Yasuhiro Shirai, Masatoshi Yanagida, Kenjiro Miyano (National Inst. Materials Sciences, Japan)

[ThO-41j-03] 11:00 AM – 11:15 AM

Understanding the charge dynamics and degradation processes in 2D/3D n-i-p structured perovskite solar cells using electrochemical impedance spectroscopy

Zubair Ahmad (Qatar Univ., Qatar)

[ThO-41j-04] 11:15 AM – 11:30 AM

Analysis of charge states and device degradation mechanisms in PEA-containing tin perovskite solar cells

Atsushi Sato¹, Seira Yamaguchi¹, Mayu Motohashi¹, Yihuang Wang¹, Tomoya Nakamura², Atsushi Wakamiya², Kazuhiro Marumoto¹ (1. Univ. Tsukuba, Japan, 2. Kyoto Univ., Japan)

[ThO-41j-05] 11:30 AM – 11:45 AM

Passivation of CsPbIBr₂ for the fabrication of a stable and efficient carbon-based inorganic perovskite solar cell

Akanksha Choubey, Nagapandiselvi Perumal, Senthil Pandian Muthu, Ramasamy Perumalsamy (Sri Sivasubramaniya Nadar College of Engineering, India)

[ThO-41j-06] 11:45 AM – 12:00 PM

Estimation of thermal budget during the lamination process for perovskite solar cells

Atsushi Masuda¹, Taeko Semba¹, Liangle Wang², Md. Shahiduzzaman², Tetsuya Taima² (1. Niigata Univ., Japan, 2. Kanazawa Univ., Japan)

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

Sub-area 4-2: Emerging materials and game-change technologies

[MoO-42a] Quantum Dot Solar Cells

Session Chairs: Joseph M. Luther (National Renewable Energy Lab., USA), Qing Shen (Univ. Electro-Communications, Japan)

Mon. Nov 14, 2022 8:30 AM - 10:00 AM 431 (Bldg. 4, 3F)

[MoO-42a-01] 8:30 AM – 9:00 AM

(INVITED) Bulk photovoltaic effect of two-dimensional materials in polar structure

Yijin Zhang (Univ. Tokyo, Japan)

[MoO-42a-02] 9:00 AM – 9:15 AM

High-efficiency quantum dot-sensitized solar cells by QD secondary deposition

Zhenxiao Pan, Xinhua Zhong (South China Agricultural Univ., China)

[MoO-42a-03] 9:15 AM – 9:30 AM

Reducing the trapping states of both electrons and hole in PbS quantum-dot solar cells with an efficient double passivation strategy

Chao Ding¹, Shuzi Hayase¹, Taizo Masuda^{1,2}, Qing Shen¹ (1, Univ, Electro-Communications, Japan, 2. Toyota Motor Corp., Japan)

[MoO-42a-04] 9:30 AM – 9:45 AM

Direct synthesis of lead chalcogenide (PbX, X=S, Se) quantum dot inks and photovoltaic applications

Zeke Liu, Yangliu, Wanli Ma (Soochow Univ., China)

[MoO-42a-05] 9:45 AM – 10:00 AM

High-performance quantum junction solar cells

Xintong Zhang, Yinglin Wang, Lei Wang, Xinlu Liu, Yuwen Jia, Yichun Liu (Northeast Normal Univ., China)

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

Sub-area 4-2: Emerging materials and game-change technologies

[MoO-42b] Hot Carrier and Emerging Concepts

Session Chairs: Takaya Kubo (Univ. Tokyo, Japan), Qing Shen (Univ. Electro-Communications, Japan)

Mon. Nov 14, 2022 10:30 AM - 12:00 PM 431 (Bldg. 4, 3F)

[MoO-42b-01] 10:30 AM – 11:00 AM

(INVITED) Thermodynamics of emerging photovoltaic concepts

Andreas Pusch, Nicholas J. Ekins-Daukes (Univ. New South Wales, Australia)

[MoO-42b-02] 11:00 AM – 11:15 AM

Valley photonics: A new approach towards the hot carrier solar cell

Kyle R. Dorman¹, Hamidreza Esmailpour¹, David K. Ferry², Vincent R. Whiteside¹, Jinfeng Tang¹, Tetsuya D. Mishima¹, Michael B. Santos¹, Ian R. Sellers¹ (1. Univ. Oklahoma, USA, 2. Arizona State Univ., USA)

[MoO-42b-03] 11:15 AM – 11:30 AM

Discovering ultrafast exciton transport based on delocalization in quantum dot solids

Zhilong Zhang, Jooyoung Sung, Akshay Rao (Univ. Cambridge, UK)

[MoO-42b-04] 11:30 AM – 11:45 AM

Effects of impact-Auger on hot-carrier photocatalysis for artificial photosynthesis

Yasuhiko Takeda, Shunsuke Sato, Takeshi Morikawa (Toyota Central R&D Labs., Inc., Japan)

[MoO-42b-05] 11:45 AM – 12:00 PM

Colloidal nanocrystals of hybrid perovskite semiconductors for optoelectronic and photovoltaic applications

Joseph M. Luther (National Renewable Energy Lab., USA)

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

Sub-area 4-2: Emerging materials and game-change technologies

[TuP-42] New Concepts, Nanostructure, and Emerging Materials

Tue. Nov 15, 2022 12:00 PM - 3:00 PM P-42/Event Hall (Bldg. 1, 1F)

[TuP-42-01]

Effect of Cl-doping in ZnCdTeO on photovoltaic properties of ZnCdTeO intermediate band solar cells

Daiki Tani, Katsuhiko Saito, Qixin Guo, Tooru Tanaka (Saga Univ., Japan)

[TuP-42-02]

Photocurrent enhancement by below bandgap excitation in GaPN

Abdul Qayoom, Sanjida Ferdous, Shuhei Yagi, Hiroyuki Yaguchi (Saitama Univ., Japan)

[TuP-42-03]

The effect of MBE alternating growth of phosphorus-doped ZnTe thin films

Muhamad Mustofa, Katsuhiko Saito, Qixin Guo, Tooru Tanaka (Saga Univ., Japan)

[TuP-42-04]

Optical characterization of wire-on-well structure by photoreflectance measurements

Shintaro Komaba¹, Naoki Yamamoto¹, Masakazu Sugiyama², Tetsuo Ikari¹, Atsuhiko Fukuyama¹
(1. Univ. Miyazaki, Japan, 2. Univ. Tokyo, Japan)

[TuP-42-05]

Effect of local strains on carrier transport properties of InGaAs/GaAsP superlattice solar cell structures with a different phosphorus composition

Naoki Yamamoto¹, Tetsuo Ikari¹, Shintaro Komaba¹, Masakazu Sugiyama², Atsuhiko Fukuyama¹
(1. Univ. Miyazaki, Japan, 2. Univ. Tokyo, Japan)

[TuP-42-06]

Effects of thick luminescent down-shifting layers with ZnSe/ZnS:Mn/ZnS nanoparticles on Si solar cells

Yuki Idutsu¹, Keigo Awai², Jianbo Liang^{1,2}, H. Nishimura², DaeGwi Kim¹, Yong-Gu Shim¹, Naoteru Shigekawa^{1,2} (1. Osaka Metropolitan Univ., Japan, 2. Osaka City Univ., Japan)

[TuP-42-07]

Inorganic lead halide perovskite nanocrystals for quantum cutting Si solar cell application: Effect of anion exchange on PLQY

Tomoya Yamada¹, Hyunju Lee^{1,2}, Yoshio Ohshita¹, Nobuaki Kojima¹ (1. Toyota Technological Inst., Japan, 2. Meiji Univ., Japan)

[TuP-42-08]

Planar and cylindrical waveguide-based 2D-photorecepto-conversion scheme (2DPRCS)

Akira Ishibashi, Nobuo Sawamura, Yubo Wang, Naoto Kato (Hokkaido Univ., Japan)

[TuP-42-09]

Photovoltaic properties of few-layer $WS_{0.3}Se_{1.7}/WO_x$ lateral p^+-n junctions using gold mirror layer

Abdul Kuddus, Md Faruk Hossain, Kojun Yokoyama, Keiji Ueno, Hajime Shirai (Saitama Univ., Japan)

[TuP-42-10]

Synthesis of multilayer two-dimensional group-IV flakes and nanosheets

Masashi Kurosawa¹, Mai Itoh¹, Yoshitsune Ito¹, Kazuya Okada¹, Akio Ohta¹, Masaaki Araidai¹, Kosuke O. Hara², Yuichiro Ando³, Shigeru Yamada⁴, Shigehisa Shibayama¹, Mitsuo Sakashita¹, Osamu Nakatsuka¹ (1. Nagoya Univ., Japan, 2. Univ. Yamanashi, Japan, 3. Kyoto Univ., Japan, 4. Gifu Univ., Japan)

[TuP-42-11]

Carrier density control of $CrSi_2$ partially substituted with Mn

Kaichi Tasaki, Kei Hayashi, Yuzuru Miyazaki (Tohoku Univ., Japan)

[TuP-42-12]

Effect of nitrogen partial pressure on properties of Cu_3N thin films by RF magnetron sputtering

Miho Ohishi, Katsuhiko Saito, Qixin Guo, Tooru Tanaka (Saga Univ., Japan)

[TuP-42-13]

Preparation of $(Mn,Fe,V)Si_y$ single crystals for infrared absorption optoelectronics

Toshiaki Chiba, Kei Hayashi, Yuzuru Miyazaki (Tohoku Univ., Japan)

[TuP-42-14]

Inorganic or/and organic passivation on ZnO NWs to enhance the efficiency of quantum dot/ZnO NW heterojunction solar cells

Yuyao Wei, Chao Ding, Mako Nakamura, Shuzi Hayase, Qing Shen (Univ. Electro-Communications, Japan)

[TuP-42-15]

Modulated dipole near-field to achieve broadband SiNW design for translucent solar cells

Zhongliang Gao^{1,2}, Qi Geng¹, Zhe Wang¹, Meicheng Li¹ (1. North China Electric Power Univ., China, 2. Shandong Univ. Technology, China)

[TuP-42-16]

Investigation of defects in Si/SiO₂ multilayer films by electron spin resonance
Shigeru Yamada, Yuki Nishi, Yuto Ebata, Naoki Matsuo, Takashi Itoh (Gifu Univ., Japan)

[TuP-42-17]

Thin film synthesis and characterizations of Type II SiGe alloyed clathrates
Shiori Kurita¹, Ryo Noguchi¹, Rahul Kumar², Tun Naing Aye¹, Fumitaka Ohashi¹, Himanshu S. Jha¹,
Tetsuji Kume¹ (1. Gifu Univ., Japan, 2. National Inst. Technology, Gifu College, Japan)

[TuP-42-18]

Verification of Sn position in Sn-doped Si,Ge thin film solar cell materials by X-ray
fluorescence holography

Shota Hoshi¹, Tomoya Kanno¹, Motoki Takano¹, Widyanisa Keiko¹, Youdai Kobayashi¹, Yuka
Tomimatu¹, Koji Kimura², Naohisa Happo³, Shota Suzuki⁴, Marwan Dhamrin^{4,5}, Keisuke Fukuda⁶,
Satoru Miyamoto⁶, Noritaka Usami⁶, Koichi Hayashi², Kenji Ohyama¹ (1. Ibaraki Univ., Japan, 2.
Nagoya Inst. Technology, Japan, 3. Hiroshima City Univ., Japan, 4. Toyo Aluminium K.K., Japan, 5.
Osaka Univ., Japan, 6. Nagoya Univ., Japan)

[TuP-42-19]

Development of novel crystal growth method for silicon clathrate

Haruhiko Morito¹, Suguru Iwasaki², Masaya Fujioka², Kozo Fujiwara¹ (1. Tohoku Univ., Japan, 2.
Hokkaido Univ., Japan)

[TuP-42-20]

Fabrication of pn junction by doping into a nano-crystalline Si paste made from poly-Si
raw material

Lusato Mashaka Majula, Matsuo Seiya, Rajshree Rajkumari, Yoshimine Kato (Kyushu Univ.,
Japan)

[TuP-42-21]

Solution-processed heavy pnictogen chalcogenide films for lead-free solar cell
applications

Yong Chan Choi, Kang-Won Jung (Daegu Gyeongbuk Inst. Science and Technology, Korea)

[TuP-42-22]

Research on synthesis and properties of stable perovskite materials for WLED

Yongge Yang, Chao Ding, Shuzi Hayase, Qing Shen (Univ. Electro-Communications, Japan)

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

Sub-area 4-2: Emerging materials and game-change technologies

[TuO-42c] Quantum Well Solar Cells and Emerging Technologies

Session Chairs: Tooru Tanaka (Saga Univ., Japan), Kentaroh Watanabe (Univ. Tokyo, Japan)

Tue. Nov 15, 2022 3:30 PM - 5:00 PM 431 (Bldg. 4, 3F)

[TuO-42c-01] 3:30 PM – 3:45 PM

The quantum well solar cell – The concept to record efficiency

Nicholas Ekins-Daukes (Univ. New South Wales, Australia)

[TuO-42c-02] 3:45 PM – 4:00 PM

Dilute nitride based MQWs with strain compensation for 1.0 eV subcells

Naoya Miyashita^{1,2}, Yusuke Oteki¹, Nazmul Ahsan¹, Tomah Sogabe², Koichi Yamaguchi², Yoshitaka Okada¹ (1. Univ. Tokyo, Japan, 2. Univ. Electro-Communications, Japan)

[TuO-42c-03] 4:00 PM – 4:15 PM

Broadband enhancement of intraband transition in two-step photon up-conversion solar cells with a doubled-heterointerface structure

Hambalee Mahamu, Shigeo Asahi, Takashi Kita (Kobe Univ., Japan)

[TuO-42c-04] 4:15 PM – 4:30 PM

Effects of carrier blocking barrier height on two-step photocurrent generation in dilute nitride intermediate band solar cells

Shuhei Yagi¹, Shun Numata¹, Yasushi Shoji^{2,3}, Yoshitaka Okada², Hiroyuki Yaguchi¹ (1. Saitama Univ., Japan, 2. Univ. Tokyo, Japan, 3. National Inst. Advanced Industrial Science and Technology, Japan)

[TuO-42c-05] 4:30 PM - 4:45 PM

Inverse design of perovskite/PbS quantum dot intermediate band solar cells

Kodai Shiba^{1,2}, Koichi Yamaguchi¹, Qing Shen¹, Shuzi Hayase¹, Yoshitaka Okada³, Tomah Sogabe^{1,2,3} (1. Univ. Electro-Communications, Japan, 2. Grid Inc., Japan, 3. Univ. Tokyo, Japan)

[TuO-42c-06] 4:45 PM – 5:00 PM

Enhanced infrared photocurrent of PbS quantum dot / ZnO nanowire solar cell with double-layered mixture structure

Haibin Wang¹, Takashi Koida², Takaya Kubo¹, Jotaro Nakazaki¹, Hiroshi Segawa¹ (1. Univ. Tokyo, Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan)

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

Sub-area 4-2: Emerging materials and game-change technologies

[TuO-42d] Novel Conversion Mechanisms and Materials

Session Chairs: Tomah Sogabe (Univ. Electro-Communications, Japan), Naoya Miyashita (Univ. Electro-Communications, Japan)

Tue. Nov 15, 2022 5:30 PM - 7:00 PM 431 (Bldg. 4, 3F)

[TuO-42d-01] 5:30 PM – 6:00 PM

(INVITED) Perovskite quantum dots for solar cells and beyond

Lianzhou Wang (Univ. Queensland, Australia)

[TuO-42d-02] 6:00 PM – 6:15 PM

New non-toxic, stable and scalable semiconducting materials for silicon tandem solar cells

Robert J. Patterson, Xiaojing Hao, Martin Green (Univ. New South Wales, Australia)

[TuO-42d-03] 6:15 PM – 6:30 PM

Emerging 1D SbSeI and SbSeBr micro-columnar absorbers for photovoltaic applications

Ivan Cano¹, Simon Bosseguí², Sergio Giraldo¹, Alejandro Navarro¹, Xavier Alcobé³, Joaquim Puigdollers¹, Edgardo Saucedo¹ (1. Univ. Politècnica de Catalunya, Spain, 2. EPF, Montpellier, France, 3. Univ. Barcelona, Spain)

[TuO-42d-04] 6:30 PM – 6:45 PM

Universal lossless coupling formula for 2-terminal PVTE hybrids: Theory and experiments

Kenji Kamide¹, Jun Sakuma², Toshimitsu Mochizuki¹, Hidetaka Takato¹, Hidefumi Akiyama² (1. National Inst. Advanced Industrial Science and Technology, Japan, 2. Univ. Tokyo, Japan)

[TuO-42d-05] 6:45 PM – 7:00 PM

Surface engineered silicon quantum dots in hybrid perovskite solar cells

Vladimir Svrcek, Calum McDonald, Takuya Matsui (National Inst. Advanced Industrial Science and Technology, Japan)

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

Sub-area 4-2: Emerging materials and game-change technologies

[WeP-42] Quantum Dots and Novel Technologies

Wed. Nov 16, 2022 12:00 PM - 3:00 PM P-42/Event Hall (Bldg. 1, 1F)

[WeP-42-01]

Controlling energy band structure of bismuth-based multinary quantum dots prepared by a solution-phase method and their photoelectrochemical properties

Kazutaka Akiyoshi, Wentao Zhang, Tatsuya Kameyama, Tsukasa Torimoto (Nagoya Univ., Japan)

[WeP-42-02]

Numerical modeling and optimizations of lead sulfide colloidal quantum dot solar cells

Dandan Wang, Chao Ding, Shuzi Hayase¹, Qing Shen (Univ. Electro-Communications, Japan)

[WeP-42-03]

The suppression of trap state via compensating ligand for high-performance PbS quantum dot solar cell

Chao Wang, Yinglin Wang, Xintong Zhang (Northeast Normal Univ., China)

[WeP-42-04]

Analysis of electronic and optical properties and mobility simulation of perovskite ligand passivated PbS quantum dot

Kenta Kumakura¹, Katsuyoshi Sakamoto¹, Qing Shen¹, Naoya Miyashita¹, Tomah Sogabe^{1,2,3} (1. Univ. Electron-Communication, Japan, 2. Grid Inc., Japan, 3. Univ. Tokyo, Japan)

[WeP-42-05]

Interfacial optimization for the high-performance of PbS quantum dot photovoltaics

Yinglin Wang, Xinlu Liu, Yuwen Jia, Lei Wang, Xintong Zhang, Yichun Liu (Northeast Normal Univ., China)

[WeP-42-06]

Building efficient colloidal quantum dot solar cells by surface chemistry engineering and printing technology

Guozheng Shi^{1,2}, Zeke Liu², Wanli Ma², Qing Shen¹ (1. Univ. Electro-Communications, Japan, 2. Soochow Univ., China)

[WeP-42-07]

Photoconductivity measurement of silicon quantum dot multilayers for the Bayesian optimization

Fuga Kumagai¹, Kazuhiro Gotoh¹, Satoru Miyamoto¹, Shinya Kato², Naoki Matsuo³, Shigeru Yamada³, Takashi Itoh³, Noritaka Usami¹, Yasuyoshi Kurokawa¹ (1. Nagoya Univ., Japan, 2. Nagoya Inst. Technology, Japan, 3. Gifu Univ., Japan)

[WeP-42-08]

Simultaneous A site cation doping and surface ligand management by dimethylammonium enable highly efficient and stable perovskite quantum dot photovoltaics

Yinyan Xu, Jun Zhu (Hefei Univ. Technology, China)

[WeP-42-09]

Chemical anchoring of semiconductor ligand onto perovskite quantum dots for hot and cold carriers extraction

Yusheng Li, Dandan Wang, Shota Yajima, Akihito Fuchimoto, Dong Liu, Hua Li, Yongge Yang, Yuyao Wei, Chao Ding, Shuzi Hayase, Qing Shen (Univ. Electro-Communications, Japan)

[WeP-42-10]

Effects of the perovskite QDs on the photoexcited carrier dynamics and photovoltaic properties of perovskite solar cells

Ryota Osanai, Ding Chao, Li Hua, Li Yusheng, Shuzi Hayase, Qing Shen (Univ. Electro-Communications, Japan)

[WeP-42-11]

Cs₂SnI₆ nanocrystals enhancing hole extraction for efficient carbon-based CsPbI₂Br solar cells

Guizhi Zhang, Huashang Rao, Xinhua Zhong (South China Agricultural Univ., China)

[WeP-42-12]

Synthesis of stable organic-inorganic tin halide perovskite quantum dots and their optical properties

Shota Yajima, Chao Ding, Yusheng Li, Hua Li, Taro Toyoda, Shuzi Hayase, Qing Shen (Univ. Electro-Communications, Japan)

[WeP-42-13]

Bright and stable perovskite quantum-dot light-emitting diodes

Jianjun Tian (Univ. Science and Technology Beijing, China)

[WeP-42-14]

Ultra-thin SnO_x buffer layer enables high-efficiency quantum junction photovoltaics with low current hysteresis

Yuwen Jia¹, Haibin Wang², Yinglin Wang¹, Yichun Liu¹, Xintong Zhang¹, Hiroshi Segawa² (1. Northeast Normal Univ., China, 2. Univ. Tokyo, Japan)

[WeP-42-15]

Effects of mixed A-site cations on photoelectric properties, hot carrier dynamics in hybrid lead halide perovskites

Hua Li, Chao Ding, Dong Liu, Shuzi Hayase, Qing Shen (Univ. Electro-Communications, Japan)

[WeP-42-16]

Interface modification and interfacial charge dynamic in colloidal quantum dot solar cells

Yaohong Zhang¹, Qing Shen² (1. Northwest Univ., China, 2. Univ. Electro-Communications, Japan)

[WeP-42-17]

Interfacial engineering to enhance open-circuit voltage for high-performance colloidal quantum dot solar cells

Xiaofei Li, Yinglin Wang, Xintong Zhang, Yichun Liu (Northeast Normal Univ., China)

[WeP-42-18]

Lossless hybridization in series-connected PVTE hybrid tandems for output-power optimization

Jun Sakuma¹, Kenji Kamide², Toshimitsu Mochizuki², Hidetaka Takato², Hidefumi Akiyama¹ (1. Univ. Tokyo, Japan, 2. National Inst. Advanced Industrial Science and Technology, Japan)

[WeP-42-19]

Thermoradiative power yield from low-temperature waste heat source

Muhammad H. Sazzad, Michael P. Nielsen, Andreas Pusch, Phoebe M. Pearce, Peter J. Reece, Nicholas J. Ekins-Daukes (Univ. New South Wales, Australia)

[WeP-42-20]

Preparation of high quality inorganic single crystals for X-ray detectors by top-seed solution method

Anfeng Li, Jianyu Zhang, Manman Yang, Xia Hao, Jingquan Zhang (Sichuan Univ., China)

Joint Session: Sub-areas 1-1 and 2-3

Sub-area 1-1: Policy, market and deployment

Sub-area 2-3: Field performance of photovoltaic systems and related issues

[WeO-23c] Joint Session of Sub Area 1-1 and 2-3: Why PV Circularity and Sustainability?

Session Chair: Arnulf Jäger-Waldau (European Commission, Joint Research Center, Italy),

Edward His (Swiss Reinsurance, Switzerland)

Wed. Nov 16, 2022 3:30 PM - 5:30 PM 432 (Bldg. 4, 3F)

[WeO-23c-01] 3:30 PM – 4:00 PM

(INVITED) A critical review of PV circular economy research

Garvin Heath¹, Dwarak Ravikumar^{1,2}, Brianna Hansen¹, Elaine Kupets¹ (1. National Renewable Energy Lab., USA, 2. Univ. Waterloo, Canada)

[WeO-23c-02] 4:00 PM – 4:15 PM

HighLite H2020: Improving the environmental profile of high-performance low-cost modules for a competitive EU PV manufacturing industry

Josco Kester¹, Ashish Binani¹, Frank Lenzmann¹, Sami Lindfors², Ville Lampinen², Tadas Radavicius³, Thomas Regrettier⁴, Samuel Harrison⁵, Loic Tous⁶, Arthur Weeber¹ (1. TNO Solar Energy, The Netherlands, 2. Valoe, Finland, 3. Solitek, Lithuania, 4. Voltec, France, 5. CEA INES, France, 6. imec, Belgium)

[WeO-23c-03] 4:15 PM – 4:30 PM

Life cycle assessment of c-Si photovoltaic module recycling with hot knife technology

Rolf Frischknecht¹, Keiichi Komoto², Taisuke Doi³ (1. treeze Ltd., Switzerland, 2. Mizuho Research & Technologies, Ltd., Japan, 3. NPC Incorporated, Japan)

[WeO-23c-04] 4:30 PM – 4:45 PM

A survey of decommissioned photovoltaic modules from solar power plants in Thailand: Performance and second life opportunities

Amornrat Limmanee, Nopphadol Sitthiphol, Suttinan Jaroensathainchok, Rangson Pluemkamon, Saifon Kotesopa, Nuttakarn Udomdachanut, Aswin Hongsingthong (National Energy Technology Center, National Science and Technology Development Agency, Thailand)

[WeO-23c-05] 4:45 PM – 5:00 PM

Photovoltaic recycle technology with low temperature thermal decomposition

Masaru Sasai, Takeharu Yamashita, Daisuke Inoue (Tokuyama Corp., Japan)

[WeO-23c-06] 5:00 PM – 5:30 PM

(INVITED) Developments concerning the re-use of decommissioned PV modules

Arvid van der Heide^{1,2,3}, Karsten Wambach⁴, Jan Clyncke⁵, Jef Poortmans^{1,2,3} (1. imec, Belgium, 2. Hasselt Univ., Belgium, 3. EnergyVille, Belgium, 4. bifa Umweltinstitut GmbH, Germany,

5. PV CYCLE, Belgium)

Joint Session: Areas 3 and 4

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

[WeO-41f] Area 3 and 4 Joint Session / Perovskite-X tandem

Session Chair: Eric Diau (National Chiao Tung Univ., Taiwan)

Wed. Nov 16, 2022 10:30 AM - 12:00 PM Shirotori Hall (Bldg. 4, 1F)

[WeO-41f-01] 10:30 AM – 11:00 AM

(INVITED) High-performance perovskite-CIGS thin-film tandem solar cells and mini-modules

Fan Fu (Empa–Swiss Federal Labs. for Materials Science and Technology, Switzerland)

[WeO-41f-02] 11:00 AM – 11:30 AM

(INVITED) High efficiency perovskite/hetero-junction crystalline silicon tandem solar cells

Kenji Yamamoto, Hisashi Uzu, Daisuke Adachi (1. Kaneka Corp., Japan)

[WeO-41f-03] 11:30 AM – 11:45 AM

Industrial proven, high throughput vacuum deposition equipment for the mass production of TOPCon, SHJ & perovskite solar cells

Xuemei Cheng, Simon Hübner, Frank May, Torsten Dippell (Singulus Technologies AG, Germany)

[WeO-41f-04] 11:45 AM – 12:00 PM

Novel lamination approach for fabrication of monolithic perovskite/silicon tandem photovoltaics

Julie Roger¹, Luisa K. Schorn¹, Minasadat Heydarian¹, Ahmed Farag¹, Thomas Feeney¹, Daniel Baumann¹, Hang Hu¹, Felix Laufer¹, Weiyuan Duan², Kaining Ding², Andreas Lambertz², Paul Fassl¹, Matthias Worgull¹, Ulrich W. Paetzold¹ (1. Karlsruhe Inst. Technology, Germany, 2.

Forschungszentrum Jülich GmbH, Germany)

Joint Session: Areas 3 and 4

Area 3: Photovoltaic modules, solar cells, advanced materials, sophisticated processes, cell and module characterizations

Area 4: Perovskite and emerging photovoltaics, advanced materials, sophisticated processes

[ThO-41i] Area 3 and 4 Joint Session / Perovskite-X tandem

Session Chair: Senol Öz, (Saule Technologies, Poland)

Thu. Nov 17, 2022 10:30 AM - 12:00 PM Shirotori Hall (Bldg. 4, 1F)

[ThO-41i-01] 10:30 AM – 11:00 AM

(INVITED) Efficient and stable all-perovskite tandem solar cells and modules

Hairen Tan (Nanjing Univ., China)

[ThO-41i-02] 11:00 AM – 11:15 AM

Nanocrystalline Si as a recombination junction layer in perovskite-Si tandem solar cells

Calum McDonald, Hitoshi Sai, Vladimir Svrcek, Atsushi Kogo, Tetsuhiko Miyadera, Takuro N. Murakami, Masayuki Chikamatsu, Yuji Yoshida, Takuya Matsui (National Inst. Advanced Industrial Science and Technology, Japan)

[ThO-41i-03] 11:15 AM – 11:30 AM

Development of high-efficiency two-terminal perovskite/silicon tandem solar cells

Miyuki Shiokawa^{1,4}, Mengmeng Chen², Shuzi Hayase², Hitoshi Sai³, Takuya Matsu³, Tomohiro Tobari¹, Yutaka Saita¹, Takeshi Gotanda^{1,4} (1. Toshiba Energy Systems & Solutions Corp., Japan, 2. Univ. Electro-Communications, Japan, 3. National Inst. Advanced Industrial Science and Technology, Japan, 4. Toshiba Corp., Japan)

[ThO-41i-04] 11:30 AM – 11:45 AM

Perovskite/silicon tandem cell manufactured by directly depositing SnO₂ on TOPCon silicon cell in CBD method

Jiyeon Hyun, Kyung Mun Yeom, Ha Eun Lee, Donghwan Kim, Hae-Seok Lee, Yoonmook Kang (Korea Univ., Korea)

[ThO-41i-05] 11:45 AM – 12:00 PM

Efficient semi-transparent perovskite solar cells for four-terminal perovskite/CIGS tandem solar cells

Takeru Bessho¹, Motoshi Nakamura^{1,2}, Ching Chang Lin¹, Chie Nishiyama¹, Keishi Tada¹, Hiroshi Segawa¹ (1. Univ. Tokyo, Japan, 2. Idemitsu Kosan Co., Ltd., Japan)

Closing Ceremony

Session Chairs: Noritaka Usami (Nagoya Univ., Japan), Atsushi Masuda (Niigata Univ., Japan)

Thu. Nov 17, 2022 3:00 PM - 4:00 PM Shirotori Hall (Bldg. 4, 1F)

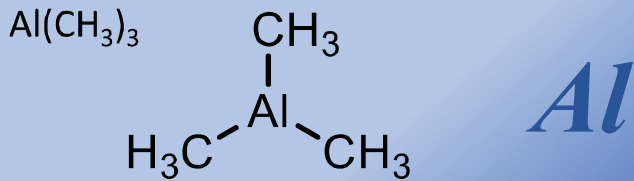
Highlight of Conference

Best Paper Award, Poster Award, and Student Award Ceremony

Announcement of Next Conferences

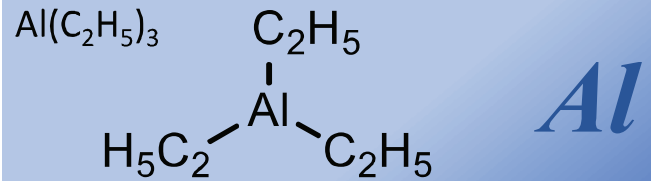
Organometallic Compounds

Trimethylaluminum



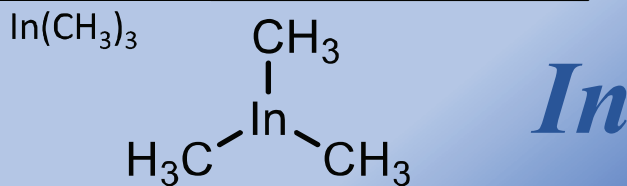
CAS RN® : 75-24-1
 Appearance : Colorless to Pale
 Yellow Clear Liquid
 MW : 72.09
 b.p. : 127 °C

Triethylaluminum



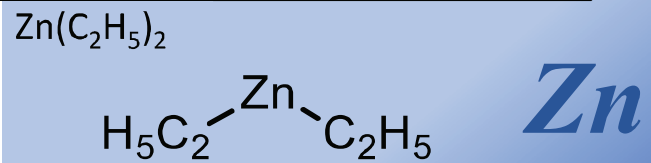
CAS RN® : 97-93-8
 Appearance : Colorless to Pale
 Yellow Clear Liquid
 MW : 114.16
 b.p. : 187 °C

Trimethylindium

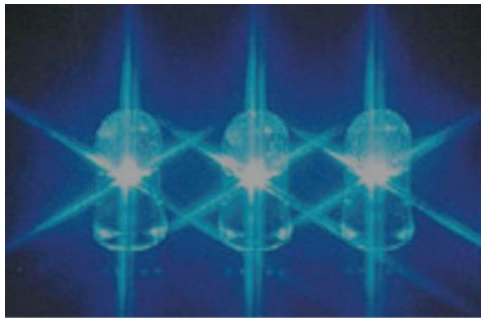


CAS RN® : 3385-78-2
 Appearance : Colorless to Pale
 Yellow Clear Solid
 MW : 159.92
 b.p. : 136 °C

Diethylzinc



CAS RN® : 557-20-0
 Appearance : Colorless to Pale
 Yellow Clear Liquid
 MW : 123.51
 b.p. : 118 °C



新材料の観察・分析 技術課題解決のための支援を実施しています

ナノ構造解析は名古屋大学へ

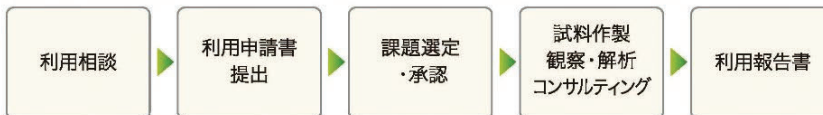
<https://arim.nagoya-microscopy.jp>



- 専任の電子顕微鏡技術者が観察を代行
- 学内の各専門分野の研究陣がサポート
- 万全の守秘体制で
成果公開・非公開の観察支援を実施



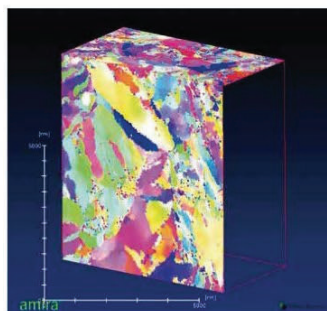
観察・分析支援手順



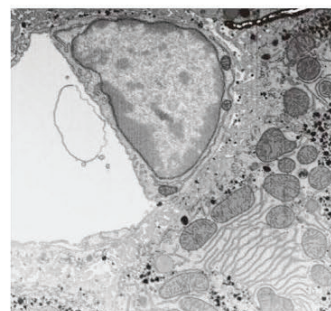
■集束イオンビーム加工機 (FIB-SEM) MI-4000L



- 【仕様】**
- FIB-SEM鏡筒:直交型
 - FIB加速電圧:最大30kV
 - SEM加速電圧:0.1~30kV
 - Arイオンビーム:0.5~2kV
 - マイクロサンプリング機能
 - FE-SEM、EDS及びEBSD(OIM)機能
 - STEM検出器装備
- 【用途】**
- Cut & See(リアルタイムで実現)
 - リアルタイムSEM・STEM観察
 - リアルタイム3D-EDS、3D-EBSD



Cut & Seeによる3D-EBSD計測
鉄鋼材料(結晶粒・結晶方位分布)

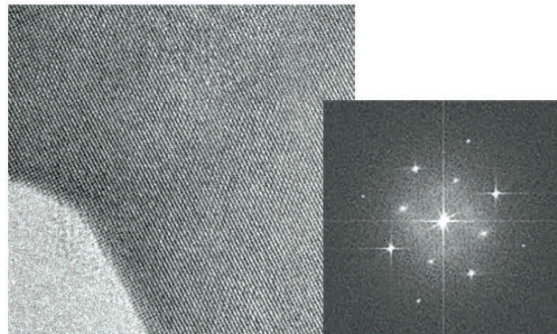


生物系試料の断面SEM観察
ラットの肝臓細胞

■反応科学超高压走査透過電子顕微鏡 JEM-1000K RS



- 【仕様】**
- 超高压でのTEM/STEM観察
 - TEM点分解能:0.15nm以下
 - STEMプローブ径:1nm
 - 加速電圧:1000、800、600kV
 - 各種ガス環境雰囲気:最大0.1気圧
 - EELSによる元素分析機能
 - 各種特殊ホルダーを整備
- 【用途】**
- ガス環境下でのその場観察
 - 3D観察(生物系試料も可能)
 - ハイコントラスト暗視野観察

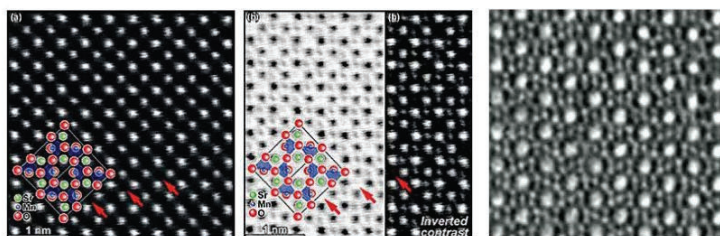


金単結晶のガス中観察(ガス圧 11,000 Pa)

■超高分解能収差補正型 TEM/STEM JEM-ARM200FC



- 【仕様】**
- TEM点分解能:110pm
 - STEM-HAADF像分解能:78pm
 - 加速電圧:200、80kV
 - 照射レンズ系に収差補正機能を搭載
 - 冷陰極電界放射型電子銃
 - STEM:HAADF、LAADF、ABF
 - EDS、EELS(Dual EELS)
- 【用途】**
- 原子レベルでの構造観察、
元素分析、電子状態分析



HAADF-STEM ABF-STEM
SrMnO_{2.5}結晶の酸素欠損サイトの観察

ゼオライト結晶の構造像

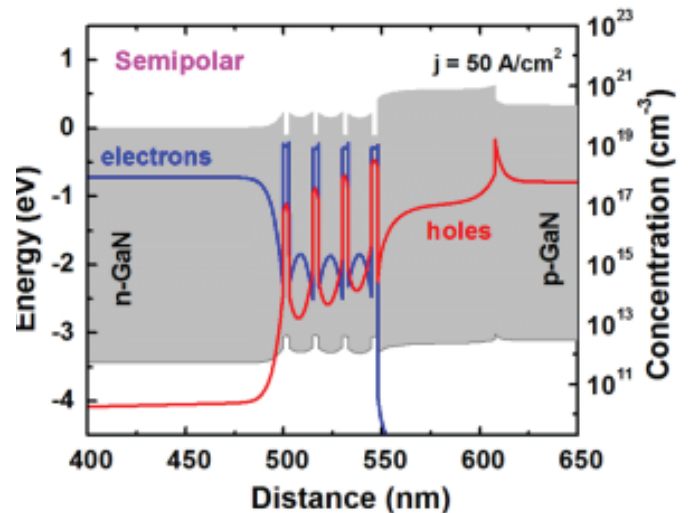
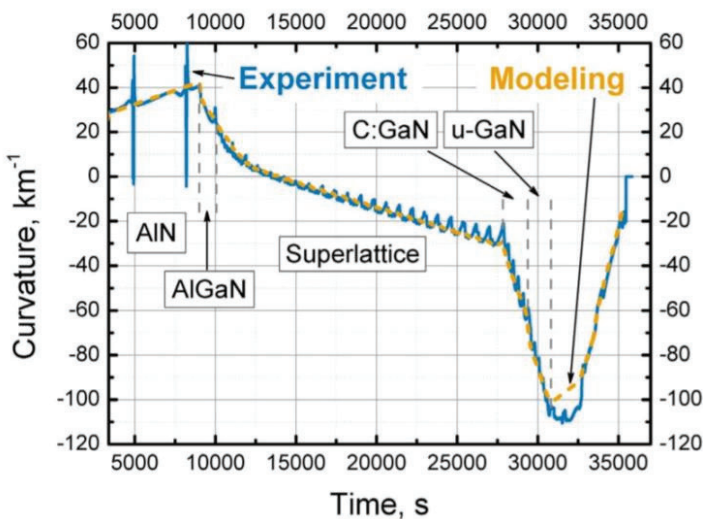
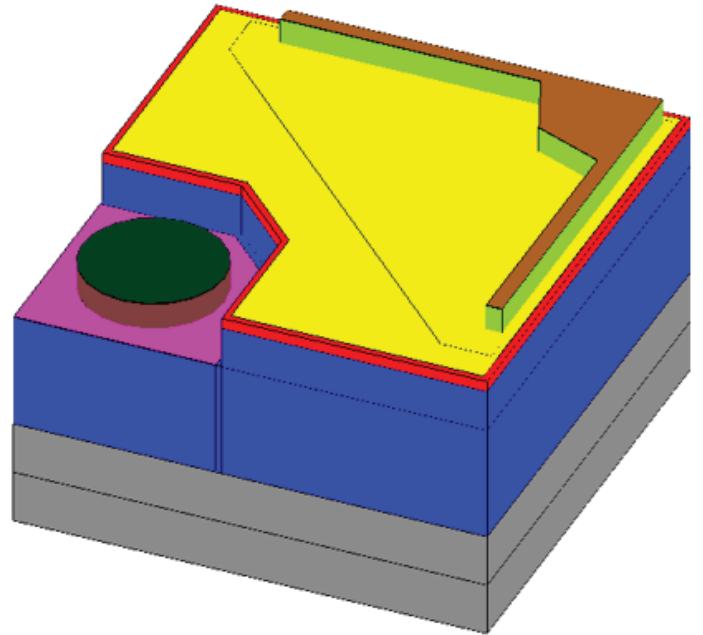
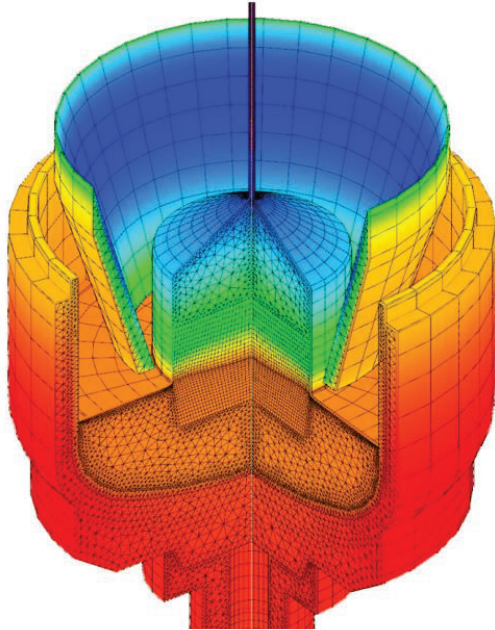
■上記以外にも用途に応じた各種設備を整備

お問い合わせは下記まで

マテリアル先端リサーチインフラ事業 (ARIM) 名古屋大学ハブ拠点 計測・分析分野

〒464-8603 名古屋市千種区不老町 名古屋大学 未来材料・システム研究所 超高压電子顕微鏡施設

TEL: 052-789-3632 E-mail :nanoplat@nagoya-microscopy.jp



Crystal Growth Simulation

Crystal Growth from the Melt, Solution and Vapor phase

Device Simulation

LED, Laser Diode, PV cell, HEMT

STR Japan K.K.

East Tower 15F, Yokohama Business Park

134, Goudo-cho, Hodogaya-ku, Yokohama, Kanagawa, 240-0005, Japan

www.str-soft.co.jp (in Japanese) www.str-soft.com (in English)



3Dスキャンニング共焦点ラマン顕微鏡 Confotec NR500



高感度・高波長分解能・高拡張性

高性能共焦点顕微ラマン分光装置



■ 主な仕様・特長

- ・高空間分解：XY <math>< 300\text{ nm}</math>, Z <math>< 600\text{ nm}</math> @532nm
- ・高波数分解能：52 cm/80 cm分光器を選択可能
回折格子を4枚同時搭載可能
- ・広波長範囲対応：
紫外から近赤外まで最適な光学系対応
- ・高スペクトル分解能：
0.25cm⁻¹ (@エッセル回折格子)

- ・励起レーザー：最大5台まで、搭載可能
- ・高速イメージングモード
- ・自動化機能
- ・高拡張性：
 - ブリルアン散乱測定、低波数ラマン測定
 - CARS、TERS、SERS、蛍光寿命測定 他

ファイバー小型分光器 SILVER-Nova



TEC冷却標準搭載ハイエンドモデル



■ 主な仕様・特長

- ・波長範囲 190 ~ 1110 nm
- ・波長分解能(@HWHM) 0.75 ~ 8 nm
- ・ゲイン機能、TEC冷却機能 (オプション：2段TEC冷却)、
ディテクターレンズ搭載
- ・スリット交換可能 (オプション)

その他、低収差・低迷光モデル、高波長分解能モデル等も提供しています。お問い合わせください。

小型FT-IR分光器 Rocketシリーズ



最大16μmまで対応のポータブルサイズ



■ 主な仕様・特長

- ・波長範囲 0.9~2.6 μm / 2~6 μm / 1.5~8.5 μm
2~12 μm / 2~16 μm
- ・波長分解能(@HWHM) <math>< 4\text{ cm}^{-1}</math>
- ・冷却機能 2段TEC、4段TECまたはDLATGS
- ・温度・振動の影響を最小限に抑制



- Design flexibility
- One-stop service
- Engineering support



AGC Inc. Architectural Glass Asia Pacific Company

Japanese : <https://www.asahiglassplaza.net/products/sunjoule/>

English : <https://agc-activeglass.com/en/sunewat/>



The use of Fluon ETFE FILM has infinite possibilities.

Applications are constantly increasing.

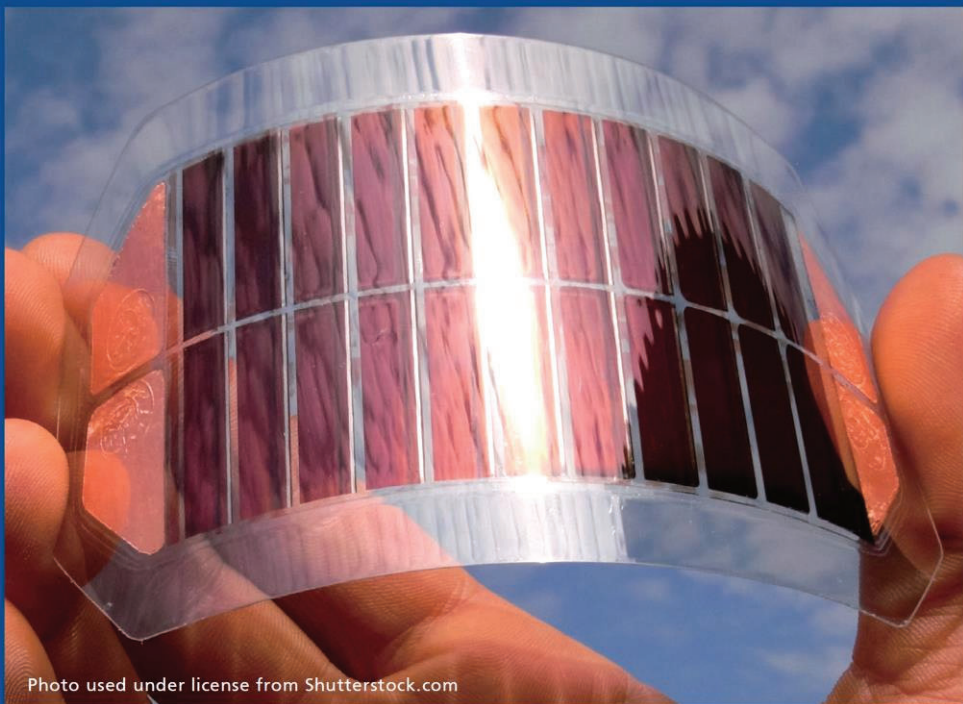


Photo used under license from Shutterstock.com



Image for illustration purposes only. Actual product may vary. Our product is not used in the photo left.

Toyol

TOYO ALUMINIUM K.K.

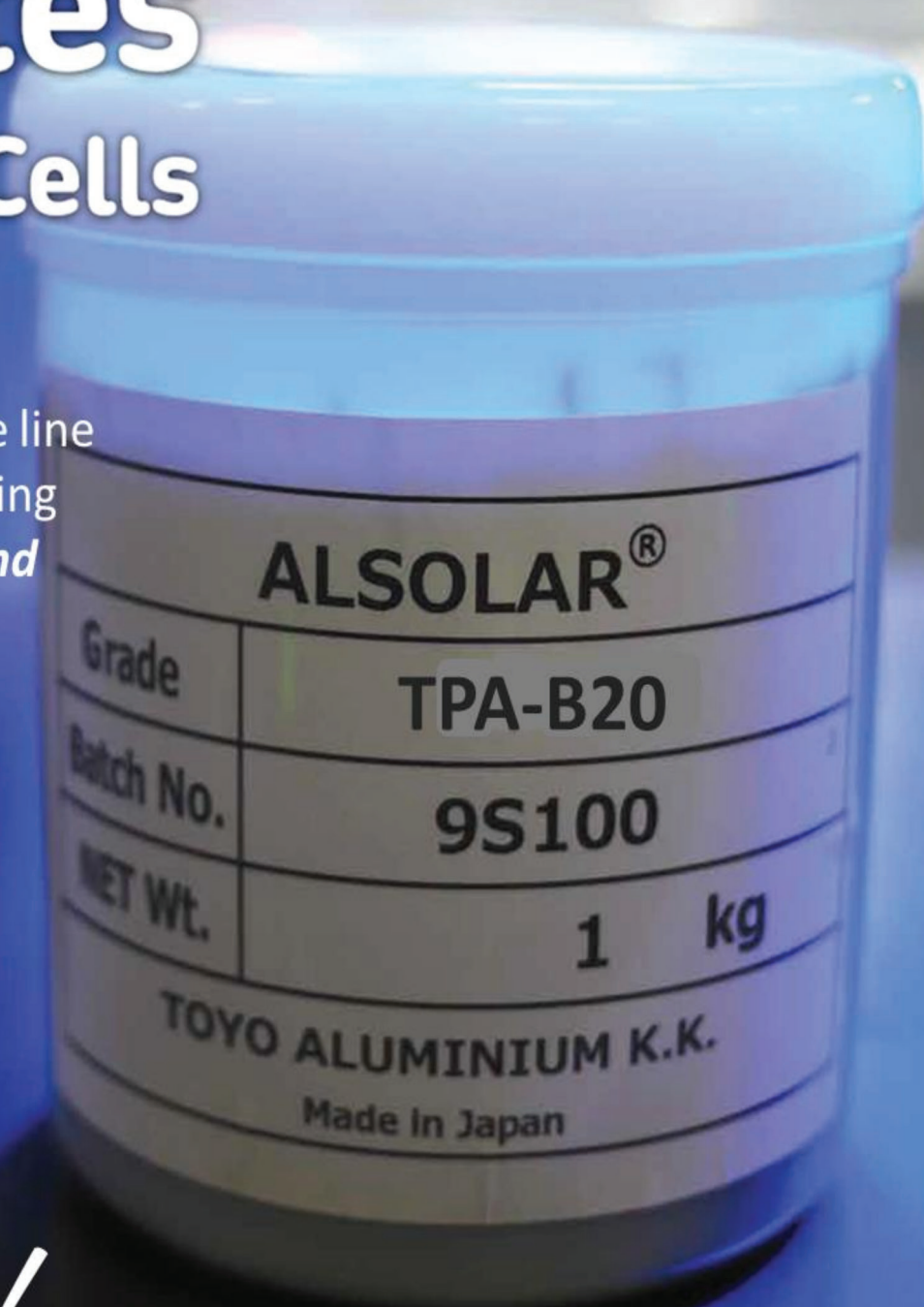
ALSOLAR® AgPastes for Si Solar Cells

Specially designed for fine line
low temperature Ag printing
on *Tandem, Perovskite and
heterojunction* solar cells

- High Efficiency
- Low Resistivity
- High Adhesion
- Excellent Reliability

Efficiency

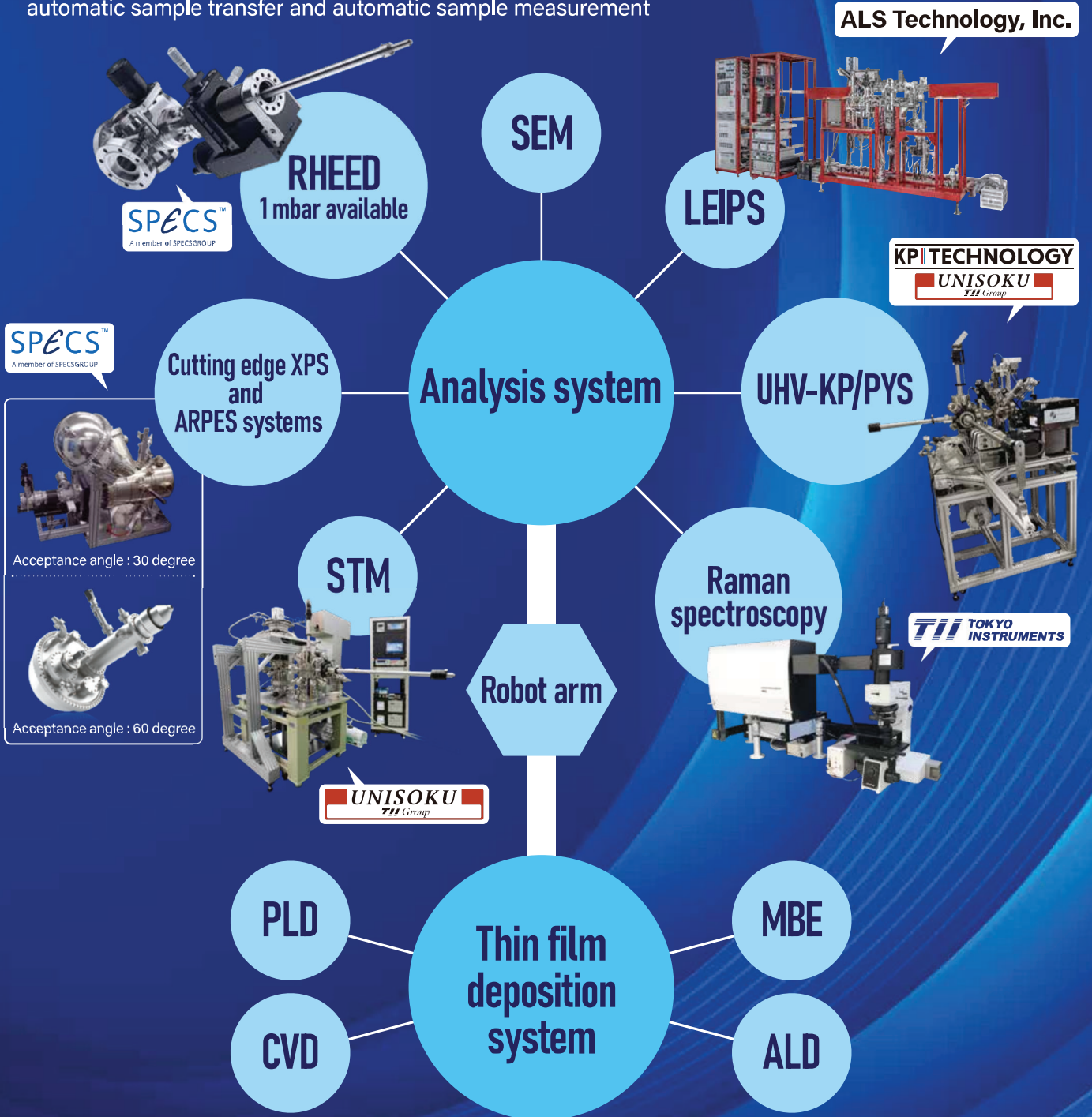
Matters !!



Excellent solution for thin film growth and analysis

Cluster material explorer system

- Automatic sample transfer between analysis system and thin film deposition system by robot arm
- Combinatorial analysis: automatic pressure and temperature control, automatic sample transfer and automatic sample measurement



TII TOKYO INSTRUMENTS

Headquarters: T. I. Building, 6-18-14 Nishi-Kasai, Edogawa-ku, Tokyo 134-0088 ☎ 03-3686-4711
 Osaka Sales Office: Shin-Osaka Kita Building, 4-1-46 Miyahara, Yodogawa-ku, Osaka 532-0003 ☎ 06-6393-7411
 ☎ <https://www.tokyoinst.co.jp> ✉ sales@tokyoinst.co.jp

TII Group Company - Expanding our global network to provide cutting-edge science to our customers -

UNISOKU
TII Group

Ultrahigh vacuum and cryogenic scanning probe microscope
 High-speed spectrometer, cryostat

LOTIS TII

Nd:YAG laser, Ti:S laser
 OPO laser

SPECS™ - TII

Enviro ESCA (Quasi-Barometric XPS)
 ARPES, etc.

<http://www.tec-research.co.jp>

We will manufacture only one equipment !

For research and development

Our products

Various vacuum equipment

- PE-CVD
- /Plasma-enhanced chemical vapor deposition
- Cat-CVD
- /Catalytic Chemical Vapor Deposition
- Sputtering equipment
- Vacuum vapor deposition equipment

Various annealing equipment

- Heat source used-
- Halogen lamp annealing
- FLA/Xenon flash lamp annealing
- Electric furnace annealing
- High-frequency heating
- Microwave heating

NEW Product!

- C H T /Carbon heating tube
(High speed annealing)

Various components

- Vacuum exhaust unit
- High pressure steam heat treatment chamber
- Vacuum flange
- Crystal oscillator

Other equipment

- Thermal vacuum test equipment
- /Spacecraft thermal vacuum test

Design outsourcing

- Mechanical design
- Software design
- Electrical circuit design

Semiconductor (thin film) analysis service

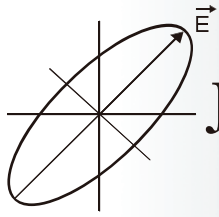
* We design and produce custom equipment, so please contact us.

Techno Research.,Ltd

Nokodai Tamakoganei Ventureport 2-24-16
Naka -Cyo, Koganei-City, Tokiyo 184-0012 JAPAN
TEL+81-42-380-8055 FAX+81-42-380-8056
e-mail:miyazaki-tom@tec-research.co.jp



TECHNO RESEARCH
Challenge to Possibilities



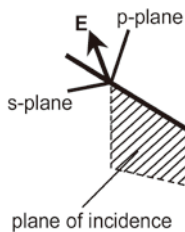
J.A. Woollam Japan

Ellipsometry Solutions



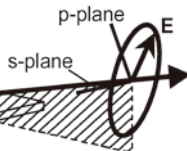
分光エリプソメーター

1. Known input polarization



2. Reflect off sample ...

3. Measure output polarization



薄膜の膜厚

異方性

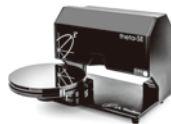
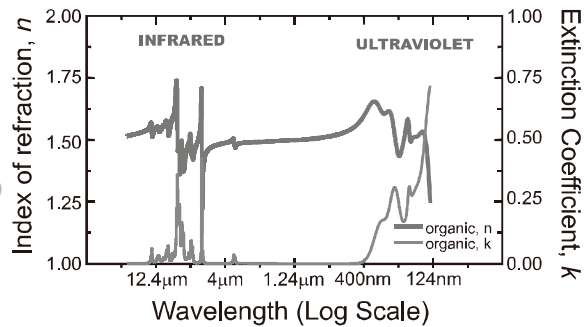
表面層・界面層

光学定数

(屈折率n, 消衰係数k)

化学結合情報

膜構成物質の
混合比



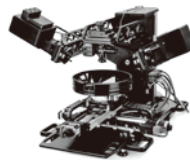
146 400



1000



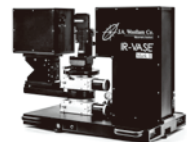
1700



2500

4000

30,000



What is

エリプソメーター?

分光エリプソメーターは、薄膜の厚み、光学定数(屈折率n、消衰係数k)および、表面や物質の微細構造を任意の波長範囲の偏光した光を利用して測定する、非破壊・非接触の大変感度の良い測定装置です。

ある偏光状態の光を斜めから膜に当てると、反射した光は膜の作用により偏光の変化が起きます。

光の強度に依存しない偏光の変化を測定するため、再現性がよく高感度な測定ができます。

ジェー・エー・ウーラム・ジャパン株式会社

〒167-0051 東京都杉並区荻窪 5-22-9 藤ビル2F
TEL. 03-3220-5871 FAX. 03-3220-5876

info@jawjapan.com
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Increase power generation from your PV module

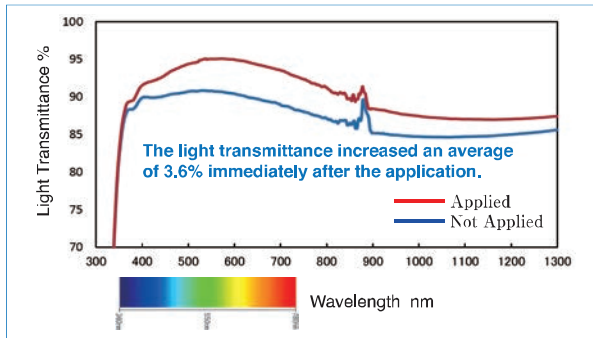
EXCEL PURE

Features of EXCEL PURE

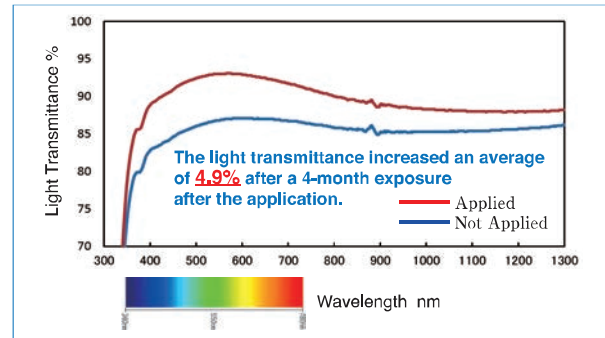
EXCEL PURE improves the light transmittance of cover glass for PV module immediately after application, and maintains its effect for a long period of time.

Results of light transmittance measurement

Initial Values



4-Month Exposure after Application

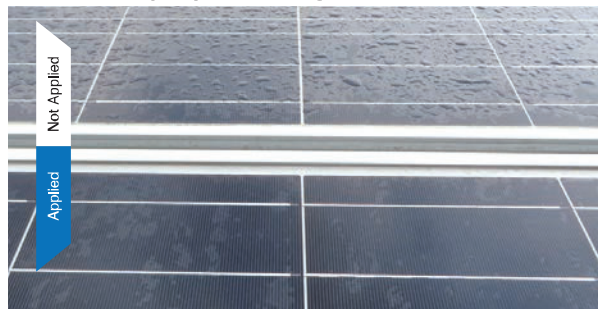


The light transmittance of cover glass for PV module coated by EXCEL PURE improves immediately after its application. Also, after application, contaminants are prevented from attaching to glass surface due to the excellent anti-fouling effect of EXCEL PURE. As the result, glass surface is kept clean and a decrease of light transmittance by contaminants is prevented as well.

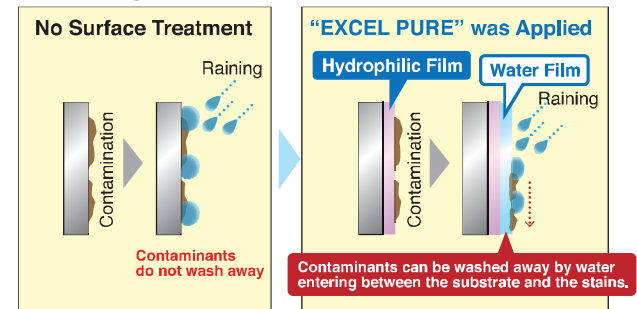
Features of EXCEL PURE

Excellent antifouling performance is exhibited due to the hydrophilic film coating.

Formation of Hydrophilic Coating Film



Self-Cleaning Effect

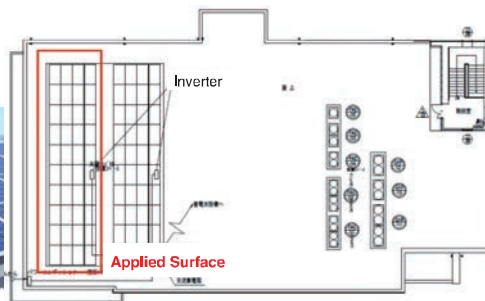


EXCEL PURE forms hydrophilic coating film on the surface of substrate. Water droplets on coating film become thin water film due to the hydrophilicity. Water film flows into gap between surface of substrate and contaminants to make contaminants float and wash away.

Verification Test

EXCEL PURE was applied to PV modules installed on the roof of a building, and the power generation was compared with that of the non-applied PV modules.

Date of Measurement : April 8, 2014
 Start of Measurement : April 9, 2014
 Number of Applied PV modules : 40
 Number of Non-Applied PV modules : 40



| Power Generation Difference (kW) Each Month | | | |
|---|----------------------|------------------|---------------|
| | Non-Applied Area (1) | Applied Area (2) | (2)/(1) |
| Before Application | 322 | 326 | 101.2% |
| Apr-14 | 828 | 860 | 103.8% |
| May-14 | 790 | 820 | 103.8% |
| Jun-14 | 1051 | 1090 | 103.7% |
| Jul-14 | 1041 | 1082 | 103.9% |
| Aug-14 | 733 | 767 | 104.7% |
| Sep-14 | 909 | 942 | 103.6% |
| Oct-14 | 691 | 717 | 103.9% |
| Nov-14 | 429 | 452 | 105.3% |
| Dec-14 | 200 | 209 | 104.4% |
| Jan-15 | 270 | 290 | 107.4% |
| Feb-15 | 435 | 465 | 106.7% |
| Mar-15 | 695 | 732 | 105.4% |
| Total | 8073 | 8427 | 104.4% |

The difference in power generation became large immediately after application. The power generation of the applied PV modules increased 3.2% on an annual average (B)-(A).

For more information, please visit our web site.

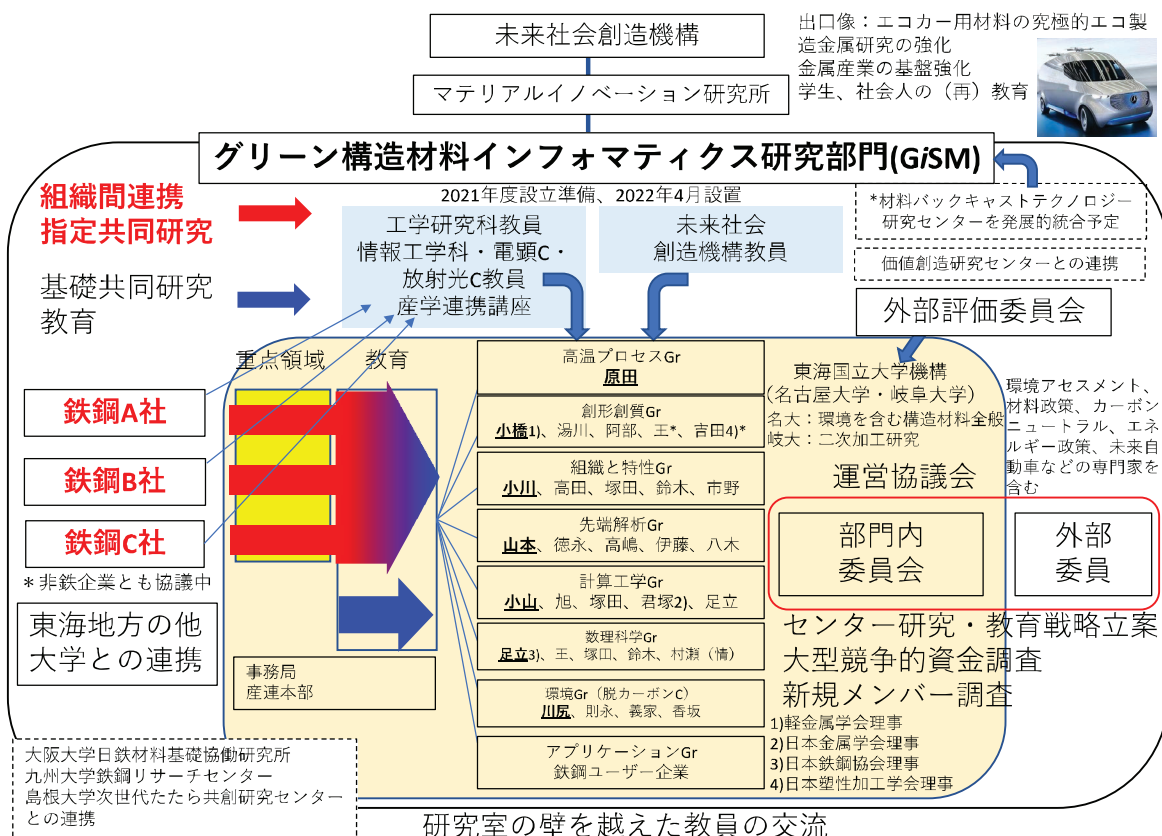
Product information on EXCEL PURE

Corporate profile

1. GiSM の活動概要

我が国の強みである構造金属材料は、安全・安心社会、環境・エネルギー問題に貢献する社会基盤材料として身近に存在しています。重量比で全金属材料の95%が鉄鋼材料であり、国内1億トン、全世界で8億トンの鉄鋼材料が生産されており、今後鉄鋼材料の需要は一層増えることが予想されています。したがって、鉄鋼材料が社会に及ぼす影響は計り知れないぐらい大きいといえます。製造過程のエコプロセス化・アップグレードリサイクル、特性の一層の向上は構造金属材料開発の永遠の課題です。本部門では、鉄鋼材料、非鉄金属材料を対象にこれらの課題に挑戦し、先端解析、計算工学、数理科学を駆使して、効率的に構造金属材料のポテンシャルを最大限引き出すための基礎研究を実施します。併せて、環境に優しい製造過程のエコプロセス化を追求します。これらを通じて、日本の工業の集積地である東海地方における鉄鋼をはじめとする構造金属材料研究の研究拠点として、研究、人材育成、産学連携に努めます。

2. GiSM の体制



3. 共同研究のお問い合わせ先

当研究部門では、構造金属材料およびその製造プロセスに関する産学連携を推進しています。当研究部門との共同研究などのお問い合わせは以下にお願いします。

GiSM 事務局 : gism@material.nagoya-u.ac.jp

TOSHIBA

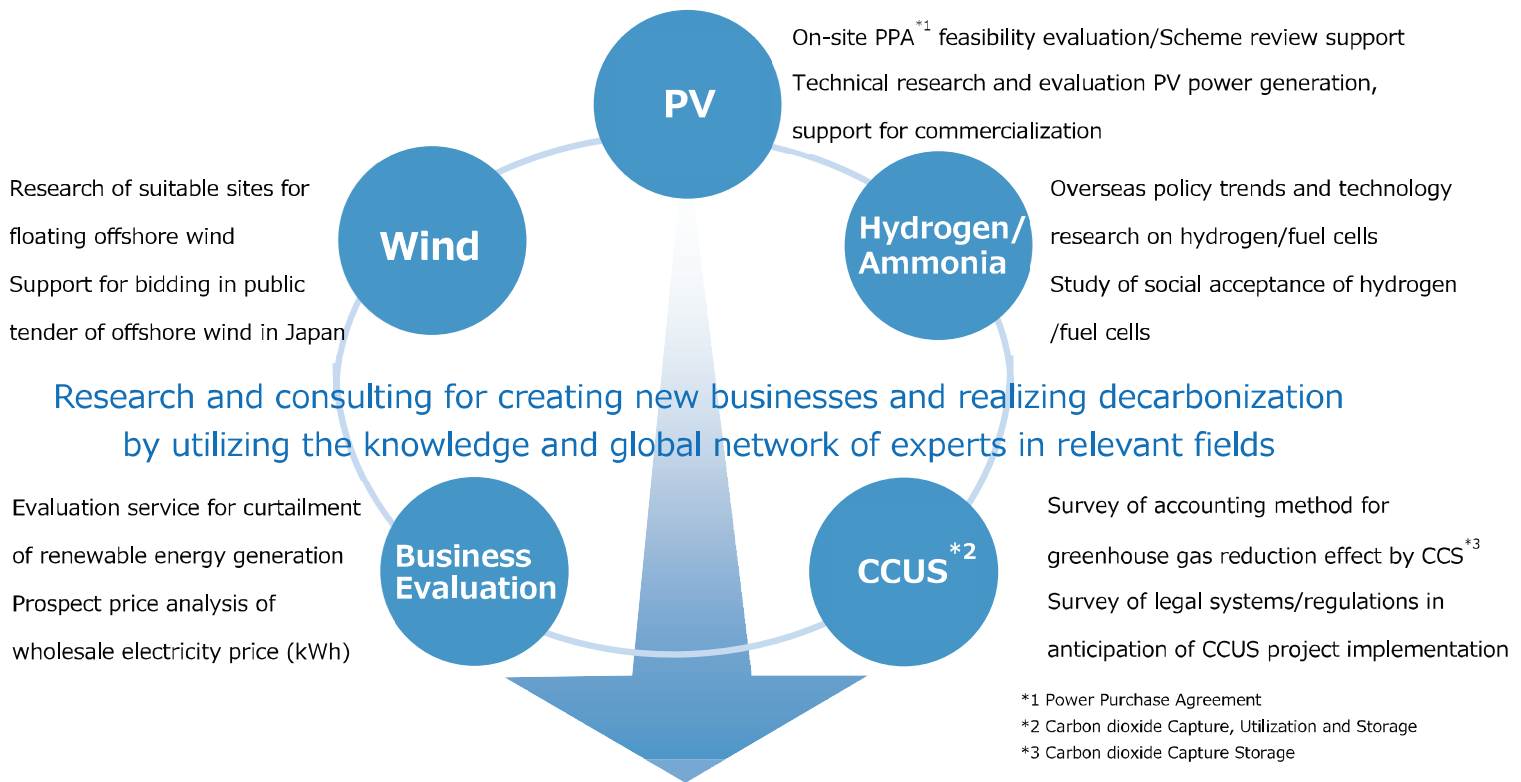


We turn on the promise of a new day
by designing the future of energy.

Toshiba Energy Systems & Solutions Corporation

<https://www.global.toshiba/ww/company/energy.html>





Combining expertise in renewable energy and decarbonization technology, we support customers' transition to next-generation energy through business/related policy support.

Example of solutions in the field of energy and resources

Simulation analysis on power generation business

- Evaluation service for curtailment of renewable energy generation
- Prospect price analysis of wholesale electricity price (kWh)

Support for distributed electric power business

- Consideration of power business schemes (distributed resources/corporate PPV)
- Trend survey on future distributed power supply business (distribution/microgrid)

Business review support for PPA business

- On-site PPA business evaluation
- Off-site PPA (corporate PPA) business scheme study support

Research/Consulting on photovoltaic solar energy (PV)

- Commercialization support and consulting for PV related businesses
- Trend analysis related to PV market, sustainability and relevant technologies

Research/Consulting on hydrogen and fuel cells

- Policy analysis (cost-benefit analysis, cost-effectiveness analysis)
- Study of social acceptance of hydrogen and fuel cells

Research/Consulting on CCS/CCUS

- Survey of accounting method for greenhouse gas reduction effect by CCS
- Survey of legal systems/regulations in anticipation of CCUS project

Research/Consulting on energy conservation

- Support for energy conservation policy planning
- Energy consumption analysis based on EMS(Energy Management System) data

Output image of curtailment analysis of renewable energy output

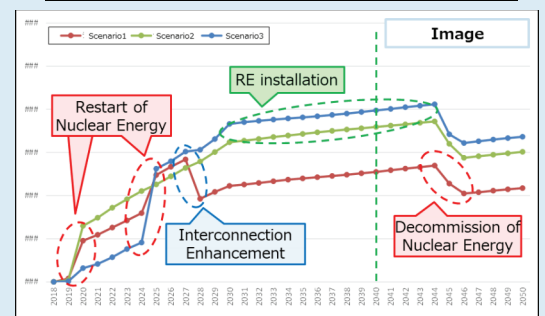
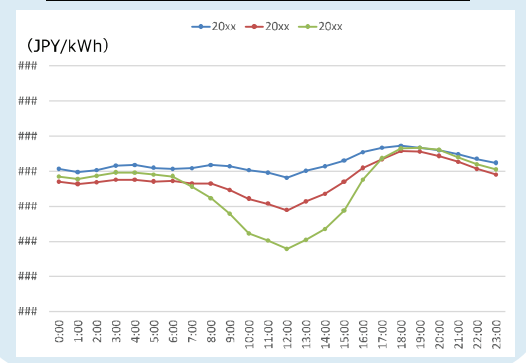


Image of prospect price analysis of wholesale electricity price (kWh)



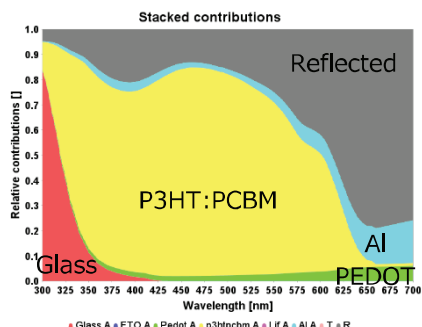
太陽電池の研究開発を加速させる

Fluxim製品

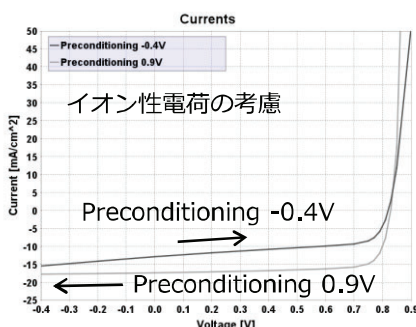
SCIENTIFIC TOOLS THAT BOOST YOUR R&D FOR OLED

Setfos

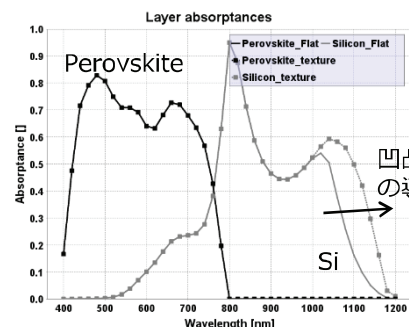
有機薄膜太陽電池・ペロブスカイト太陽電池などのデバイス構造設計のための強力なシミュレーションソフトウェアです。光学・電気連携シミュレーションや凹凸面を設けたシミュレーションも可能です。



層ごとの吸収割合の波長依存性



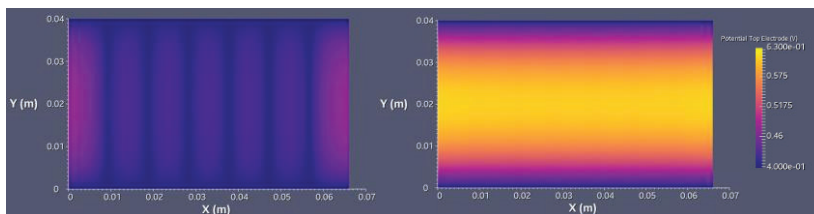
ペロブスカイト太陽電池 IV特性



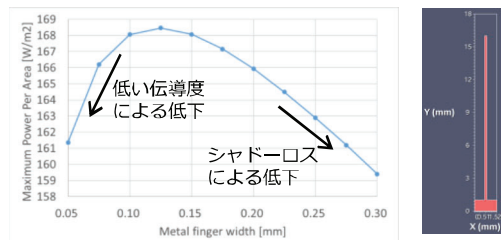
タンデム型太陽電池 活性層吸収率

Laoss

太陽電池パネルにおいて発生する電極の電圧降下などをシミュレーションできるソフトウェアです。透明電極に設けた金属電極幅の最適化を行うこともできます。



太陽電池パネル表面の電位分布(左：補助電極あり 右：補助電極なし)
補助電極の導入により、電位分布が減少



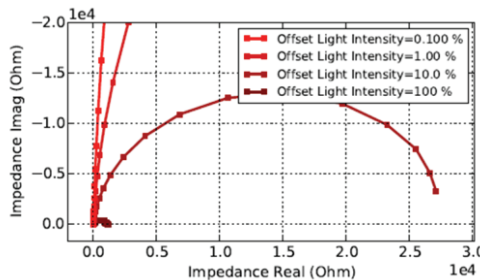
太陽電池最大電力のフィンガー電極幅依存性

Paios

IV特性をはじめ、過渡光電流や過渡光電圧、インピーダンス分光やCELIVなど、1台で様々な光・電気信号を印加した実験を行うことができます。モジュール追加により、単色LED光を照射する測定や温度依存性の測定も可能です。



装置外観(1台で様々な測定が可能)



インピーダンス分光測定結果例

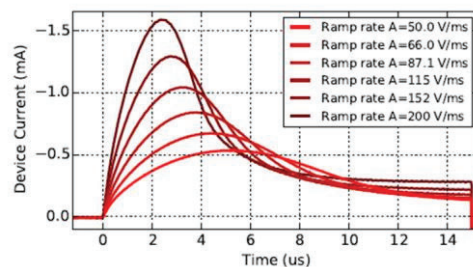


Photo-CELIV測定結果例

サイバネットシステム株式会社
CAE第2事業部

101-0022 東京都千代田区神田練塀町3 富士ソフトビル
TEL : 03-5297-3081 E-mail : optsales@cybernet.co.jp
<https://www.cybernet.co.jp/optical/>





Different Greatness in Simplicity Different from Nature



22.53%

Efficiency

87%–92%

High bifacial rate

PID

No PID

3₊%

Lower LCOE
Decrease 3+ %



Lower temperature
coefficient
Decrease 2.96%

10₊%

Higher power gen-
eration
Improve 10+%

9.6%

Higher IRR
Up to 9.6%

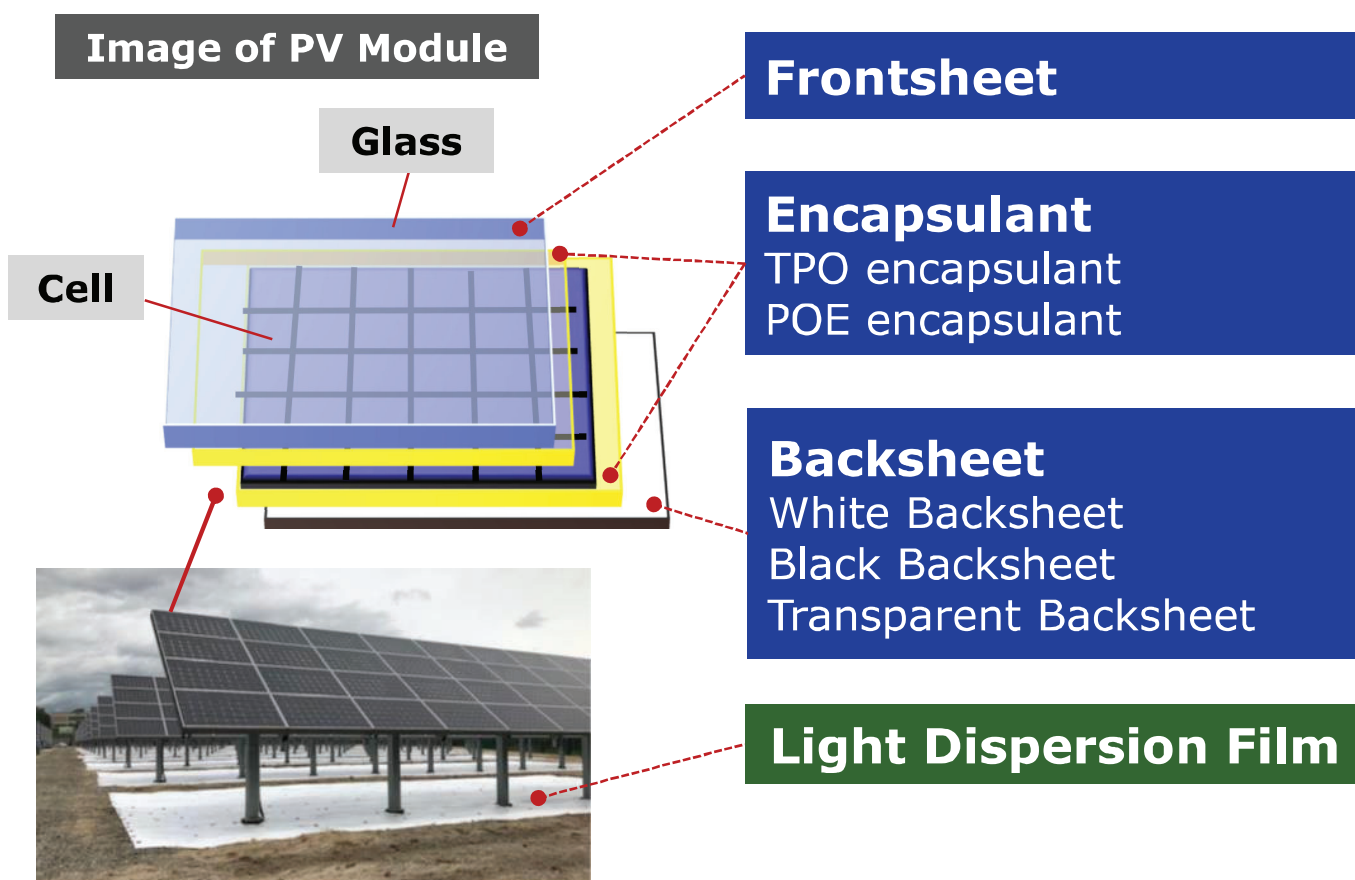
≤ 1%

Lower degradation
First year ≤1%
Annual -0.25%



Tel: 0512 8255 7328 Email: modulesales@akcome.com

Website: www.akcome.com/module



Frontsheet

- High optical transmittance, long-term reliability

Encapsulant

- High optical transmittance, long-term reliability, PID-free
(Without generating acidic gas, low water vapor permeability)

Backsheet

- White Backsheet: Long-term reliability
- Black Backsheet: Power generation improvement by reflecting infrared
- Transparent Backsheet: High optical transmittance, long-term reliability

Light Dispersion Film

- Power generation improvement by increasing albedo
(Combination use of bifacial module and the Light Dispersion Film)



Dai Nippon Printing Co., Ltd.

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