TECHNICAL PROGRAMME

• Opening, Keynote and Plenary Speeches
• Oral Presentation Session
• Poster Presentation Sessions
Monday, November 4
08:30-12:10
Golden Hall, 1F, Qujiang International Conference Center

OPENING
Chairman: Ying Zhao
Professor, Nankai University, China

08:30-09:00
Opening and Welcome Address
Baoshan Li
Vice Chair, China Renewable Energy Society, China
Xuqun You
President, Shaanxi Normal University, China

Opening Speech from National Energy Agency of China (NEA), Ministry of Industry and Information Technology of China (MIIT), Ministry of Science and Technology of China (MOST)

Welcome Address from LONGi, TBEA, China

09:00-09:20
PVSEC Award Ceremony
Chairman: Honghua Xu
Vice Chair, China Renewable Energy Society, China

KEYNOTE & PLENARY
Chairman: Shengzhong Liu
Professor, Shaanxi Normal University, China

09:20-09:50
KEYNOTE: Sun Culture and Solar Technologies in Ancient China
Hui Shen
Professor, Sun Yat-sen University, China

09:50-10:15
Plenary: PV - From Technology to The Energy System - Latest Insights by IEA PVPS
Stefan Nowak
Chairman, IEA PVPS
10:15-10:40  
**Plenary: China PV Development Status and Future Energy Revolution Vision**  
Zhongying Wang  
Director, China National Renewable Energy Center, China

10:40-11:05  
**Plenary: Environmental and Ecological Impacts of Wind-Photovoltaic-Hydro-Storage Complementary Energy and Large-Scale Photovoltaic Power Stations**  
Xiaoping Xie  
Chairman, Yellow River Upstream Hydropower Development Co., Ltd, China

11:05-11:15  
Coffee Break

11:15-11:45  
**KEYNOTE: What Comes after PERC?**  
Martin A. Green  
Professor, University of New South Wales (UNSW), Australia

11:45-12:10  
**Plenary: Efficient and Stable Perovskite Solar Cells**  
Jingbi You  
Professor, Institute of Semiconductors, Chinese Academy of Sciences, China

**Tuesday, November 5**  
**08:30-12:15**  
Golden Hall, 1F, Qujiang International Conference Center

Chairman: Dengyuan Song  
CTO, Yingli Solar, China

08:30-08:55  
**Plenary: Silicon Photovoltaics - New Opportunities for an Old Technology**  
Stefan W. Glunz  
Professor, Fraunhofer Institute for Solar Energy Systems

08:55-09:20  
**Plenary: Recent Key Technology Progresses and Issues in Crystalline Silicon Wafers for Solar Cells**  
Yuepeng Wan  
CTO, GCL-Poly Energy Holdings Limited, China
09:20-09:45
Plenary: Recent Improvements in Research and Industrialization of Front and Back-contacted Solar Cells and Modules Using Low-temperature Passivating Contacts
Christophe Ballif
Professor, EPFL, Switzerland

09:45-10:05
Plenary: Power, Peak, Cost Valley - Innovation LCOE Solution
Jun Lv
Vice President, Longi Solar Technology Co., Ltd., China

10:05-10:25
Plenary: Passive Damping Scheme Design for Multiple Grid-Connected Photovoltaic Inverters with a Common Capacitor
Hongwei Zhou
CTO, TBEA XINJIANG SUNOASIS CO., LTD., China

10:25-10:35
Coffee Break

Chairman: Zhiqiang Feng
Vice President, Trina Solar, China

10:35-11:00
Plenary: Recent Progress and Future Prospects of CIS-based Thin-film Solar Cell Technology – High Efficiency and New Applications
Takuya Kato
Chief Researcher, Idemitsu Kosan Co., Ltd., China

11:00-11:25
Plenary: CdTe and 1.7 eV MgCdTe Solar Cells and A Liftoff Technology Using Water-soluble Sacrificial Layers
Yong-Hang Zhang
Professor, Arizona State University, USA

11:25-11:50
Plenary: Super-high Efficiency III-V Multi-junction and Concentrator Solar Cells, and PV-powered Vehicle Applications
Masafumi Yamaguchi
Professor, Toyota Technological Institute, Japan

11:50-12:15
Plenary: Systematic Study on Potential-induced Degradation of N-type Crystalline Si Photovoltaic Modules
Keisuke Ohdaira
Professor, Japan Advanced Institute of Science and Technology, Japan
MONDAY, NOVEMBER 4

**ORAL PRESENTATION**

Monday, November 4, Room 402

**Area 2 Perovskite Solar Cells**

Session Chair: Xiaodan Zhang, Janwon Seo

**INVITED SPEECH**

13:30-13:50
*Interfacial Layers for Efficient and Stable Perovskite Solar Cells*

Jangwon Seo
Korea Research Institute of Chemical Technology (KRICT), Korea

13:50-14:10
*MATERIALS ENGINEERING FOR EFFICIENT STABLE Pb-FREE PEROVSKITE PHOTOVOLTAICS*

Yuanyuan Zhou
Brown University, USA

**ORAL PRESENTATION**

14:10-14:25
*Interfacial Engineering of Perovskite Solar Cell with Efficient Electron Transport Layers*

Molang Cai
North China Electric Power University, China

14:25-14:40
*ION MIGRATION STUDY AND INTERFACIAL ENGINEERING TOWARD OPERATIONALLY STABLE PEROVSKITE SOLAR CELLS*

Qing Zhao
Peking University, China

14:40-14:55
*Perovskite: The Control of Phase Transformation*

Kui Zhao
ShaanXi Normal University, China

14:55-15:10
*Multifunctional Passivator with Carboxyl Groups for Planar Perovskite Solar Cells*

Xiaoqiang Shi, Xuepeng Liu, Yong Ding, Molang Cai, Songyuan Dai
North China Electric Power University, China

15:10-15:25
*Functional Interfacial Modification by PTAA for Enhanced Efficiency and Stability of Planar Perovskite Solar Cells*

Yuelong Li, Xuepeng Liu, Fuhua Hou, Yong Ding, Ying Zhao, Xiaodan Zhang
Nankai University, China
15:25-15:40
Thiocyanate Assisted Nucleation for Perovskite Solar Cell by Gas-Quenched Deposition
Haimang Yi, Leiping Duan, Faiazul Haque, Gavin Conibeer, Ashraf Uddin
University of New South Wales, Australia

15:40-15:55
Surface Passivation of Perovskite Film for Efficient Solar Cells
Yang Zhao, Qiufeng Ye, Zema Chu, Feng Gao, Jingbi You
Institute of Semiconductors, Chinese Academy of Sciences, China

Monday, November 4, Room 308
Area 3 Organic Solar Cells
Session Chair: Jianhui Hou

INVITED SPEECH
13:30-13:50
Organic Solar Cells as A Next Generation Green Energy Source
Han Young Woo
Department of Chemistry, College of Science, Korea University, Korea

13:50-14:10
Efficient Flexible Organic Solar Cells
Ziyi Ge
Ningbo Institute of Materials Tecnology & Engineering, Chinese Academy of Sciences, China

ORAL PRESENTATION
14:10-14:22
Time-Resolved Microwave Conductivity Measurements for Organic Solar Cell Materials
Supriya Pillai\textsuperscript{1,2}, Nikos Kopidakis\textsuperscript{2}, Chao Wang\textsuperscript{3}, Mats Anderson\textsuperscript{4}, Christopher McNeill\textsuperscript{3}
\textsuperscript{1}University of New South Wales (UNSW), Australia
\textsuperscript{2}Macquarie University, Australia
\textsuperscript{3}Monash University, Australia
\textsuperscript{4}Flinders University, Australia

14:22-14:34
AMANDA - A Platform for Automatic and Autonomous Research on Printed Semiconductors
Tobias Stubhan\textsuperscript{1}, Christian Berger\textsuperscript{1}, Jerrit Wagner\textsuperscript{1}, Jens Hauch\textsuperscript{1}, Prof. Dr. Christoph J. Brabec\textsuperscript{1}
\textsuperscript{1}Helmholtz Institute Erlangen-Nuremberg, Germany

14:34-14:46
Stability Improvement in Organic Solar Cells with Annealed Pentacene/Gold Anode Buffer
Kenji Harafuji\textsuperscript{1}, Takahiro Okada\textsuperscript{1}
\textsuperscript{1}Ritsumeikan University, Japan
INVITED SPEECH
14:46-15:06
Development of High Performance Polymers for Applications to Highly Reliable Large-Area Organic Solar Cells
Hae Jung Son
Photo-electronic Hybrids Research Center, Korea Institute of Science and Technology (KIST)

15:06-15:26
Interface Engineering and Optical Coupling for Highly Efficient Semitransparent Inverted Polymer Solar Cells
Yinhua Zhou
HUST (Huazhong University of Science and Technology)

ORAL PRESENTATION
15:26-15:38
Entropy Promotes Charge Separation in Bulk Heterojunction Organic Photovoltaics
Eisuke Kawashima1, Mikiya Fujii1, Koichi Yamashita2
1The University of Tokyo, Japan
2Kyoto University, Japan

15:38-15:50
Energy Distributions of Charge Transfer State in Organic Photovoltaics
Zilong Zheng1, Wencai Zhou1, Yongzhe Zhang1
1Beijing University of Technology, China

15:50-16:02
10cm² Nonfullerene Solar Cells with Efficiency over 10% Using An Ultrathin Silver Electrode with A 4-nm Percolation Threshold Thickness
Xueshi Jiang1, Yinhua Zhou1
1Huazhong University of Science and Technology, China

Monday, November 4, Room 306
Area 6 Silicon Feedstock & Wafers
Session Chair: Yuepeng Wan, Reimann

INVITED SPEECH
13:30-13:50
Crystal Growth of CZ-Si for High Efficiency Cells: Learn Lessons from the Past
Koichi Kakimoto
Research Institute for Applied Mechanics, Kyushu University, Japan

13:50-14:10
Defect Engineering of Cast Silicon Crystal
Xuegong Yu
Zhejiang University, China
ORAL PRESENTATION

14:10-14:25
Production of High Performance Multi-Crystalline Silicon Ingots for PV Application by Using Contamination-Free Sixny Seed Particles
Christian Reimann
Fraunhofer IISB, Germany

14:25-14:40
Influence of Temperature Gradient at Solid/Liquid Interface on the Defect Propagation in High-Performance Mc-Si Ingot Growth
Zhiqiang Zhang¹, Xuegong Yu¹, Shuai Yuan¹, Hao Jin², Qi Wang², Deren Yang¹
¹Zhejiang University, China
²Jinko Solar, China

14:40-14:55
Quantitative Evaluation of Electrical Characteristics of Inclined Grain Boundaries in Multicrystalline Silicon by Photoluminescence Imaging and Finite Element Simulation
Kazuki Mitamura¹, Kentaro Kutsukake¹, Takuto Kojima², Noritaka Usami¹
¹Graduate School of Engineering, Nagoya University
²Center for Advanced Intelligence Project, RIKEN

14:55-15:10
Transient Global Modeling of Oxygen and Carbon Segregations During the Pulling Process of Czochralski Silicon Crystal Growth
Xin Liu, Hirofumi Harada, Yoshiji Miyamura, Xue-feng Han, Satoshi Nakano, Shin-ichi Nishizawa, Koichi Kakimoto
Research Institute for Applied Mechanics, Kyushu University, Japan

15:10-15:25
Numerical Analysis on Asymmetric Phenomenon in the 200 mm (8 inch) Floating Zone Silicon
Xuefeng Han, Satoshi Nakano, Xin Liu, Hirofumi Harada, Yoshiji Miyamura, Koichi Kakimoto
Kyushu University, Japan

15:25-15:40
Numerical Analysis of the Effect of Seed Crystal on Dislocation Density in Si Crystal for Solar Cells
Satoshi Nakano, Xin Liu, Xuefeng Han, Koichi Kakimoto
Kyushu University, Japan

15:40-15:55
Numerical Analysis and Optimization of Gas Flow and Impurity Control in Directional Solidification Multi-crystalline Silicon
Wenjia Su, Chen Li
Jiangsu University, China
Monday, November 4, Room 313

Area 10 Performance and Reliability of PV Module

Session Chair: Zhang Zhen

INVITED SPEECH
13:30-13:50
Corrosion Mechanisms of the Front-Side Metallization by High-Temperature High-Humidity Test on Crystalline Si PV Module
Taeko Semba
NAMICS Corporation, Japan

ORAL PRESENTATION
13:50-14:05
Effect of High Wind Speed Dust on Silicon Photovoltaic Modules Performance
Chengying Shi
Telecommunication Technology Labs, China

14:05-14:20
Thermomechanical Stress in Glass-Glass Modules of Half Silicon Solar Cells Interconnected by Conventional Tabbing
Pei-Chieh Hsiao¹, Zhimeng Wang¹, Ning Song¹, Yang Li¹, Zi Ouyang¹, Chen Zhu², Jun Lv², Canjun Shen², Cheng Chen², Guoqing Chen², Xueqing Zhang³, Alison Lennon¹
¹School of Photovoltaics and Renewable Energy Engineering, UNSW, Australia
²LONGi Solar Technology Co, Chian
³Hebei Sizhuo Photovoltaic Technology Co, China

14:20-14:35
Performance Monitoring of PV Modules and Arrays for Reliability Evaluation
Yoshihiro HISHIKAWA¹, Masahiro Yoshita¹, Takakazu Takenouchi¹, Michiya Higa¹, Manit Seapan², Keiichi Okajima²
¹AIST, Japan
²University of Tsukuba, Japan

14:35-14:50
The Irradiance Mismatch Effects on the Performance of Bifacial Photovoltaic Modules
Yating Zhang¹, Qi Gao², Youlin Yu³, Fanying Meng¹, Zhengxin Liu¹
¹Shanghai Institute of Microsystem and Information Technology (SIMIT), Chinese Academy of Sciences (CAS) University of the Chinese Academy of Sciences, China
²Shanghai Institute of Microsystem and Information Technology (SIMIT), Chinese Academy of Sciences (CAS), China
³Shanghai Institute of Microsystem and Information Technology (SIMIT), Chinese Academy of Sciences (CAS) ShanghaiTech University, China
14:50-15:05
Thermal Management of PV Modules: Passive Cooling Solutions for Front and Back Surfaces
Juan Camilo Ortiz Lizcano
Delft University of Technology, Netherland

15:05-15:20
Study on Simulation and Optimization for output Characteristics of Bifacial PV Modules Based on Outdoor Empirical Tests
Yunlin Sun1, Siming Chen2, Rongrong Chen2, Bingzhi Li2
1ShunDe SYSU Institute for Solar Energy, Guangdong HuaJu Testing Tech. Co., Ltd, China
2Guangdong HuaJu Testing Tech. Co., Ltd, China

15:20-15:35
Impact of (Multi-) Busbar Design in Full and Halved Cell Modules on the Cell-to-Module Yield under Realistic Conditions
Marco Ernst1, Ingrid Haedrich, Yang Li2, Alison Lennon2
1Australian National University, Australia
2University of New South Wales, Australia

15:35-15:50
Physical Mechanism and Temperature Control of Shaded Solar Cell Hot-Spot
Peide Han, Huixue Ren, Cong Gao
Institute of Semiconductors, Chinese Academy of Sciences, China

Monday, November 4, Room 311
Area 13 PV Energy Storage and Novel PV Application
Session Chair: Xiaoliang Wei, Baoguo Wang

INVITED SPEECH
13:30-13:50
Flow Battery for Large Scale Energy Storage
Huamin Zhang
Dalian Institute of Chemical Physics China Academy of Sciences (DICP), China

13:50-14:10
Research on the Electrode of High-Power-All-Vanadium Redox Flow Batteries
Xiongwei Wu
Hunan Agricultural University, China

14:10-14:30
Organic Redox Flow Batteries for Next-Generation Grid Energy Storage
Xiaoliang Wei1, Wei Wang2, Lu Zhang3, Zhengcheng Zhang3
1Indiana University-Purdue University Indianapolis (IUPUI), India
2Pacific Northwest National Laboratory, USA
3Argonne National Laboratory, USA
ORAL PRESENTATION

14:30-14:45

Standardization Discussions for the Car-Roof PV – Starting Two Years Ago, and What We Have Achieved Since Then
Kenji Araki¹, Liang Ji², George Kelly³, Emilio Agudo⁴, Ignacio Anton⁵, Mathieu Baudrit⁶, Anna Carr⁷, Rebeca Herrero⁸, Sarah Kurtz⁹, Zhengxin Liu⁹, Moritz Limpinsel¹⁰, Zhonglin Lu¹¹, Mauro Pravettoni¹², Kensuke Nishioka¹³, Yasuyuki Ota¹³, Paul Robusto¹⁴, Hiromi Tobita¹⁵, Qian Wu¹⁶, Zhenyu Wu¹⁶, Sewang Yoon¹⁷, Masahiro Yoshita¹⁸, Masafumi Yamaguchi¹¹

¹Toyota Technological Institute, Japan
²UL, USA
³Sunset technology, USA
⁴Solar Added Value (SAV), Spain
⁵Instituto de Energia Solar-Universidad Politécnica de Madrid, Spain
⁶Sono Motors GmbH de'guo Germany
⁷TNO, Holland
⁸University California Merced, Merced, USA
⁹SIMIT Chinese Academy of Sciences, Shanghai, China
¹⁰Alta Devices, USA
¹¹Nanjing Sunport Power Corp, China
¹²Solar Energy Research Institute of Singapore, National University of Singapore, Singapore
¹³University of Miyazaki, Japan
¹⁴Miasolé Hi-Tech Corp. USA
¹⁵Japan Electrical Safety & Environment Technology Laboratory (JET), Japan
¹⁶Hanergy Mobile Energy Holding Group, China
¹⁷TS Corporation, Seoul, North Korea
¹⁸AIST, Japan

14:45-15:00

Product Development and Characterization for Building Integrated Photovoltaics as A Future GW Market
Joerg Palm, Jochen Weick, Lutz Tautenhahn, Peter Borowski, Manfred Kitze, Stefan Grünsteidl
AVANCIS GmbH, Germany

15:00-15:15

A Brand New Whole-Roof-Integrated Solar System
Xiaowei Nie, Jicai DING, Xiaowei NIE, Shanlong LOU, Yan LIN
Yantai DingCheng New Energy Co. Ltd.

15:15-15:30

Home/Building Island Nano-Grid For 100% Renewable Clean Energy and 3 Years Payback
John Borland
J.O.B. Technologies, USA
15:30-15:45
Estimation of the Annually Angular Distribution of Solar Irradiance onto the Vehicle Using Shading Model
Yasuyuki Ota, Kenji Araki, Masafumi Yamaguchi

1University of Miyazaki, Japan
2Toyota Technological Institute, Japan

15:45-16:00
Research on Household Energy Storage System Based on Droop Control
Xunbo Fu1, Zhiran Dong1, Hongwei Liu1, Wenhui Shi2, Zhankui Zhang2

1Beijing Corona Science & Technology Co. Ltd, China
2State Key Laboratory of Operation and Control of Renewable Energy & Storage Systems, China Electric Power Research Institute.
Area 1 Advanced Concepts and New Emerging Materials for Future PV
Session Chair: Jiang Tang

INVITED SPEECH
13:30-13:50
Study on Highly Stable and Efficiency Perovskite Solar Cells
Wenhua Zhang
Institute of chemical materials, China academy of engineering physics

13:50-14:10
Solution Processed High Efficiency Thin Film Sb$_2$(S, Se)$_3$ Solar Cells
Tao Chen, Xiaomin Wang, Chunyan Wu
University of Science and Technology of China (USTC), China

ORAL PRESENTATION
14:10-14:25
Alcohol Vapor Post-Annealing for Highly Efficient Sb$_2$S$_3$ Planar Heterojunction Solar Cells
Xuanhua Li
Northwestern Polytechnical University, China

14:25-14:40
PbS Quantum Dot/ZnO Nanowire Solar Cells with High Infrared Spectral Sensitivity
Haibin Wang
RCAST, The University of Tokyo, Japan

14:40-14:55
Epitaxial Growth of BaSi$_2$ Thin Films by Sputtering for Solar Cell Applications
Rui Du, Kaiwen Yang, Yiwen Zhang, Weijie Du
Shanghai Normal University, China

14:55-15:10
Close-spaced Evaporation: Scalable Technique for BaSi$_2$ Film Deposition
Kosuke O. Hara$^1$, Shuhei Takizawa$^1$, Noritaka Usami$^2$, Junji Yamanaka$^1$, Keisuke Arimoto$^1$
$^1$University of Yamanashi, Japan
$^2$Nagoya University, Japan
15:10-15:25
Low Temperature Silver Nanowires as Transparent Conducting Layer for Solar Cells
Supriya Pillai\textsuperscript{1}, Martin Green\textsuperscript{1}, Supriya Pillai\textsuperscript{1,2}
\textsuperscript{1}University of New South Wales, Australia
\textsuperscript{2}Macquarie University, Australia

15:25-15:40
9.2\%-efficient Core-shell Structured Antimony Selenide Nanorod Array Solar Cells
Xiaoyang Liang\textsuperscript{1}, Li Ziqiang\textsuperscript{1}, Liang Xiaoyang\textsuperscript{1}, Guo Chunsheng\textsuperscript{1}, Liu Tao\textsuperscript{1},
Liu Yufan\textsuperscript{1}, Mai Yaohua\textsuperscript{2}
\textsuperscript{1}Hebei University, China
\textsuperscript{2}Jinan University, China

15:40-15:55
Effect of Narrow Bandpass Filtering in Heat Recovery (HERC) Solar Cell
Kenji Kamide\textsuperscript{1}, Toshimitsu Mochizuki\textsuperscript{1}, Hidefumi Akiyama\textsuperscript{2}, Hidetaka Takato\textsuperscript{1}
\textsuperscript{1}National Institute of Advanced Industrial Science and Technology (AIST), Japan
\textsuperscript{2}The University of Tokyo, Japan

Tuesday, November 5, Room 405
Area 4 Thin-film Compound Semiconductor PV
Session Chair: Xudong Xiao, William Shafarman

INVITED SPEECH
13:30-13:50
Actively Control the Energy Bandgap Grading of Light Absorber in Cu(InGa)Se\textsubscript{2} Solar Cells
Xudong Xiao
The Chinese University of Hong Kong, China

13:50-14:10
Advances in Alloying and Bandgap Control for CIGS Solar Cells
William Shafarman
University of Delaware, USA

ORAL PRESENTATION
14:10-14:25
High Efficiency Ag-Alloyed CIGS Process Development at MiaSolé Hi-Tech
Dmitry Poplavskyy, Neil Mackie, Xinxuan Tan, Atyie Bayman, Nanke Jiang
Miasole Hi-Tech Corp, USA

14:25-14:40
High-Performance Near-Stoichiometric Cu(\textit{In, Ga})(\textit{Se, S})\textsubscript{2} Solar Cells by Sub-Percent Ag-Doping
Hiroki Sugimoto, Hiroshi Tomita, Koji Yamaguchi, Yoshiaki Hirai, Takuya Kato
Advanced Technology Research Laboratories, Idemitsu Kosan Co., Ltd., Japan
14:40-14:55
Epitaxial Cu(In, Ga)Se₂ Solar Cells on p-type GaAs Substrates
Jiro Nishinaga, Takeyoshi Sugaya
AIST, Japan

14:55-15:00
Break

15:00-15:15
Impact of Alkali Treatment in Cu(In, Ga)(S, Se)₂ on Its Quality and Carrier Recombination
Jakapan Chantana¹, Yu Kawano¹, Takahito Nishimura¹, Yoshinori Kimoto², Takuya Kato²,
Hiroki Sugimoto², Takashi Minemoto¹
¹Ritsumeikan University, Japan
²Showa Shell Sekiyu K. K., Japan

15:15-15:30
Optimization of Ag-based Reflective Back Mirrors for Ultrathin Cu(In, Ga)Se₂-Based Solar Cells
Louis Gouillart¹, Wei Chao Chen², Andrea Cattoni¹, Julie Goffard¹, Lars Riekher²,
Marie Jubault³, Negar Naghavi⁴, Marika Edoff², Stéphane Collin⁵
¹C2N, France
²Ångström Solar Centre, Sweden
³EDF, France
⁴IPVF, France
⁵C2N, USA

15:30-15:45
Dielectric-Based Surface Passivation for Thin Film Photovoltaics, What Can We Expect in the Near Future?
Bart Vermang
Imec / UHasselt / EnergyVille, Belgium

15:45-16:00
Adjustment of the Ga Grading in Cu(In, Ga)Se₂ Thin Films at Low-Temperature Deposition Process
Wei Liu
Institute of Photoelectronic Thin Film Devices and Technology of Nankai University,
Key Laboratory of Photoelectronic Thin Film Devices and Technology of Tianjin, Nankai University, Tianjin 300071, P. R. China.
Tuesday, November 5, Room 306

**Area 6 Silicon Feedstock & Wafers**

Session Chair: Xuegong Yu, Noritaka Usami

**INVITED SPEECH**

13:30-13:50

*Ultra-high Bulk Carrier Lifetime Measurement in Crystalline Silicon*

**John Murphy**

University of Warwick, UK

**ORAL PRESENTATION**

13:50-14:05

*The Effect of DB on Minority Carrier Lifetime Improvement of Seed Assisted Cast Silicon Ingot*

**Huali Zhang**

GCL Jiangsu Silicon Materials, China

14:05-14:20

*Defect Filtering Effect in Cast Mono-Like Silicon*

**Yuan Shuai ¹, Xuegong Yu ¹, Dongli Hu ², Xiaodong Zhu ¹, Hangfei Li ¹, Liang He ³, Hongrong Chen ², Hongzhi Luo ³, Yunfei Xu ³, Deren Yang ¹**

¹Zhejiang University, China ²Jiangsu GCL Silicon Material Technology Development Co., Ltd., China ³LDK Solar Co. Ltd., China

14:20-14:35

*The Effect of Temperature on Iron Detection in Crystalline Silicon by Carrier Lifetime Measurements*

**Xiaodong Zhu, Shuai Yuan, Xuegong Yu, Deren Yang**

Zhejiang University, China

14:35-14:50

*Onset of Ring Defects in n-type Czochralski Silicon*

**Rabin Basnet ¹, sieu Pheng Phang ¹, Christian Samundsett ¹, Di Yan ¹, Wenshenf Liang ¹, Chang Sun ¹, Stephane Armand ¹, Fiacre E. Rougieux ², Daniel Macdonald ¹**

¹The Australian National University, Australia ²University of New South Wales, Australia

14:50-15:05

*Towards 22.1% conversion efficiency using new generation low dislocation cast mono wafer*

**Zhenzhong Zhang**

Rietech new energy science & technology, China
15:05-15:20
Design and Numerical Optimization on Spray-type Gas Guidance System in Multicrystalline Silicon Furnace  
Wenjia Su, Chen Li  
Jiangsu University, China

15:20-15:35
Characterization of Bendable Crystalline Si Solar Cells Made by Ultra-thin Wafer Slicing  
Noboru Yamada¹, Kohei Onishi², Ryo Yokogawa², Tappei Nishihara², Takefumi Kamioka²,  
Kyotaro Nakamura³, Tomoyuki Kawatsu⁴, Toshiki Nagai⁴, Yuya Kotake¹, Yukio Miyashita¹,  
Yoshio Ohshita³, Atsushi Ogura²  
¹Nagaoka University of Technology, Japan  
²Meiji University, Japan  
³Toyota Technological Institute, Japan  
⁴Komatsu NTC Ltd., Japan

15:35-15:50
Alternative Mono Crystalline Si Wafers for A Sustainable PV Market Growth  
Stefan Janz, Stephan Riepe  
Fraunhofer ISE, Germany

15:50-16:05
Demonstration of A Potential Closed-Loop Approach to Recycle End-Of-Life Silicon Photovoltaic Modules  
Rong Deng, Marina Monteiro Lunardi, Jingjia Ji, Chee Mun Chong  
University of New South Wales, Australia

Tuesday, November 5, Room 311
Area 8 Thin Film, IBC and HIT Solar Cells  
Session Chair: Zhengxin Liu, Daisuke Adachi

INVITED SPEECH
13:30-14:00
Silicon Heterojunction Technology Rising up to Progressive PV Industry Adoption: Myth or Reality?  
Ribeyron Pierre-Jean  
CEA-INES, France

ORAL PRESENTATION
14:00-14:15
Defect Engineering for Silicon Heterojunction Solar Cells  
Matthew Wright¹, Daniel Chen¹, Anastasia Soeriyadi¹, Bruno Vicari stefani¹,  
Moonyong Kim¹, Brett Hallam¹  
¹University of New South Wales (UNSW), Australia
14:15-14:30
ASA Software for Opto-Electrical Simulation of Silicon, CIGS and Perovskite Solar Cells
Rudi Santbergen¹, Carlos Ruiz Tobon¹, Paul Procel Moya¹, Manvika Singh¹,
Nasim Rezaei², Andres Calcabrini³, Miro Zeman¹, Olindo Isabella¹
¹Delft University of Technology, Holland

14:30-14:45
New Analysis Method to Evaluate Amorphous/Crystalline Si Interface for High Efficiency Heterojunction Solar Cells
Takefumi Kamioka¹, Yutaka Hayashi², Kazuhiro Gotoh³, Ryo Ozaki², Motoo Morimura²,
Ayako Shimizu³, Kyotaro Nakamura², Noritaka Usami³, Yoshio Ohshita², Atsushi Ogura¹
¹Meiji University, Japan
²Toyota Technological Institute Japan
³Nagoya University, Japan

14:45-15:00
Origins of Hydrogen for Bulk Defect Passivation in Silicon Heterojunction Solar Cells
Chang Sun¹, William Weigand², Daniel Chen³, Jianwei Shi², Rabin Basnet¹,
Zhengshan Yu², Sieu Pheng Phang¹, Zachary C. Holman², Brett Hallam³,
Daniel Macdonald¹
¹The Australian National University, Australia
²Arizona State University, USA
³University of New South Wales, Australia

15:00-15:15
Novel High-mobility IFO:H Film for Passivating Contacts in c-Si Solar Cells
Can Han¹, Luana Mazzarella¹, Yifeng Zhao¹, Guangtao Yang¹, Paul Procel¹,
Martijn Tijsen¹, Ana Montes¹, Luca Spitaleri², Antonino Gulino², Xiaodan Zhang³
Olindo Isabella¹, Miro Zeman¹
¹Delft University of Technology, Netherlands
²University of Catania, Italy
³Nankai University, China

15:15-15:30
Optimized a-Si:H(i)/c-Si Interface Passivation and Band Alignment Via Hydrogen Dilution Treatment for Rear-Emmitter Silicon Heterojunction Solar Cells
Zhuopeng Wu¹, Liping Zhang¹, Rengfang Chen¹, Zhenfei Li¹, Fanying Meng¹,
Zhengxin Liu¹
¹Shanghai Institute of Microsystem and Information Technology, China

15:30-15:45
Study of the Various P-Type Material Rear Emitter Optimization for High Efficient Bifacial Rear Emitter Heterojunction Cells
Sangho Kim¹, Eun-chel Cho¹, Young Hyun Cho¹, Youngkuk Kim¹, Jinjoo Park²,
Sunhwa Lee¹, Pham Duy Phong¹, Donghyun Oh¹, Junsin Yi¹
¹Sungkyunkwan University, Korea
²Cheongju University, Korea

15:45-16:00
Low Reflective Index Interlayer in Microcrystalline Silicon Oxide Front Contact Layers for Silicon Heterojunction Solar Cells
Chen-Wei Peng¹, Juyun Wang¹, Chao Lei², Wei Long¹, Cao Yu¹, Jingquan Zhang², Xixiang Xu¹
¹Hanergy Thin Film Power Group, China
²Sichuan University, China

Tuesday, November 5, Room 308
Area 9 Topcon Solar Cells
Session Chair: Jin Hao

INVITED SPEECH
13:30-13:50
Passivating Contacts for Silicon Solar Cells Based on Physical Vapour Deposition of Doped Silicon Films
Di Yan, Andres Cuevas, Sieu Pheng Phang, Yimao Wan, Wenjie Yang, Daniel Macdonald
Research School of Electrical, Energy and Materials Engineering, The Australian National University, Australia

13:50-14:10
Silicon-Based Carrier-Selective Passivating Contacts for High-Efficiency C-Si Solar Cells
Olindo Isabella
Delft University of Technology, Holland

ORAL PRESENTATION
14:10-14:25
Ultra-thin poly-Si Passivating Contacts for c-Si Solar Cells
Guangtao Yang¹, Paul Procel¹, Can Han¹, Luana Mazzarella¹, Manvika Singh¹, Arthur Weeber¹, Olindo Isabella¹, Miro Zeman¹
¹Delft University of Technology, Netherland

14:25-14:40
Mass Production of Low Cost Polysi Passivating Contacts N-Type Solar Cells
Zhang Wei¹, Wang Ziqian¹, Lang Fang¹, Ma Hongna¹, Zhang Wenhui¹, Li feng¹
¹Yingli Energy (China) Co., Ltd, China

14:40-14:55
Approaching 23% Cell Efficiency with Meyer Burger Single Side Passivated Contact Technology
Dirk Landgraf
Meyer Burger (Germany) GmbH, Germany
14:55-15:10
Band Bending at the TiO2 Electron-Selective Contact/n-Si Interface Directly Observed by Hard X-ray Photoelectron Spectroscopy
Hyunju Lee1, Takefumi Kamioka2, Atsushi Ogura2, Yoshio Ohshita1
1Toyota Technological Institute, Japan
2Meiji University, Japan

15:10-15:25
Development of Thin Poly-SiCx Passivating Contacts for c-Si Solar Cells
L. Mazzarella, Antonios Mandrampazakis1, Can Han2, Paul Procel1, Yifeng Zhao1, Guangtao Yang1, Arthur Weeber3, Olindo Isabella1, Miro Zeman1
1Delft University of Technology, Netherlands
2Delft University of Technology, Nankai University, Shenzhen Institute of Wide bandgap Semiconductors, Netherlands
3Delft University of Technology, ECN.TNO Solar Energy, Netherlands

15:25-15:40
Dopant Diffusion Through Pinholes and Continuous Oxide Layers in N-Type Polysilicon on Oxide (POLO) Passivating Contacts
Jan Krügener1, Felix Haase2, Christina Hollemann2, Robby Peibst2, Hans-Jörg OSten3, 1Institute of Electronic Materials and Devices, Germany
2Institute for Solar Energy Research in Hamelin, Germany
3Institute of Electronic Materials and Devices; Laboratory of Nano and Quantum Engineering, Germany

15:40-15:55
Development of Ultra-thin Doped Poly-Si Layers for Passivated Contact Solar Cell Applications
Xia Yan, Ning CHEN1, Firdaus Bin SUHAIMI1, Menglei XU2, Jie YANG2, Xinyu ZHANG2, Qi WANG2, Hao JIN2, Shanmugam VINODH1, Shubham DUTTAGUPTA1
1SERIS, Singapore
2Jinko, China
ORAL PRESENTATION

Wednesday, November 6, Room 402

Area 2 Perovskite Solar Cells
Session Chair: Baomin Xu, Hairen Tan

INVITED SPEECH
08:30-08:50
Efficient and Stable Perovskite Solar Cell and Module
Liyuan Han
Shanghai Jiao Tong University, China

ORAL PRESENTATION
08:50-09:05
Fabricating Wide Bandgap Perovskite Solar Cells through Thermal Evaporating Method
Yong Peng, Zhiliang Ku, Yi-bing Cheng
Skate Key lab of Advanced Technology for Materials Synthesis and Processing, Wuhan University of Technology, China

09:05-09:20
Constructing a "litchi array" - Like Textured Perovskite Absorber with Excellent Light Harvesting in Planar Perovskite Solar Cells
Lin Fan, Pengfei Wang, Lili Yang, Fengyou Wang, Xiaoyan Liu, Maobin Wei, Huilian Liu, Jinghai Yang
Key Laboratory of Functional Materials Physics and Chemistry of the Ministry of Education, China.

09:20-09:35
Current Matching in Monolithic Two-terminal Perovskite/Silicon Tandem Cells via Band Gap Tuning
Zeguo Tang¹, Shaofei Yang², Yongcai He¹, Lin Mao¹, Tian Yang¹, Minghui Xie¹, Qing Chang¹, Lei Ding¹, Bo He¹, Zhenwei Peng¹, Cao Yu¹, Xia Hao³, Jingquan Zhang³, Hui Yan⁴, Xixiang Xu¹
¹Hanergy Thin Film Power Group, China
²The Hanergy Thin Film Power Group Limited, China
³Sichuan University, China
⁴Beijing University of Technology, China

09:35-09:50
Compositional Engineering of Perovskite Materials for Tandem Devices
Fuhua Hou, Biao Shi, Yucheng Li, Lingling Yan, Peirun Chen, Pengyang Wang, Changchun Wei, Dekun Zhang, Guangcai Wang, Yi Ding, Qian Huang, Yuelong Li, Ying Zhao, Xiaodan Zhang
Institute of Photo-electronic Thin Film Devices and Technology of Nankai University, China
09:50-10:05
Efficient and Stable Monolithic All-perovskite Tandem Solar Cells
Renxing Lin, Ke Xiao, Qiaolei Han, Yuan Gao, Hairen Tan
Nanjing University, China

Wednesday, November 6, Room 402
Area 2 Perovskite Solar Cells
Session Chair: Sang Il Seok, Liyuan Han

INVITED SPEECH
10:30-10:50
Fabrication of High Efficiency and Highly Stable Perovskite Solar Cells
Baomin Xu
Southern University of Science and Technology, Shenzhen, China

ORAL PRESENTATION
10:50-11:05
Multi-Inch Single-Crystalline Perovskite Membrane for High-Detectivity Flexible Photosensors
Yucheng Liu, Yunxia Zhang, Zhou Yang, Kui Zhao, Shengzhong (Frank) Liu
Shaanxi Normal University, China

11:05-11:20
Accurate Efficiency Measurements for Emerging PV: A Comparison of NREL’s Steady-State Performance Calibration Protocol Between Conventional and Emerging PV Technologies
Tao Song Tom Moriarty, Dean Levi
National Renewable Energy Laboratory, USA

11:20-11:35
Yttria Stabilized Zirconia-based Photoelectrodes for Perovskite Solar Cells
Marina Vildanova, Anna Nikolskaia, Sergey Kozlov, Olga Karyagina, Liudmila Larina, Oleg Shevaleyevsky
Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, Russia

11:35-11:50
Imaging Spatial Variations of Optical Bandgaps in Perovskite Solar Cells
Hieu Nguyen, Boyi Chen, Daniel Macdonald
The Australian National University, Australia

11:50-12:05
Pb-Reduced CsPb0.9Zn0.1I2Br Thin Films for Efficient Perovskite Solar Cells
Jing Zhang
Ningbo University, China
Wednesday, November 6, Room 405

Area 4 Thin-film Compound Semiconductor PV
Session Chair: Jin Hyeok Kim, Edgardo Saucedo

INVITED SPEECH
08:30-08:50
Cation Substitution Strategies for Bandgap Engineering in Kesterite Solar Cells
Edgardo Saucedo, Sergio Giraldo, Yudania Sanchez, Marcel Placidi, Victor Izquierdo-Roca, Alejandro Perez-Rodriguez
Catalonia Institute for Energy Research (IREC), Spain

ORAL PRESENTATION
08:50-09:05
Heterojunction Passivation for Beyond 10% Efficiency Cd-free CZTS Solar Cells by Nanoscale ALD-Alumina
Xin Cui, Kaiwen Sun, Jialiang Huang, Chang-Yeh Lee, Chang Yan, Heng Sun, Yuanfang Zhang, Martin Green, Bram Hoex, Xiaojing Hao
UNSW, Australia

09:05-09:20
Development of Kesterite-Type Thin Films by Using a Combinatorial Approach and High Throughput Characterization
Leo Choubrac, Lars Steinkopf, Taiseer Jokadar, Thomas Unold
HZB, Germany

09:20-09:35
High Performance Pure Selenized Cu$_2$ZnSnSe$_4$ Solar Cells by Sputtering from Cu-Zn-Sn-Se Quaternary Compound Target
Xinchen Li$^1$, Daming Zhuang$^1$, Ning Zhang$^2$, Ming Zhao$^1$, Yaowei Wei$^1$, Guoan Ren$^1$
$^1$Tsinghua University, China
$^2$Beijing Sifang Crenergy Optoelectronics Technology Co., Ltd., China

09:35-09:50
Interface Passivation at CZTS/CdS Heterojunction through UV-O3 Treatment
Shengli Zhang$^1$, Yi Zhang$^2$, Minh Tam Hoang$^3$, Tuquabo Tesfamichael$^3$, Hongxia Wang$^3$
$^1$Nankai University & Queensland University of Technology, China
$^2$Nankai University, China
$^3$Queensland University of Technology, Australia

09:50-10:05
Investigation of Nanostructure at the Heterojunction Interface of High-Efficiency CZTS Solar Cell Using High-resolution Scanning Transmission Electron Microscopy
Jialiang Huang, Kaiwen Sun, Xin Cui, Xiaojing Hao
UNSW, Australia
Wednesday, November 6, Room 405

Area 4 Thin-film Compound Semiconductor PV
Session Chair: Yaohua Mai, Xianzhong Lin

INVITED SPEECH
10:30-10:50
II-VI Ternary Compound Semiconductors and Their Application in CdTe Solar Cells
Lili Wu
Sichuan University, China

ORAL PRESENTATION
10:50-11:05
Molecular Beam Epitaxy of BaSi₂ Light Absorbers with Smooth BaSi₂/Si Interface Using Three-Step Growth Method
Yudai Yamashita, Takuma Sato, Kaoru Toko, Takashi Suemasu
University of Tsukuba, Japan

11:05-11:20
SILAR Based ZnxCd1-xS Buffer Layers for Enabling High Voc in Vapor Transport Deposited SnS Thin-film Solar Cells
PRAVIN SHIVAJI PAWAR, Jaeyeong Heo
Chonnam National University, South Korea

11:20-11:35
The Effect of Growth Temperature and Duration on VTD-SnS Absorber Layer for Thin Film Solar Cells
Jaeyeong Heo, Jae Yu Cho
Chonnam National University, South Korea

11:35-11:50
Optical Characterization Methods of Photovoltaics New Materials
Xueyun Zhang, Yasaman Tabari-Saadi, Michael Nielsen, Henner Kampwerth, Xiaojing Hao
UNSW, Australia

11:50-12:05
Fabrication of Sb₂S₃ Planar Thin Film Solar Cell with Vapor Transport Deposition (VTD) Method
Yiyu Zeng, Kaiwen Sun, Jialiang Huang, Martin Green, Xiaojing Hao
University of new south wales, Australia
Area 5 III-V Compound Semiconductor, Concentrator and Space PV Technologies
Session Chair: Nicholas Ekins-Daukes, Sun Qiang, Chen Nuofu

INVITED SPEECH

08:30-08:50
Development of Nanostructures and Light Management Strategies for Radiation Hard Multi-Junction Solar Cells
*Seth Hubbard, Julia D’Rozario, George Nelson, Steve Polly*
Rochester Institute of Technology, USA

08:50-09:10
High Efficiency Solar Cells for Space Application
*He Wang, Qiang Sun, Peng Gao*
Tianjin Institute of Power Sources, China

ORAL PRESENTATION

09:10-09:25
Towards Scaling-Up of Plastic Integrated CPV (PIC) Panels: Status, Challenges and Prospects
*Michihiko Takase¹, Kan-Hua Lee¹, Nobuhiko Hayashi¹, Shutetsu Kanayama², Kenji Araki*
¹Panasonic Corporation, Japan
²Toyota Technological Institute, Japan

09:25-09:40
Low-Mass, Flexible Thin Film III-V PV Cells & Modules for Low Earth Orbit Applications
*Ian Cooper, Aarohi Vijh, Andy Ritenour, Paul Sims, Brendan Kayes*
Alta Devices, USA

09:40-09:55
The Degradation of III-V Multijunction Solar Cells Under Non-Uniform Radiation Damages
*Wu Yiyong¹, Guo Hongliang¹, Wu Yuemin², Sun Qiang¹, Yu Hui¹, Guo Bin¹*
¹Harbin Institute of Technology
²Institute of Spacecraft System Engineering, China Academy of Space Technology, China

09:55-10:10
Scalable and Low Cost Back End of Line (BEOL) Technologies for Development of III-V Solar Cells
*Nastaran Hayati-Roodbari, Carina Hendler, Alexander Wheeldon, Roman Trattnig*
Joanneum Research Forschungsges.mbH, Austria
Wednesday, November 6, Room 313

Area 5 III-V Compound Semiconductor, Concentrator and Space PV Technologies
Session Chair: Nicholas Ekins-Daukes, Sun Qiang, Chen Nuofu

INVITED SPEECH
10:30-10:50
Integration of III-V Solar Cells with Silicon for Space & Terrestrial Applications and Opportunities for Ultra-Thin, Low Mass, Flexible Device Architectures
Andrew D Johnson
IQE Solar, UK

ORAL PRESENTATION
10:50-11:05
A Spectrum-Energy Model for Annual Yield Estimation of 2- And 4-Terminal Tandem Solar Cells
Hiroki Tawa¹, Hiromu Saiki¹, Yasuyuki Ota¹, Kenji Araki², Kohsuke Ueda³, Tatsuya Takamoto³, Masafumi Yamaguchi², Kensuke Nishioka¹
¹University of Miyazaki, Japan
²Toyota Technological Institute, Japan
³Sharp Corporation, Japan

11:05-11:20
Characteristics of Ge/Si1-xGex Film Grown on Si Substrate with Cut-off Angle
Meng Chen, Nuofu Chen, Quanli Tao, Zhenwen Chang
North China Electric Power University, China

11:20-11:35
Silicon Based Alloy Semiconductors Fabrication by Screen-Printing
Masahiro Nakahara, Shota Suzuki, Kosuke Tsuji, Marwan Dhamrin
Toyo Aluminium, Japan

11:35-11:50
A Novel Model of GaInP/InGaAs/GeSi Triple Junction Solar Cells
Quanli Tao, Nuofu Chen, Meng Chen, Zhenwen Chang, Dayan Ma
North China Electricity Power University, China

11:50-12:05
Can We Break the 43% Limit of the Annual Average Efficiency (Non-concentration)?
Kenji Araki, Daisuke Sato, Yasuyuki Ota, Kensuke Nishioka, Masafumi Yamaguchi
Toyota Technological Institute, Japan
Area 7 Crystalline Silicon Solar Cells and Tandem Solar Cells
Session Chair: Armin Aberle, Qi Wang

INVITED SPEECH
08:30-08:50
Crystalline Silicon N-Type Solar Cells
Qi Wang
Zhejiang Jinko Solar, China

ORAL PRESENTATION
08:50-09:05
Fabrication of Bifacial Si Solar Cell with Very High Bifacial Factor
Wensheng Liang¹, Kean Fong¹, Jingnan Tong¹, Marco Ernst¹, Daniel Walter¹,
Parvathala Narangari¹, Stephane Armand¹, Sachin Surve¹, Teng Kho¹, Keith McIntosh²
Matthew Stocks¹, Klaus Weber¹, Andrew Blakers¹
¹Australian National University, Australian
²PV Lighthouse, Australian

09:05-09:20
Influence of Light Illumination on the Potential-induced Degradation of n-type Rear-emitter Crystalline Si Photovoltaic Modules
Yuansong Xu¹, Seira Yamaguchi¹, Kyotaro Nakamura², Atsushi Masuda³,
Keisuke Ohdaira¹
¹Japan Advanced Insistute of Science and Technology, Japan
²Toyota Technological Insitute, Japan
³National Institute of Advanced Industrial Science and Technology, Japan

09:20-09:35
Fabrication and Comparison of n-type and p-type Bifacial to Mono-facial Si Solar Cells
Kean Chern Fong¹, Wensheng Liang¹, Jingnan Tong¹, Marco Ernst¹, Daniel Walter¹,
Parvathala Narangari¹, Sachin Surve¹, Teng Kho¹, Keith McIntosh², Matthew Stocks¹, Klaus
Weber¹, Andrew Blakers¹
¹Australian National University, Australian
²PV Lighthouse, Australian

09:35-09:50
Investigation of UVID on N-Type Solar Cell
Jikui Ma¹, Shang Qiao¹, Shufang Wang¹, Guangsheng Fu¹, Yonggang Guo²,
Zhicheng Song², Peng Dong²
¹Hebei Key Laboratory of Optic-Electronic Information and Materials, College of Physics
Science and Technology, Hebei University, China
²SPIC Xi’an solar power Co., Ltd, China
09:50-10:05
Investigation of Si Impact with Fine Line Al Printing on Narrow Point Contact Opening
Kosuke Tsuji, Marwan Dhamrin
Toyo Aluminium K.K. Japan

Wednesday, November 6, Room 306
Area 7 Crystalline Silicon Solar Cells and Tandem Solar Cells
Session Chair: Zhenguo Li, Makoto Konagai

INVITED SPEECH
10:30-10:50
Progress With Crystalline Silicon Solar Cells And Modules At SERIS
Armin Aberle
Solar Energy Research Institute of Singapore (SERIS), National University of Singapore (NUS), Singapore

10:50-11:10
Quasi-omnidirectional Silicon Solar Cells
Wenzhong Shen
Institute of Solar Energy, Shanghai Jiao Tong University

ORAL PRESENTATION
11:10-11:25
The Roadmap to >24% of PERC
Fan Jianbin
Longi Green Energy Technology Co. Ltd., China

11:25-11:40
PERC+POLO solar cells minimizing carrier recombination at the Ag front contact with simulated efficiency potential up to 23.8%
Thorsten Dullweber
Institute for Solar Energy Research Hamelin (ISFH), Germany

11:40-11:55
LeTID Phenomenon in Monocrystalline PERC
Zhu Haitao
Longi Green Energy Technology Co. Ltd. China

11:55-12:10
Advances in Screen Printed Metallization for Si-Solar Cells -Towards Ultra-Fine Line Contact Fingers Below 20 µm
Sebastian Tepner
Fraunhofer ISE, Germany
Wednesday, November 6, Room 308

**Area 10 Performance and Reliability of PV Module**

Session Chair: Zhiqiang Feng

### INVITED SPEECH

**08:30-08:50**

**Detail Analysis of Potential Induced Degradation in P-Type Crystalline Silicon Photovoltaic Modules**

Yasuaki Ishikawa, Mohammad Aminul Islam, Dong Chung Nguyen

Nara Institute of Science and Technology, Japan

### ORAL PRESENTATION

**08:50-09:05**

**Lifetime Prediction of Crystalline Si PV Modules under UV-Hygrothermal Stress**

Yuji Ino, Tomonari Sakamoto, Kouiichirou Niira, Takuya Kurose, Shinsuke Uchida, Shinji Yada, Shirou Inoue, Kyosuke Fujiwara, Shuichi Asao, Katsuhiro Shirasawa, Hidetaka Takato

1National Institute of Advanced Industrial Science and Technology (AIST), Japan
2KYOCERA Corporation, Japan

**09:05-09:20**

**Analysis of PID on the Back of P-PERC Bifacial PV Module**

Li Yuanyuan

SPIC XI’AN SOLAR POWER CO., LTD, China

**09:20-09:35**

**A Simple Method to Estimate Degradation Rates of Photovoltaics without Irradiance Data**

Amornrat Limmanee, Nuttakarn Udomdachanut, Suttinan Jaroenathainchok, Taweewat Krajangsang, Nopphadol Sitthiphol, Aswin Hongsingthong, Jaran Sritharathikhun

NECTEC, National Science and Technology Development Agency, Thailand

**09:35-09:50**

**IEC TS 60904-1-2 Measurement of Current-Voltage Characteristics of Bifacial PV Devices**

Jing Rongwei

TÜV SÜD Certification and Testing (China) Co., Ltd.

**09:50-10:05**

**Indoor Accelerated Aging Test for Silicon PV Module with a Combined Procedure of Thermal Cycling and High Intensity Irradiance**

Hao Song, Bingjie Zhu, Lin Zhang, Zhao Wu, Min Yun

CPVT, China
Wednesday, November 6, Room 308

Area 10 Performance and Reliability of PV Module

Session Chair: Guoqiang Xing

INVITED SPEECH
10:30-10:50
Newly Launched Mass Production Module Technologies with Dramatic Improvement in Power and Reliability
Guoqiang Xing
Canadian Solar Inc.

ORAL PRESENTATION
10:50-11:05
Research on Optimization of Structured Ribbon for Photovoltaic Module
Yan Yang, Jianxiong Ni, Jiong Zheng, Ying Zhang, Xiaodong Du, Chao Ma
State Key Laboratory of Photovoltaic Materials and Technology, Yingli Group Company Limited, China

11:05-11:20
Performance and Degradation Comparison for Long-term Reliability of Various Kinds of Photovoltaic Modules in the East of China
Bing Gao, Zhengxin Liu
Chinese Academy of Sciences- Shanghai Institute of Microsystem & Information Technology, China

11:20-11:35
Evaluation Long-term Reliability of Solar Module and Its Components by Field Study
Ji.Xia1, Hongjie Hu1, Kaushik Roy Choudhury2, Thomas Felder2, Jared Tracy2, William J. Gambogi2
1DuPont (China) Research & Development and Management Co., LTD., China
2DuPont Company, USA

11:35-11:50
Performance and Durability of Transparent Backsheets for Bifacial PV Modules
William Gambogi1, Michael Demko1, Thomas Felder1, Steven MacMaster1, Bao-Ling Yu1, Hongjie Hu2, Zhen Pan2, Daniel Hu2, Kaushik Roy Choudhury1
1DuPont, USA
2DuPont (China) Research & Development and Management Co., Ltd., China

11:50-12:05
The Study on LeTID of Mono Crystalline CZ-silicon
Chunhua Zhong, jiangliangcong, Jianbo Wang, Cheng Zhu, Jun Lv
Longi Solar Technology Co., Ltd., Xi’an 710018, China
12:05-12:20
Optimization of Silicon PV Modules for Power/Yield and Durability Using Light Redirecting Films
James Ma¹, Alison Lennon²
¹3M, USA
²University of New South Wales, Australia

Wednesday, November 6, Room 311
Area 13 PV Energy Storage and Novel PV Application
Session Chair: Xianfeng Li, Leo Liu

INVITED SPEECH
10:30-10:50
Electrochemical Energy Conversion and Storage for Sustainable Energy System
Baoguo Wang
Tsinghua University, China

10:50-11:10
Developing New Chemistries for Redox Flow Batteries
T. Leo Liu (Tianbiao Liu)
Utah State University, USA

ORAL PRESENTATION
11:10-11:25
Fabricate and Characterize a Curved Photovoltaic Roof-Tile with Architectural Aesthetics
Yishan
Hanergy Thin Film Power Group, MiaSoléChina High-tech Equipment Manufacturing Company, Fujian, China

11:25-11:40
Single Atom Tungsten Doped Ultrathin α-Ni(OH)2 for Enhanced Electrocatalytic Water Oxidation
Junqing Yan, Shengzhong Liu
Shaanxi Normal University, China

11:40-11:55
Matthew Stocks, Ryan Stocks, Bin Lu, Cheng Cheng, Andrew Blakers
Australian National University, Australia
Wednesday, November 6, Room 311

Area 14 PV Deployment, Markets, Policies and Financing

Session Chair: Hao Jin, Izumi Kaizuka

INVITED SPEECH

08:30-08:50  
Policies and Status of Photovoltaic Solar Energy in Europe  
Arnulf Jäger-Waldau  
European Commission, DG JRC, EU

08:50-09:10  
Evolution of Global PV Markets - The Latest Survey Results on PV Markets and Policies from the IEA PVPS Programme in 2018  
Izumi Kaizuka  
RTS Corporation, IEA PVPS Task 1, Japan

ORAL PRESENTATION

09:10-09:25  
Technical, Financial and Environmental Feasibility Analysis of Photovoltaic EV Charging Stations with Energy Storage in China and the United States  
Alonzo Sierra\(^1\), Cihan Gercek\(^1\), Angèle Reinders\(^2\)  
\(^1\)University of Twente, Netherland  
\(^2\)University of Twente, Eindhoven University of Technology, Netherland

09:25-09:40  
Life Cycle Comparative Analysis of Three Kinds of Photovoltaic Modules: p-Multi-BSF, p-Mono-PERC and n-Mono-HJT  
Xiaojie Jia, Wenjing Wang  
Institute of Electrical Engineering, Chinese Academy of Science (CAS), China

09:40-09:55  
Latest Development of IEC 61215/61730 Standards  
Bo Xiangxi  
TÜV SÜD Certification and Testing (China) Co., Ltd., China

09:55-10:10  
Energy Ratings of PV Modules  
Christos Monokroussos  
TÜV Rheinland (Shanghai) Co., Ltd., China
Thursday, November 7, Room 405  
Area 1 Advanced Concepts and New Emerging Materials for Future PV  
Session Chair: Tao Chen

INVITED SPEECH
08:30-08:50
Perovskite Single and Multijunction Solar Cells
Joseph J. Berry  
National Renewable Energy Laboratory (NREL), USA

ORAL PRESENTATION
08:50-09:05
Optimization of Industrial Solar Cell Manufacturing Using Machine Learning
Casper Anton Eijkens, Yoann Buratti, Ziv Hameiri  
University of New South Wales (SPREE UNSW), Australia

09:05-09:20
Improvements in Energy Yield and Financial Benefits for Next-generation DSM AR Coatings
Peter Pasmans  
DSM, Netherlands

09:20-09:35
Ni(X)Al(Y)O Alloy as a Charge Transport Material: Photoemission Study
Samed. Halilov¹, Md. Anower Hossain², Tian Zhang², Bram Hoex², Amir Abdallah¹, Sergey Rashkeev¹  
¹QEERI, HBKU, Education City, Doha, Qatar  
²University of New South Wales, Australia

09:35-09:50
Heat Recovery (HERC) Solar Cell Using Thermoelectric Materials: HERC-SC Type II
Kenji Kamide¹, Toshimitsu Mochizuki¹, Hidefumi Akiyama², Hidetaka Takato¹  
¹National Institute of Advanced Industrial Science and Technology (AIST), Japan  
²The University of Tokyo, Japan

09:50-10:05
Improvement of Performance Ratio of Tandem Cells Using Super-multijunction Configuration-modeling and Outdoor Performance Validation
Kenji Araki¹, Daisuke Sato¹, Yasuyuki Ota², Kensuke Nishioka², Masafumi Yamaguchi¹  
¹Toyota Technological Institute, Japan  
²University of Miyazaki, Japan
Thursday, November 7, Room 306

Area 1 Advanced Concepts and New Emerging Materials for Future PV
Session Chair: Xu Pan

INVITED SPEECH
10:30-10:50
Perovskite Material and Solar Cell Research by Surface Science and Advanced Characterization
Yabing Qi
Okinawa Institute of Science and Technology Graduate University (OIST), Japan

ORAL PRESENTATION
10:50-11:05
Hot Carrier Generation and Energy Selective Extraction in MOSFET-inspired Three Terminal Heterostructure
Zacharie Jehl Li-Kao, Oussama Ourahou, Daniel Suchet, Marc Bescond
Sergio Giraldo, Yoshitaka Okada, Jean-Francois Guillemoles
1Catalonia Institute for Energy Research, Spain
2LIA NextPV, The University of Tokyo, Japan
3LIMMS/CNRS, University of Tokyo, Japan
4Catalonia Institute for Energy Research (IREC), Spain
5Research Center for Advanced Science and Technology (RCAST), The University of Tokyo, Japan

11:05-11:20
Demonstration of Three-Terminal GaAs/Si Tandem Solar Cells with a Back-Contact-Type Bottom Cell
Takeshi Tayagaki, Kikuo Makita, Tomihisa Tachibana, Hidenori Mizuno, Ryuji Oshima, Hidetaka Takato, Takeyoshi Sugaya
National Institute of Advanced Industrial Science and Technology (AIST), Japan

11:20-11:35
Charge Accumulation in Quantum Well Solar Cells Studied by Cross-sectional Kelvin Probe Force Microscopy
Takeshi Noda, Nobuyuki Ishida, Takaaki Mano
National Institute for Materials Science, Japan

11:35-11:50
A New Designed PV Glass to Reduce the Shadowing Loss of the Finger Grid and Improve Solar Cell's Efficiency
Li Xiaodong, Sun Xipeng, Tie Jianrui, Tie Jianrui
Tianjin Hengdian Space Power Co., Ltd, China
Thursday, November 7, Room 402

Area 2 Perovskite Solar Cells
Session Chair: Tekeru Bessho, Zhike Liu

INVITED SPEECH
08:30-08:50
Development of a Large-area Film-based Perovskite Photovoltaic Module
Shigehiko Mori, Haruhi Ohka, Hideyuki Nakao, Akio Amano, Kenji Todori
Corporate Research & Development Center, Toshiba Corporation, Japan

ORAL PRESENTATION
08:50-09:05
Chemical Origin of Photoluminescence of Cesium-Bismuth-Bromide Perovskites and Improved Luminescence via Transition Metal Chloride Additives
Joonyun Kim, Jinu Park, Byungha Shin
KAIST, Korea

09:05-09:20
Revealing the Hidden Process Parameters of Co-Evaporation: A Practical Guideline for Efficient Co-Evaporated Perovskite Absorbers
Tobias Abzieher, Michael Hetterich, Bryce S. Richards, Uli Lemmer, Michael Powalla, Ulrich W. Paetzold
Karlsruhe Institute of Technology, Germany

09:20-09:35
Green Anti-solvent Processed Planar Perovskite Solar Cells and Its Hysteresis Modulation
Xiaojia Zheng, Deyu Xin, Min Zhang, Zenghua Wang, Wen-Hua Zhang
Sichuan Research Center of New Materials, Institute of Chemical Materials, China Academy of Engineering Physics, China

09:35-09:50
Scalable Printing Perovskites for High Efficiency Photovoltaic Solar Cells
Fei Guo, Yaohua Mai
Jinan University, China

09:50-10:05
Scalable and Efficient Perovskite Solar Cells in Ambient Air with Spray-Coated Active Layer
Jian Su, Hongkun Cai, Jingtao Yang, Xiaofang Ye, Rui Han, Jian Ni, Juan Li, Jianjun Zhang
Nankai University, China
Thursday, November 7, Room 402

Area 2 Perovskite Solar Cells
Session Chair: Shigehiko Mori, Yong Peng

INVITED SPEECH
10:30-10:50
Photovoltaic Properties of Less-Hysteresis by Potassium Doped Perovskite Solar Cells
Takeru Bessho
The University of Tokyo, Japan

ORAL PRESENTATION
10:50-11:05
A Technoeconomic Analysis of Perovskite Solar Cell Technology
Zhenrui Yu
Svolt Energy Technology Co. Ltd, China

11:05-11:20
Synergistic Improvement of Perovskite Film Quality for Efficient Solar Cells via Multiple Chloride Salt Additives
Fei Ma, Shaiqiang Mu, Zema Chu, Yang Zhao, Qiu Feng Ye, Shi Qi Yu, Jingbi You
Key Laboratory of Semiconductor Materials Science, Institute of Semiconductors, Chinese Academy of Sciences, China

11:20-11:35
Sputtered Aluminum Doped Zinc Oxide as the Rear Electrode for the Semitransparent Perovskite Solar Cell
Nan Li1, Jin Yan1, Yuqian Ai1, Fanping Meng1, Feng Huang1, Chuihui Shou2, Jiang Sheng1, Baojie Yan1, Jichun Ye1
1Ningbo Institute of Material Technology and Engineering, China
2Zhejiang Energy Group R&D, China

11:35-12:05
Graded Bandgap CsPbI2+xBr1-x Perovskite Solar Cells with a Stabilized Efficiency of 14.4%
Bian Hui, Dongliang Bai, Kang Wang, Lei Liang, Haoran Wang, Jingru Zhang, Zhiwen Jin, Qian Wang, Shengzhong (Frank) Liu
Shaanxi Normal University, China

11:50-12:05
Nb-doped TiO2 Nanospindles as Superior Electron Transporting Materials for High Performance Planar Structured Perovskite Solar Cells
Bing Cai, Yinhua Lv, Wenhua Zhang
Institute of Chemical Materials, China Academy of Engineering Physics, China.
Thursday, November 7, Room 402

Area 2 Perovskite Solar Cells
Session Chair: Shengzhong Liu, Tingli Ma

INVITED SPEECH
13:30-13:50
Low-cost New Carbon Electrodes for Effective Sandwich-structured Perovskite Solar Cells
Fanning Meng¹, Liguo Gao¹, Chu Zhang², Tingli Ma³
¹Dalian University of Technology, China
²China Jiliang University, China
³Kyushu Institute of Technology, Japan

ORAL PRESENTATION
13:50-14:05
High Efficiency Flexible Perovskite Solar Cells
Shengzhong (Frank) Liu, Jiangshan Feng, Dong Yang, Yucheng Liu, Kui Zhao
Shaanxi Normal University, China

14:05-14:20
Material Engineering towards Stable/Lead-Free Perovskite Solar Cells
Feng Wang¹, Weihua Ning¹, Ni Zhao², Feng Gao¹
¹Linköping University, Sweden
²The Chinese University of Hong Kong, China

14:20-14:35
Ionic Liquid for Facile Fabrication of Efficient and Stable Perovskite Solar Cells
Yonghua Chen¹, Lingfeng Chao¹, Wei Huang²
¹Nanjing Tech University, China
²Northwestern Polytechnical University, China

14:35-14:50
Controlling Ions Lateral Diffusion of Perovskite Solar Modules for 1000 Hours Light and Thermal Stability
Enbing Bi, Han Chen, Liyuan Han
Shanghai Jiao Tong University, China

14:50-15:05
Retarding Thermal Degradation in Hybrid Perovskites by Ionic Liquid Additives
Rui Xia¹, Yifeng Chen¹, Daming Chen¹, Zhiqiang Feng¹, Cristina Roldán-Carmona², Mohammad Khaja Nazeeruddin²
¹Trina solar, China
²EPFL, Swiss
15:05-15:20
The Thermal Behavior of Planar Perovskite Solar Cells
Changbao Han, Yichuan Chen, Qi Meng Yueyue Xiao, Junjie Sun, Hongli Gao, Yongzhe Zhang, Hui Yan
Beijing University of Technology, China

15:20-15:35
Influence of Device Architecture and Absorber Composition on the Thermal Stability of Perovskite Solar Cells
Jonas A. Schwenzer, Tobias Abzieher, Bryce S. Richards, Uli Lemmer, Ulrich W. Paetzold
Karlsruhe Institute of Technology, Germany

15:35-15:50
Achieving Efficient and Stable Perovskite Photovoltaics through Material Design
Yao Kai, Zhou Lang
Nanchang University, China

Thursday, November 7, Room 306
Area 3 Organic Solar Cells
Session Chair: Feng Gao

INVITED SPEECH
08:30-08:50
Morphology Control during Blade-coating of Organic Solar Cells
Wei Ma
Xi’an Jiaotong University, China

08:50-09:10
n-Type Polymer Semiconductors Containing B-N Unit and Their Application in OPVs and OFETs
Jun Liu, Chuandong Dou, Zicheng Ding, Lixiang Wang
Changchun Institute of Applied Chemistry, Chinese Academy Of Sciences, China

ORAL PRESENTATION
09:10-09:22
Volatilizable Solid Additives in Highly Efficient Non-fullerene Organic Solar Cells
Runnan Yu¹, Huifeng Yao², Jianhui Hou²
¹Beijing University of Chemical Technology, China
²Institute of Chemistry, Chinese Academy of Sciences, China
INVITED SPEECH
09:22-09:42
Interfacial Engineering and Optical Coupling for Multicolored Semitransparent Inverted Organic Photovoltaics
Zhan’ao Tan¹, Yiming Bai², Chunyan Zhao², Shuai Zhang¹
¹Beijing University of Chemical Technology, China
²North China Electric Power University, China

09:42-10:02
Printable Interlayers for Large-area Organic Solar Cells
Bowei Xu
Institute of Chemistry, Chinese Academy of Sciences, China

ORAL PRESENTATION
10:02-10:14
Highly Efficient Interfacial Layers for Polymer Solar Cells
Zhong Zheng¹, Jianhui Hou¹
¹Institute of Chemistry, Chinese Academy of Sciences, China

Thursday, November 7, Room 405
Area 4 Thin-film Compound Semiconductor PV
Session Chair: Yonghang Zhang, Deliang Wang

INVITED SPEECH
10:30-10:50
Recent Advances and Future Challenges in CdTe Photovoltaics
Wyatt Metzger
National Renewable Energy Laboratory (NREL), USA

ORAL PRESENTATION
10:50-11:05
Comparison Study of Monocrystalline 1.7-eV MgCdTe Solar Cells with 15.2% Efficiency
Jia Ding, Jacob Becker, Cheng-Ying Tsai, Calli Campbell, Yong-Hang Zhang
Arizona State University, USA

11:05-11:20
Band Offsets in Thin-Film CdTe Solar Cells
James Sites, Alexandra Bothwell, Pascal Jundt
Colorado State University, USA

11:20-11:35
Surface Passivation of Metal Oxide for CdTe
Lingling Wu, Zihan Li, Dongming Wang, Yanbo Cai, Xunyong Lei, Deliang Wang
University of Science and Technology of China, China
11:35-11:50
Ionized Oxygen Vacancy in Highly Conductive Mg0.2Zn0.8O Film
Dongming Wang, Lingling Wu, Guangwei Wang, Yanbo Cai, Deliang Wang
University of Science and Technology of China, China

11:50-12:05
Variations in Grain Boundary Recombination in Cadmium Telluride Solar Cells
Thomas Fiducia¹, Kexue Li², Junliang Liu³, Chris Grovenor³, Budhika Mendis⁴, Amit Munshi⁵, Kurt Barth⁶, Walajabad Sampath⁶, Ryan Maclachlan¹,
Vladislav Kornienko¹, Yau Yau Tse¹, Michael Walls¹
¹Loughborough University, Britain
²Manchester University, Britain
³Oxford University, Britain
⁴Durham University, Britain
⁵Colorado State University, USA

12:05-12:15
Poly-CdTe Thin-film Solar Cell with 19.25% Efficiency
Xuanzhi Wu, Peng Zhou, Dikun Lao, Wu Zhan, Yuxia Jiang, Xinyuan Qin, Haibing Ying,
Mengfei Zhang, Anhong Hu, Jie Zhou
LONGYAN ENERGY TECHNOLOGY (ADVANCED SOLAR POWER (HANG ZHOU) INC.)

Thursday, November 7, Room 405
Area 4 Thin-film Compound Semiconductor PV
Session Chair: Michael Powalla, Daming Zhuang

INVITED SPEECH
13:30-13:50
A Sunny Outlook of CdTe PV
Gang Xiong
First Solar, USA

ORAL PRESENTATION
13:50-14:05
Electroplated CdSeTe Solar Module
Kuo-Jui Hsiao
Reel Solar Power Inc., USA

14:05-14:20
High Efficiency Ag-Alloyed Cu(In, Ga)Se₂ Thin Film Solar Cells Reaching 22.9%
Oleksandr Bilousov, Viktor Fjällström, Viktoria Gusak, Philippe Lingois,
Sven-Olof Katterwe, Tobias Jarmar, Erik Wallin, Olle Lundberg, Lars Stolt,
Solibro Research AB, Sweden
14:20-14:35
Low Band Gap Cu(In, Ga)Se$_2$ Absorber for Perovskite - Chalcopyrite Tandem Cells
Pieter Bolt$^1$, Maarten van der Vleuten$^1$, Marcel Simor$^1$, Remi Aninat$^1$, Mirjam Theelen$^1$, Valerio Zardetto$^1$, Dong Zhang$^1$, Guy Brammertz$^2$, Bart Vermang$^2$, Pieter Bolt$^1$
$^1$TNO, Netherlands
$^2$Imec, Belgium

14:35-14:50
Fast Growth of Cu(In, Ga)(S, Se)$_2$ Solar Cell Absorbers under Atmospheric Pressure
Pablo Reyes-Figueroa, Guillermo Farias-Basulto, Erik Waack, Ralf Haberecht, Reiner Klenk, Rutger Schlatmann
Helmholtz-Zentrum Berlin

14:50-14:55
Break

SESSION CHAIR: Shigeru Niki, Lars Stolt

INVITED SPEECH
14:55-15:15
Progress in Understanding CIGS Solar Cells with Efficiencies above 22%
Michael Powalla
ZSW Baden-Württemberg, Germany

ORAL PRESENTATION
15:15-15:30
Materials Designs of (Cu$_{1-x}$Ag$_x$)InSe$_2$ and Cu/Ag-poor (Cu$_{1-x}$Ag$_x$)In$_5$Se$_8$ Systems for Ag-Alloyed CuInSe$_2$-Based Solar Cell Application
Tsuyoshi Maeda, Tomoya Ishida, Takahiro Wada
Ryukoku University, Japan

15:30-15:45
Study of Defect Properties in RbF Treated Cu(In, Ga)Se$_2$ Solar Cells
Hamidou TANGARA$^1$, Setareh Zahedi-Azad$^2$, Jennifer Ophelie Lydia NOT$^3$, Jakob Schick$^2$, Alban Lafuente Sampietro$^1$, Roland Scheer 2, Takeaki Sakurai$^1$
$^1$University of Tsukuba, Japan
$^2$Martin-Luther-Universität Halle-Wittenberg, Germany
$^3$Université Grenobles Alpes, University of Tsukuba, France

15:45-16:00
Study on Cu(In, Ga)(Se, S)$_2$ Solar Cells Fabricated via Sputtering Quaternary Targets and Annealing in Sulfur-containing Atmosphere
Xunyan Lyu, Daming Zhuang, Ming Zhao, Yaowei Wei, Guoan Ren, Yixuan Wu, Chen Wang
School of Materials Science and Engineering, Tsinghua University, China
Thursday, November 7, Room 313

Area 7 Crystalline Silicon Solar Cells and Tandem Solar Cells
Session Chair: Zhiqiang Feng, Xiaodan Zhang

INVITED SPEECH
08:30-08:50
Silicon-Perovskite Hybrid Tandem Devices
A. W. Weeber
ECN, TNO, TU Delft, Netherlands

08:50-09:10
Recent Progress of Rib Si Solar Cell Technology and Its Application to InGaP/Si Spectrum
Makoto Konagai
Advanced Research Laboratories, Japan

ORAL PRESENTATION
09:10-09:25
Large Area Efficient Monolithic Perovskite/Homo-Junction-Silicon Tandem Solar Cell
Jianghui Zheng1, Jonathan Lau1, Hamid Mehrvarz1, Fa-Jun Ma1, Yajie Jiang1,
Xiaofan Deng1, Anastasia Soeriyadi1, Jinchool Kim1, Meng Zhang1, Long Hu1,
Xin Cui1, Da Seul Lee1, Jueming Bing1, Yongyoon Cho1, Chwenhaw Liao1, Yang Li1,
Yong Li1, Chao Chen2, Martin Green1, Shujuan Huang1, Anita Ho-Baillie1
1Australian Centre for Advanced Photovoltaics, (UNSW), Australia
2Xiamen University, China

09:25-09:40
Detailed Analysis of 25% Silicon IBC, and IBC-Tandem Solar Cells
Kean Chern Fong1, Osorio Mayon1, The Duong1, Wensheng Liang1,
Teng Kho1, Sachin Surve1, Keith McIntosh2, Matthew Stocks1, Andrew Blakers1
1Australian National University, Australia
2PV Lighthouse, Australia

09:40-09:55
Fabrication of III-V/Si Tandem Solar Cells by the Copper Nanoparticle Array-Mediated Smart Stack Approach
Hidenori Mizuno
Research Center for Photovoltaic Technologies (AIST), Japan

09:55-10:10
Application of Laser-Assisted Dielectric Patterning in the Development of Small-size Silicon Cells for Tandem Applications
Mei Huang, Tianyuan Liu, Maung Thway, Xia Yan, Armin G. Aberle, Fen Lin, Rolf Stangl
National University of Singapore, Singapore
Area 7 Crystalline Silicon Solar Cells and Tandem Solar Cells
Session Chair: Pierre J. Verlinden, Arthur W. Weeber

INVITED SPEECH
10:30-10:50
Nanoscale Thin Films for Contact and Surface Passivation of Silicon Solar Cells
Bram Hoex
University of New South Wales, Australia

ORAL PRESENTATION
10:50-11:05
In-situ Doped PolySi Passivating Contacts Resulting in over 22% Perpoly Cells
Kees Tool1, John Anker1, Maciej Stodolny1, Gaby Janssen1, Astrid Gutjahr1,
Martijn Lenes2, Peter Venema2, Jochen Loffler1
1ECN.TNO Solar, Netherland
2Tempress Systems BV, Netherland

11:05-11:20
Metal Nitride Electron-Selective Contacts for Crystalline Silicon Solar Cells
Xinbo Yang, Stefaan De Wolf
King Abdullah University of Science and Technology, Saudi Arabia

11:20-11:35
Effect of Encapsulant on Bifacial Silicon Heterojunction Solar Cell Operation for High Latitudes
Mandy R. Lewis1, Christopher E. Valdivia1, Erin M. Tonita1, Ras-Jeevan K. Obhi1,
Mariana I. Bertoni2, Karin Hinzer1
1SUNLAB, University of Ottawa/DEfECT Lab, Arizona State University, Canada
2DEfECT Lab, Arizona State University, Canada

11:35-11:50
Lithography-free and Dopant-free Back-contact Silicon Heterojunction Solar Cells
Yurong Zhou, Zongheng Sun, Fengchao Li, Yuqin Zhou, Fengzhen Liu
University of Chinese Academy of Sciences, China

11:50-12:05
A New High-Quality Surfaces Passivation Technology for Si Solar Cells Without Use of Vacuum Equipment and Thermal Budget
Kunpeng Ge1, Linlin Yang1, Jianxin Guo1, Lu Wan1, Feng Li2, Ying Xu1,
Jianhui Chen1, Dengyuan Song2
1Hebei university, China
2Yingli Green Energy Holding Co. China
THE 29TH INTERNATIONAL CONFERENCE ON PHOTOVOLTAIC SCIENCE & ENGINEERING
THE 18TH CHINA PHOTOVOLTAIC CONFERENCE

Thursday, November 7, Room 313

Area 7 Crystalline Silicon Solar Cells and Tandem Solar Cells
Session Chair: Dengyuan Song, Meng Tao

INVITED SPEECH

13:30-13:50
Sustainability of Today’s Si PV Technology
M. Tao
Arizona State University, USA

13:50-14:10
Ag-Free Paste Solutions for High Efficiency Silicon Solar Cells
M. Dhamrin
Toyo Aluminium K. K. Shiga, Japan

ORAL PRESENTATION

14:10-14:25
Degradation Behavior of the PERC Solar Cells after IEC 61215 Damp Heat Test in Dark
Gaofei Li¹, Jin Huang¹, Peng Wang², Jilei Wang¹, Miao Wang¹, Pengfei Hao¹, Linfeng Lu²
¹Jinneng Clean Energy Limited Company, China
²Shanghai Advanced Research Institute, Chinese Academy of Sciences, China

14:25-14:40
Current Status and Development of Mass Production of Multicrystalline Q.ANTUM p-type Solar Cells
Alexander To, Bernhard Kloeter, Kai Petter
Hanwha Q CELLS GmbH, Germany

14:40-14:55
Carrier Distribution Investigation of Potential-Induced Degradation in Monocrystalline Silicon Solar Cell Using Scanning Nonlinear Dielectric Microscopy
Yasuo Cho¹, Sachiko Jonai², Atsushi Masuda²
¹Tohoku University, Japan
²National Institute of Advanced Industrial Science and Technology, Japan

14:55-15:10
Machine learning for Q.ANTUM production optimization
Bernhard Klöter, Sven Wasmer
Hanwha Q CELLS GmbH, Germany

15:10-15:25
High performance & flexible passivation stacks realized by industrial scale batch-type plasma-enhanced atomic layer deposition/chemical vapor deposition (PEALD/CVD) platform for high efficiency solar cell manufacturing
He Zhang, Xiang Li, Weiming Li
Jiangsu Leadmicro Nano-Equipment Technology Ltd, China
15:25-15:40
Research on the Effect of Large Diameter Single Crystal on Crystal Quality
Tingting Du, Nannan Fu, Hao Deng, Rui Zhou
Longi Green Energy Technology Co. Ltd, China

Thursday, November 7, Room 306
Area 8 Thin Film, IBC and HITsolar Cells
Session Chair: Pierre Verlinden, RIBEYRON Pierre-Jean

INVITED SPEECH
13:30-13:50
High-efficiency Technology of Silicon Heterojunction Solar Cells
Mitsuhiro Matsumoto
Panasonic, Japan

13:50-14:10
Road of Amorphous/Crystalline Silicon Heterojunction (SHJ) Solar Cells of SIMIT from Lab to Industry
Fanying Meng
Shanghai Institute of Microsystem & Information Technology (SIMIT) Chinese Academy of Sciences, China

ORAL PRESENTATION
14:10-14:25
Insight of Hydrogen Plasma Etching on the Improvement of surface passivation in Silicon Wafer Heterojunction Solar Cells
Ge Jia¹, Muzhi TANG², Thomas MUELLER³
¹Nanjing Tech University, China
²REC Solar Pte. Ltd, Singapore
³Solar Energy Research Institute of Singapore, Singapore

14:25-14:40
Study on the Influence of N-type Monocrystalline Silicon Quality on HJT Cell Efficiency
Nannan Fu¹, Hao Deng¹
¹LONGi Green Energy Technology Co., Ltd., China

14:40-14:55
Achieving High Efficiency Silicon Heterojunction Solar Cells by Applying Porous Amorphous Silicon Buffer Layers with No Epitaxial Growth
Tianyu Ruan¹, Minghao Qu², Xiaoning Ru³, Xianlin Qu¹, Jianqiang Wang¹, Yongcai He¹, Kun Zheng¹, Xixiang Xu², Cao Yu², Yongzhe Zhang¹, Hui Yan¹
¹Beijing University of Technology, China
²Hanergy Thin Film Power Group Ltd. China
15:10-15:25
Progress in HJT Solar Cells and Modules about the 100MW Mass Production Line in Jinergy
Gaofei Li¹, Liyou Yang¹, Jilei Wang¹, Juan Zhang¹, Yong Gao¹, Jin Huang¹, Yanhui Bai¹, Linfeng Lu², Dongdong Li², Peng Wang², Guanlin Du²
¹Jinneng Clean Energy Limited Company, Lvliang, Shanxi 032100, China
²Shanghai Advanced Research Institute, Chinese Academy of Sciences, Shanghai 201210, China

15:25-15:40
Increasing the Performance of Silicon Heterojunction Solar Cells by Heat-Assisted Light Soaking
Hexian Zhang
Gsolar Power CO., Ltd, China

15:40-15:55
Optimised Design of Silicon Heterojunction Solar Cells for Field Operating Conditions
Jean Cattin¹, Olivier Dupré¹, Brahim Aïssa², Jan Haschke¹, Christophe Ballif¹, Mathieu Boccard¹
¹EPFL, Switzerland
²Hamad Bin Khalifa University - QEERI, State of Qatar

15:55-16:10
Pushing the Practical Efficiency Limit of Passivated Contacts Solar Cells Using Thin CZ-wafers
André Augusto, Pradeep Balaji, Joseph Karas, Richard R. King, Stuart G. Bowden
Arizona State University, USA

Thursday, November 7, Room 308
Area 9 Topcon Solar Cells
Session Chair: Rensheng Liu

INVITED SPEECH
13:30-13:50
Silicon Alloys for Silicon Heterojunction and Passivated Contact Solar Cells
Kaining Ding
Forschungszentrum Jülich GmbH, Germany

13:50-14:10
TOPCon - Improvements in Laboratory and Industrialization at Fraunhofer ISE
Frank Feldmann
Fraunhofer ISE, Germany
ORAL PRESENTATION

14:10-14:25
The Development and Mass-production of Bifacial nTOPCon Silicon Solar Cells and Modules
Cheng Chen
Jolywood Solar Technology Co. Ltd., China

14:25-14:40
Investigation of the Light Soaking Stability of Contact-passivated Solar Cells Employing Ultra-thin ALD AlOx as the Tunnel Layer
Zheng Xin¹, Zhi Peng Ling², Rolf STANGL¹, Jian Wei HO¹
¹Solar Energy Research Institute of Singapore, Singapore
²REC Solar Pte. Ltd., Singapore

14:40-14:55
Stability Study on the Passivation Quality of Polysilicon-based Passivating Contacts for Silicon Solar Cells
Hang Cheong Sio, Daniel Macdonald, Hang Cheong Sio, Di Kang
The Australian National University, Australia

14:55-15:10
Analysis of Screen-printed Metallisation of monoPolyTM Cells
Ankit Khanna¹, Pradeep Padhmnath¹, Naomi Nandakumar¹, James Lai¹, Jeffrey Ison¹, Deng Wang², Qian Sun², Ming Huang², Shumei Huang², Baobing Fan², Bingbing Ding², Vinodh Shamugam¹, Shubham Duttagupta¹
¹SERIS, Singapore
²China

15:10-15:25
Development of Industrial High Efficiency N-type Solar Cell with Passivated Contact Technology
Dawei Liu, Yufeng Ni
SPIC Xi’an Solar Power Co., Ltd, China

15:25-15:40
Combining Poly-Silicon on Oxide Solar Cells with Cast-Mono Wafers: an Alternative Path for Low Carbon-Footprint Premium Products?
DUBOIS Sébastien, ROUSSEAU Sylvain, CABAL Raphael, DESRUES Thibaut, HAYES Maxim, LANTERNE Adeline, MARTEL Benoit, OLIVEAU Camille, PIHAN Etienne
CEA-INES, France

15:40-15:55
Luminescence: Science and Applications in Silicon Photovoltaics
Hieu Nguyen, Daniel Macdonald
The Australian National University, Australia
15:55-16:10
Passivation with Ultrathin SiO$_x$ and Poly-SiN$_x$ on c-Si for TOPCon Solar Cells
Qing Yang, Yuheng Zeng, Zhixue Wang, Xueqi Guo, Zhe Rui, Baojie Yan, Jichun Ye
Ningbo Institute of Materials Technology & Engineering, China

Thursday, November 7, Room 311
Area 10 Performance and Reliability of PV Module
Session Chair: Atsushi Masuda

INVITED SPEECH
08:30-08:50
LID and LETID in PERC type Solar Modules: Ensuring High and Consistent Energy Yields
Max B. Koentopp
Hanwha Q CELLS GmbH, USA

08:50-09:10
Low Uncertainty PV Module Calibrations
Nikos Kopidakis
National Renewable Energy Laboratory, USA

ORAL PRESENTATION
09:10-09:25
Quantitative Evaluation of Outdoor Degradation Rate of PV System by Analyzing Output Current, Voltage and Power
Takehiro Yoshida, Kanako Kawasaki, Hiroto Koshirae, Yuzuru Ueda
Tokyo University of Science, Japan

09:25-09:40
Balanced Contact Method to Reduce Thermomechanical Stress in Silicon Solar Cells Induced by Interconnection
Pei-Chieh Hsiao$^1$, Zhimeng Wang$^1$, Ning Song$^1$, Yang Li$^1$, Zi Ouyang$^1$, Chen Zhu$^2$, Jun Lv$^2$, Canjun Shen$^2$, Cheng Chen$^2$, Guoqing Chen$^2$, Xueqing Zhang$^2$
$^1$School of Photovoltaics and Renewable Energy Engineering, UNSW, Australia
$^2$LONGi Solar Technology Co, China

09:40-09:55
Recovery of CIGS Solar Cells from PID Stress with Spectrally Selective Illumination and Light Soaking
Keiichiro Sakurai$^1$, Hiroshi Tomita$^2$, Shuui Tokuda$^2$, Darshan Schmitz$^2$, Hajime Shibata$^1$, Atsushi Masuda$^1$
$^1$AIST, Japan
$^2$Solar Frontier, Japan
09:55-10:10
Establishing the Long Term Reliability Performance of Flexible PV Modules from Accelerated Testing
Bill J.J. Liu, Venkata Bheemreddy
Miasole, USA

Thursday, November 7, Room 308
Area 11 PV Systems Including BOS Component
Session Chair: Boris. Farnung

INVITED SPEECH
08:30-08:55
Long-term Trends of in-plane-irradiance, Energy Yield and Performance for PV Systems
Björn Müller
Fraunhofer Institute for Solar Energy Systems, Germany

ORAL PRESENTATION
08:55-09:15
Development of a Big Data Bank for PV Monitoring Data, Analysis and Simulation in COST Action PEARL PV
Angele Reinders¹, Wilfried van Sark¹, David Moser²
¹University of Twente and Eindhoven University of Technology, Netherland
²EURAC, Italy

09:15-09:35
Artificial Intelligence Algorithm for Bifacial Solar Tracking System
Shitao Wang
Arctech Solar Holding Co., Ltd, China

09:35-09:55
Is Tracker Allocation Optimization in Monsoon Region Different from North America and Europe?
Kenji Araki¹, Daisuke Sato¹, Yasuyuki Ota², Kensuke Nishioka², Masafumi Yamaguchi³
¹Toyota Technological Institute, Japan
²University of Miyazaki, Japan
Thursday, November 7, Room 308
Area 11 PV Systems Including BOS Component
Session Chair: Haitao Liu

INVITED SPEECH
10:30-10:55
Intelligent Microgrid-System Solutions for Distributed Energy
Huang Lang
TBEA Xinjiang Sunoasis Co., Ltd. China

ORAL PRESENTATION
10:55-11:15
Photovoltaics in the Urban Environment: Towards a Fast, Accurate and Remote 3D-Based Energy Potential Simulation Framework
Andres Calcabrini, Hesan Ziar, Olindo Isabella, Miro Zeman
Delft University of Technology, Netherland

11:15-11:40
River PV Pump Systems and Its Role in Local Economic and Society Development
Zuming Liu, Jiehui Li, Jun Dong
Yunnan Normal University/Yunnan ZY Energy Corporation, China

11:40-12:00
A Fault Detection Method Based on Similarity Measurement for Photovoltaic System
Chen Chen, Wu Linyong, Ce Ji, Shukai Tian, Liying Luo
Xi'an LONGi Clean Energy Co., Ltd. China

Thursday, November 7, Room 308
Area 12 PV System Integration Including Smart Grid
Session Chair: Yibo Wang, Luciano Martini

INVITED SPEECH
10:30-10:50
Cooperation with Neighboring Countries to Realize Super Grid in Northeast Asia
Jinsoo Song
Northeast Asia Renewable Energy Institute

10:50-11:10
Researches and Practices of Grid Integration Technology
Lingzhi Zhu
New energy research center, China electric power research institute
11:10-11:30
An Overview of Global Grid Codes for the Integration of High Penetration of Solar PV Systems
Roland Bründlinger
Austrian Institute of Technology (AIT), Austria

ORAL PRESENTATION
11:30-11:45
Large-scale Solar Energy Integration in Australia and the Asia-Pacific
Bin Lu, Andrew Blakers, Matthew Stocks, Cheng Cheng, Anna Nadolny
Australian National University, Australia

11:45-12:00
Integrating High PV Penetrations into Restructured Electricity Industries - Experience from the Australian National Electricity Market
Iain MacGill, Navid Haghdadi, Anna Bruce
UNSW Sydney, Australia

Thursday, November 7, Room 308
Area 12 PV System Integration Including Smart Grid
Session Chair: Yibo Wang, Luciano Martini

INVITED SPEECH
13:30-13:50
International Cooperation to Enable Seamless Integration of High Levels of Variable Renewable Energy into Electric Power Systems
Luciano Martini
Ricerca sul Sistema Energetico Spa (RSE), Italy

13:50-14:10
Distributed Direct Current (DC) Microgrid in Building and Campus Energy System Applications
Wei Feng
Lawrence Berkeley National Laboratory (LBNL), USA

14:10-14:30
Integration of Photovoltaic Systems into Smart Grids
Gerd Heilscher
Technische Hochschule Ulm, University of Applied Sciences, Germany
ORAL PRESENTATION

14:30-14:42
Data-driven Estimation of Aggregate Distributed PV Systems output in the Australian States
Navid Haghdadi, Anna Bruce, Iain MacGill
UNSW, Australia

14:42-14:54
Series-connected PV MVDC Converter with Wide Range Input and Output Voltage for Large Scale PV System
Huan Wang, Xinke Huang, Yibo Wang, Honghua Xu
Institute of Electrical Engineering, Chinese Academy of Sciences, China

14:54-15:06
An Improved Double-diode Model Based Simulation Method for PV Arrays
Yuanqing Yao, Yibo Wang
Institute of Electrical Engineering, Chinese Academy of Sciences, China

15:06-15:18
Solar Collective Self-consumption and Blockchain
Quinette Jean Yves
TECSOL, France

15:18-15:30
A Control Method of Low Voltage Ride Through for Photovoltaic Converters Based on Model Predictive Control
Gang Fang, Yong Yang, Jinjun Lu, Tao Liu, Weibo Zeng, Jiabing Wu, Shuai Weng, Li Wang, Chenyang Li
Jiang Su Goodwe Power Technology Co., Ltd

15:30-15:42
Fault Diagnosis Algorithm Based on IV Curve and Parameter Optimization for PV Arrays
Kun Ding Xiang Chen, Fudong Chen, Yuanliang Li
College of Mechanical & Electrical Engineering, Hohai University, China

15:42-15:54
Seasonal Irradiation Prediction in Solar-sharing by Solar-trackers for Uniform Illumination to Crops Using Solar Irradiation Databases
Kenji Araki, Daisuke Sato, Masafumi Yamaguchi
Toyota Technological Institute, Japan
Friday, November 8, International Reporting Hall

Area 2 Perovskite Solar Cells

Session Chair: Hiroshi Segawa, Yonghua Chen

### INVITED SPEECH

08:30-08:50
Sn-Perovskite Solar Cells with Narrow Band Gap – Toward Tandem and Pb Free Perovskite Solar Cells
Shuzi Hayase
The University of Electro-Communications, Japan

08:50-09:10
Thermal Stability Issue of Perovskite Solar Cells
Seigo Ito
University of Hyogo, Japan

### ORAL PRESENTATION

09:10-09:25
Surface Molecular Doping of Metal Oxide Nanocrystals to Enhance Carrier Transport of Perovskite Solar Cells
Zhubing He, Wei Chen, Bao Tu, Yinghui Wu, Rongguo Xu
Southern University of Science and Technology, China

09:25-09:40
Precursor Engineering for High Performance CsPbI₂Br Perovskite Solar Cells
Zhike Liu, Shengzhong (Frank) Liu
Shaanxi Normal University, China

09:40-09:55
Reduced Defects Density in Perovskite Absorber Achieved by Ionic Compensation
Xin Zhou, Yuelong Li
Nankai University, China

9:55-10:10
First-Principles Study of Enhanced Out-of-Plane Transport Properties and Stability in Dion-Jacobson 2D Perovskite Semiconductors for High-Performance optoelectronics
Zhuo Xu, Ming Chen, Shengzhong (Frank) Liu
Shaanxi Normal University, China
INVITED SPEECH

08:30-08:50
Beyond 10% Efficiency Cd-Free Earth-Abundant and Environmentally-Friendly CZTS Solar Cells
Xiaojing Hao
University of New South Wales, Australia

ORAL PRESENTATION

08:50-09:05
High Efficiency Cu₂ZnSnS₄ Solar Cells Through a Novel Moisture-Assisted Post-Deposition Annealing
Heng Sun, Jialiang Huang, Chang Yan, Kaiwen Sun, Jaesung Yun, Trevor Young, Martin Green, Xiaojing Hao
University of New South Wales, Australia

09:05-09:20
Interface Carrier Transport of Pure Sulfide Cu₂ZnSnS₄ Thin Film Solar Cells
Yanchan Huang¹, Jianjun Li², Xiaochen You¹, Hongbing Zhu¹, Yaohua Mai¹, Xiaojing Hao², Martin A. Green²
¹Institute of New Energy Technology, College of Information Science and Technology, Jinan University, Guangzhou 510632, China
²Australian Centre for Advanced Photovoltaics, School of Photovoltaic and Renewable Energy Engineering, University of New South Wales, Sydney, NSW 2052, Australia

09:20-09:35
The Influences of Zn/Sn Ratio on Performances of Cu₂ZnSnSe₄ Solar Cells by Sputtering from Quaternary Targets
Xinchen Li¹, Daming Zhuang¹, Ming Zhao¹, Ning Zhang², Guoan Ren¹, Xunyan Lyu¹, Chen Wang¹
¹Tsinghua University, China
²Beijing Sifang Crenergy Optoelectronics Technology Co., Ltd., China

09:35-09:50
Enhancing the Performance of Ba-Doped Kesterite Solar Cells by Sol-Gel Method
Jiajia Guo, Zhaojing Zhang, Qing Gao, Jianping Ao, Guozhong Sun, Zhiqing Zhou, Fangfang Liu, Yi Zhang, Yun Sun
Nankai University, China
09:50-10:05
Effects of H₂Se Concentration in Mixed Annealing Atmosphere on CZTSSe Absorbers for High-Efficiency CZTSSe Solar Cells
Guoan Ren, DaMing Zhuang, Ming Zhao, YaoWei Wei, YiXuan Wu, XinChen Li, XunYan Lyu, Chen Wang
Tsinghua University, China

Friday, November 8, Room 306
Area 5 III-V Compound Semiconductor, Concentrator and Space PV Technologies
Session Chair: Nicholas Ekins-Daukes, Sun Qiang, Chen Nuofu

INVITED SPEECH
08:30-08:50
Navigating the 1eV Junction Challenge with Lattice-Matched GaAs Based Multi-Junction Solar Cells
Nicholas Ekins-Daukes
UNSW Sydney, Australia

08:50-09:10
Progress in Industrialization of High Efficient Space GaAs Solar Cells in China
Tu JieLei
Yunnan Normal University, China

ORAL PRESENTATION
09:10-09:25
Potential of Low-concentration Static CPV Module (Tandem, Flexible and High Coverage to the 3-D Curved Surface) for Car-roof Application
Daisuke Sato¹, Kenji Araki¹, Noboru Yamada², Masafumi Yamaguchi¹
¹Toyota Technological Institute, Japan
²Nagaoka University of Technology, Japan

09:25-09:40
GaAs//Si Hybrid Double Junction Cells Fabricated by Direct Bonding of Epitaxially Lifted-Off GaAs Subcell Layers on PET Films
Ryo Kozono¹, Jianbo Liang¹, Kentaroh Watanabe², Masakazu Sugiyama²,
Naoteru Shigekawa¹
¹Osaka City University, Japan
²University of Tokyo, Japan

09:40-09:55
High-efficiency Planar Micro-tracking Photovoltaic Modules with Hybrid III-V/Si Architecture for Space-constrained Installations
Gael Nardin¹, Alvaro F. Aguilar¹, Laetitia Anglade¹, Florian Gerlich¹, Mathieu Ackermann¹, Laurent Coulot¹, Delphine Petri², Jacques Levrat², Jonathan Champliaud²,
Antonin Faes\textsuperscript{2}, Matthieu Despeisses\textsuperscript{2}, Stephen Askins\textsuperscript{3}, Norman Jost\textsuperscript{3}, César Domingez\textsuperscript{3}, Ignacio Anton\textsuperscript{3} \\
\textsuperscript{1}Insolight SA, Switzerland \hspace{1cm} \textsuperscript{2}CSEM PV-Center, Switzerland \hspace{1cm} \textsuperscript{3}Universidad Politécnica de Madrid, Spain

09:55-10:10
Development of GaAs//InGaAs 2-junction Solar Cell with Surface Activated Bonding
Takafumi Fukutani\textsuperscript{1}, Kentaroh Watanabe\textsuperscript{2}, Hassanet Sodabanlu\textsuperscript{2}, Yoshiaki Nakano\textsuperscript{1}, Masakazu Sugiyama\textsuperscript{2} \\
\textsuperscript{1}Department of Engineering, University of Tokyo, Japan \hspace{1cm} \textsuperscript{2}Research Center for Advanced Science and Technology, University of Tokyo, Japan

Friday, November 8, Room 311
Area 8 Thin Film, IBC and HIT solar Cells
Session Chair: Fanying Meng, Mitsuhiro Matsumoto

INVITED SPEECH
08:30-08:50
High Efficiency Hetero-junction Back Contact Crystalline Si Solar Cells
Daisuke Adachi
Kaneka, Japan

08:50-09:10
ZEBRA: Standardly Diffused IBC Cell Technology Moving Towards 700mV and 24% at PERC Production Costs
Radovan Kopecek
ISC Konstanz, Germany

ORAL PRESENTATION
09:10-09:25
Bifacial IBC Crystalline Silicon Solar Cell: Fabrication with Multi-layer Metallization Structure Using Screen Printing Technology
Tomihisa Tachibana, Katsuto Tanahashi, Toshimitsu Mochizuki, Katsuhiko Shirasawa, Hidetaka Takato
AIST, Japan

09:25-09:40
Rib Silicon Heterojunction Solar Cells with Textured Surfaces
Tsukasa Takamura\textsuperscript{1}, Ryuto Iwata\textsuperscript{1}, Yukimi Ichikawa\textsuperscript{1}, Kimihiko Saito\textsuperscript{2}, Makoto Konagai\textsuperscript{1} \\
\textsuperscript{1}Tokyo City University, Japan \hspace{1cm} \textsuperscript{2}Fukushima University, Japan
09:40-09:55
Development and Mass-production of Cost-effective Interdigitated Back Contact Solar Cells
Yingwen Zhao
Jolywood Solar Technology Co. Ltd. China

09:55-10:10
Straight Forward IBC-HJT Cells over 25% Efficiency
Strahm, Benjamin, D. Lachenal, D. Baetzner, W. Frammelsberger, N. Holm, T. Koessler, B. Legradic, P. papet
Meyer Burger Research AG, Switzerland

Friday, November 8, Room 308
Area 11 PV Systems Including BOS Component
Session Chair: Yonggang Shao

INVITED SPEECH
08:30-08:55
Degradation Rates of High-efficiency Crystalline Silicon Photovoltaic Technologies under Subtropical Coastal Climate Conditions
Tetsuyuki Ishii
Central Research Institute of Electric Power Industry, Japan

ORAL PRESENTATION
08:55-09:15
Snow Cover Loss Separation Method for PV Systems Using Clustering of Operating Point
Ryutarou Iwashita, Yuzuru Ueda
Tokyo University of Science, Japan

09:15-09:35
Estimated Power Generation Amounts Calculated by Using the Degradation Rate of Photovoltaic Modules Exposed Outdoors in Japan
Yasuo Chiba1, Tetsuyuki Ishii2, Ritsuko Sato1, Sungwoo Choi1, Atsushi Masuda1
1National Institute of Advanced Industrial Science and Technology, Japan
2Central Research Institute of Electric Power Industry, Japan

09:35-9:55
Feasibility for Use of Multilayer Polymer Planar Booster Reflector in PV Systems
Yugao Deng1, Yahui Shao2
1Toray Industries, Japan
2Shanghai Institute of Microsystem & Information Technology Chinese Academy of Sciences, China
Area 1 Advanced Concepts and New Emerging Materials for Future PV

1MoP.1/1190
Characterizing Modules Light Management Potential with Existing Materials (structured ribbons, films, multiwire) and New Solutions by Means of Hemispheric IAM (HIAM) Robust Method.
Martino Falsini
Martino Falsini, Italy

1MoP.2/1049
Study the Mechanisms of Carrier Quantum Confinement and Interfacial Phonon Mismatch over Phonon Bottleneck Effect in InN Multiple Quantum Wells
Yi Zhang
Hohai University/College of Energy and Electrical Engineering, China

1MoP.3/787
Hydrogen Dilution Micro-control of Intrinsic Amorphous Silicon Absorber Layer in Amorphous Silicon Solar Cells
Zilun Sheng, Pengfei Shi, Qi Shan, Ke Zhong, Hao Du, Tiantian Li
Inner Mongolia University, China

1MoP.4/777
Up to 98.2% Super Transmittance and Precise Modification Wavelength Band Via Veins Like Ag in ITO/Ag/AZO Sandwich Structure
Ningyu Ren, Pengfei Shi, Ke Zhong, Qi Shan, Zilun Sheng, Tiantian Li
Inner Mongolia University, China

1MoP.5/750
Novel Organic-Silicon Heterojunction Solar Cells with Solution-Processed Contacts
Rongzong Shen, Yurong Zhou, Fengzhen Liu
Center of Materials Science and Optoelectronics Engineering & College of Materials Science and Opto-Electronic Technology, University of Chinese Academy of Sciences, China

1MoP.6/691
Graphene-silicon Schottky Junction Solar Cells by Direct Synthesis of Graphene on Silicon
Sudip Adhikari, M. Umeno
C’s Techno Inc, Japan
1MoP.7/646
Enhanced Power Conversion Efficiency Via Hybrid Ligand Exchange Treatment of p-Type PbS Quantum Dot
Zhi Li The, Robert J Patterson, Yijun Gao, Gavin Conibeer, Shujuan Huang
UNSW, Australia

1MoP.8/603
Two-step Solution-processed Tin Oxide Films as an Electron Transport Layer for Planar Perovskite Solar Cell
Xiaoyang Ma, Jia Xu, Xiaolong Liu, Jianxi Yao
North China Electric Power University, China

1MoP.9/588
Efficient Planar CH$_3$NH$_3$PbBr$_3$ Perovskite Solar Cells Prepared at Room Temperature with Ionic-liquids/Fullerene as an Electron Transport Bilayer
Yao Qi, Jicheng Luan, Jia Xu, Xiaolong Liu, Jianxi Yao
North China Electric Power University, China

1MoP.10/554
Research of V$_2$O$_5$/WO$_3$ Layers as Hole Selective Contact for p-type Silicon Solar Cell
Zongtao Liu, Wenjie Lin, Qi Xie, Lanxiang Meng, Kai Zhang, Hui Shen
Sun Yat-sen University, China

1MoP.11/503
Investigations on Composite-Absorber Solar Cells through SCAPS Simulation
Xiaohan Yin, Zhipeng Xuan, Yunfan Wang, Dan Yang, Lili Wu
Institute of Solar Energy Materials and Devices, Sichuan University, China

1MoP.12/444
Significant Photoresponsivity Improvement of Hydrogen Passivated BaSi$_2$
Zhihao Xu, Kaoru Toko, Takashi Suemasu
University of Tsukuba, Japan

1MoP.13/407
Improvement in Electrical Conductivity of PEDOT:PSS Films Induced by Efficient Packing of PEDOT
Yanbin Shi, Yuqin Zhou, Fengzhen Liu, Ming Liu, Fengchao Li, Yurong Zhou
University of Chinese Academy of Sciences, China

1MoP.14/359
Two-Dimensional (PEA)$_2$PbBr$_4$ Perovskite Single Crystals for High Performance UV-Detector
Yunxia Zhang, Yucheng Liu, Zhou Yang, Shengzhong Liu
Shaanxi Normal University, China
1MoP.15/335
Structural, Optical and Electrical Properties of Transparent and Conducting F-doped MgZnO Films Prepared by RF Magnetron Co-sputtering
Huiqin Wang, Ailing Wang, Lili Wu, Wei Li, Jingquan Zhang, Wenwu Wang, Lianghuan Feng
Sichuan University, China

1MoP.16/301
Memoristor Based on Yellow-phase CsPbI3 Films
Yanhong Wu, Jia Xu, Jianxi Yao
NCEPU, China

1MoP.17/275
Facile Solution-Processed Ternary Sulfide as Light Absorber in Thin Film Solar Cells
Liangzheng Zhu1, Xu Pan2
1Anhui Province Key Laboratory of Condensed Matter Physics at Extreme Conditions, High Magnetic Field Laboratory, Chinese Academy of Science, China
2Key Laboratory of Novel Thin-Film Solar Cells, Institute of Applied Technology, Hefei Institutes of Physical Science, Chinese Academy of Sciences, China

1MoP.18/264
Composition Engineering of Sb2S3 Film Enabling High Performance Solar Cells
Yiwei Yin, Chunyan Wu, Tao Chen, Changfei Zhu
University of Science and Technology of China, China

1MoP.19/7
The Role of Highly Conductive ZnO by Pulsed Laser Deposition for Interface Charge Transfer in PbS Colloidal Quantum Dot Solar Cells
Jiantuo Gan
University of Electronic Science and Technology of China, China

1MoP.20/245
Single Phase FA0.92MA0.08PbI3 with Broader Absorption Spectrum, Reduced defects, and Significantly Enhanced Stability
Pengju Shi, Songyuan Dai
NCEPU, China

1MoP.21/242
Alkali Metals Doping for High-Performance Planar Heterojunction Sb2S3 Solar Cells
Chenhui Jiang, Tao Chen, Rongfeng Tang, Xiaomin Wang
University of Science and Technology of China, China

1MoP.22/231
Development of Fabrication Process for Nano-wall Si Solar Cells
Yukimi Ichikawa, Masakazu Hirai, Makoto Konagai
Tokyo City University, Japan
1MoP.23/215
Self-assembly Effect of Potassium Iodide in the FAPbI$_3$ Perovskite Solar Cells
Weng Yang, Molang Cai, Songyuan Dai
North China Electric Power University, China

1MoP.24/181
Triple Cation NH$_3$C$_2$H$_4$NH$_2$C$_2$H$_4$NH$_3^+$-induced Phase-stable Inorganic α-CsPbI$_3$ Perovskite Films for Use in Solar Cells
Xihong Ding, Songyuan Dai
North China Electric Power University, China

1MoP.25/156
Bi$_2$O$_2$Se/Graphene Heterostructures for Photo-electric Conversion
Chengyun Hong, Songyuan Dai
NCEPU, China

1MoP.26/127
Modified MnO$_2$ Nanomaterials as a Cycle-stable Cathode for High-Performance Aqueous Zn-ion Batteries
Yunzhao Wu, Yong Ding, Songyuan Dai
North China Electric Power University, China

1MoP.27/110
Facile Synthesized Pyridine-Triphenylamine Hole Transport Material for Inverted Perovskite Solar Cells
Shuang Ma, Xuepeng Liu, Songyuan Dai
North China Electric Power University, China

1MoP.28/59
Characterization of Silicon Quantum Dot Solar Cell with the Phosphorus Blocking Layer Ryushiro Akaishi$^1$, Kazuhiro Gotoh$^1$, Shinya Kato$^2$, Noritaka Usami$^1$, Yasuyoshi Kurokawa$^1$
$^1$Department of Materials Process Engineering, Nagoya University, Japan
$^2$Department of Electrical and Mechanical Engineering, Nagoya Institute of Technology, Japan

1MoP.29/1297
Effect of Number of Multiple Quantum Well to Radiative and Non-radiative Recombination Warakorn Yanwachirakul$^1$, Tetsuya Nakamura$^2$, Kentaroh Watanabe$^1$, Yoshiaki Nakano$^3$, Masakazu Sugiyama$^1$
$^1$Research Center of Advance Science and Technology (RCAST), The University of Tokyo, Japan
$^2$Japan Aerospace Exploration Agency (JAXA), Japan
$^3$Department of Electrical Engineering and Information System, The University of Tokyo, Japan
Area 2.1 Perovskite Solar Cells

2.1MoP.1/52
Planar Heterojunction Solar Cells using MAPbI₃ Films Deposited by Hot-Wall Method
Satoru Seto, Atushi Matuzawa, Miharu Kanetani
National Institute of Technology, Ishikawa College, Japan

2.1MoP.2/1160
Suppressing the Metal-contact-induced Degradation of Inverted Perovskite Solar Cells by Electron Transport Bilayer Structure
Haixu Liu, Hao Luo, Huiyu Zhang, Yanan Hao, Wenxiu Zhang, Wanbing Lu, Wei Yu
National-Local Joint Engineering Laboratory of New Energy Photoelectric Devices, College of Physics Science and Technology, Hebei University, China

2.1MoP.3/1126
Enhanced Light Absorption of Perovskite Solar Cells With Porous SnO₂ Layer
Heng Pan, Peirun Chen, Biao Shi, Yucheng Li, Qian Huang, Ying Zhao, Xiaodan Zhang
Institute of Photoelectronic Thin Film Devices and Technology of Nankai University, China

2.1MoP.4/1124
CO₂ Plasma Treatment of AZO Film as Effective Electron Transport Layer for Planar Perovskite Solar Cells
Huang Qian
Institute of Optoelectronic Thin Film Devices and Technology, Nankai University, Tianjin, China

2.1MoP.5/1083
Critical Role of Potassium in Charge-carrier Balance and Diffusion Induced Defect Passivation for Efficient Inverted pPerovskite Solar Cells
Ziyi Wu, Xuewen Yin, Hong Lin
Tsinghua University, China

2.1MoP.6/1064
Incorporation of a Novel Interfacial Layer for Improved Efficiency in Inverted Structure Perovskite Solar Cells
Faiazul Haque¹, Haimang Yi¹, Jihoo Lim¹, Leiping Duan¹, Hong Duc Pham², Prashant Sonar², Matthew Wright¹, Gavin Conibeer¹, Ashraf Uddin¹
¹The University of New South Wales, Australia
²Queensland University of Technology, Australia

2.1MoP.7/1005
One-step Solution Synthesis and Stability Study of Inorganic Perovskite Semiconductor Cs₂SnI₆
Nairui Xiao, Yali Qiu, Duoduo Liu, Yehua Tang, Kefan Wang
Henan University, China
2.1MoP.8/946
NbF5: A Novel α-Phase Stabilizer for FA-based Perovskite Solar Cells with High Efficiency
Shihao Yuan
Shaanxi Normal University, China

2.1MoP.9/940
Dual Function SBOET Glass Improves the Stability and Efficiency of Perovskite Solar Cell
Yiyang He, Jingyan Fan, Jing Gou, Shengzhong (Frank) Liu
School of Materials Science and Engineering, Shaanxi Normal University, China

2.1MoP.10/938
Fabrication of Efficient CsPbBr$_3$ Perovskite Solar Cells by Single-source Thermal Evaporation
Fei Ga, Juan Li, Rongrong Gao, Haoxu Wang, Hao Liu, Shengzhong Liu
Shaanxi Normal University, China

2.1MoP.12/931
Stable High-Performance Perovskite Solar Cells via Grain Boundary Passivation
Tianqi Niu
Shaanxi Normal University, China

2.1MoP.13/930
Crystallized Perovskite Materials used for Radiation Detection
Mingxi Hu, Zhou Yang, Shengzhong(Frank) Liu
Shaanxi Normal University, China

2.1MoP.14/927
Fluorine Passivated Defects in Zinc Oxide Electron Transport Layers for High-Performance PSCs
Shengzhong(Frank) Liu, Dapeng Wang, Wenjing Zhao
Shaanxi Normal University, China

2.1MoP.15/921
Crystallization Engineering for High Performance Perovskite Solar Cells
Haoran Wang, Kui Zhao, Shengzhong(Frank) Liu
Shaanxi Normal University, China

2.1MoP.16/914
A Complete set of Energy Level Positions of all Primary Metal-halide Perovskites
Shuxia Tao
TU/e, Netherlands

2.1MoP.17/909
Low-temperature Processed α-WOx/SnO$_2$ Electron Transporting Layer for Efficient Perovskite Solar Cells
Fengyou Wang, Yuhong Zhang, Meifang Yang, Jinyue Du, Lili Yang, Lin Fan
Jilin Normal University, China
2.1MoP.18/908
H2O-Assisted Hierarchical TiO2 as Electron Transporting Layers for Perovskite Solar Cells
Fengyou Wang, Meifang Yang, Yuhong Zhang, Lili Yang, Lin Fan
Jilin Normal University, China

2.1MoP.19/853
Strategies to Improve the Wettability of PTAA in Inverted Planar Perovskite Solar Cells
Ying Tian, Yuzeng Xu, Minna Hou, Yan Wu, Changchun Wei, Guangcai Wang,
Dekun Zhang, Qian Huang, Yuelong Li, Guofu Hou, Ying Zhao, Yi Ding, Xiaodan Zhang
Nankai University, China

2.1MoP.20/852
Stability of CuSCN-Based Perovskite Solar Cells
Ying Tian, Yuzeng Xu, Minna Hou, Yan Wu, Changchun Wei, Guangcai Wang,
Dekun Zhang, Qian Huang, Yuelong Li, Guofu Hou, Ying Zhao, Yi Ding, Xiaodan Zhang
Nankai University, China

2.1MoP.21/851
Effect of Solvent Blends on The Morphology and Efficiency of Perovskite Solar Cells
Nam Le, Nguyen Truong, Trang T.T Le, Chinho Park
Yeungnam University, Korea

2.1MoP.22/806
Highly Efficient and Stable Tin Perovskite Solar Cells Via Material and Interface Engineering
Bin-Bin Yu, Min Liao, Zhubing He
Southern University of Science and Technology, China

2.1MoP.23/780
Large-grain and Smother Cesium Doped CH3NH3PbI3 Perovskite Films by CsI Post-
treatment for Improved Solar Cells
Jinhua Gu
Zhengzhou University, China

2.1MoP.24/770
Highly Efficient and Stable Perovskite Solar Cells with NiO Thin Film as Hole Transporting
Material Prepared by Physical Vapor Deposition
A. K. Mahmud Hasan1, Zarrin Bani2, Boon Kar Yap2, Itaru Raifuku3, Yasuaki Ishikawa3,
NOWSHAD AMIN2, Yukiharu Uraoka3, Md. Akhtaruzzaman1
1Universiti Kebangsaan, Malaysia
2Universiti Tenaga Nasional, Malaysia
3Nara Institute of Science and Technology, Japan
2.1MoP.25/762
Reactive Sputtered CuxO Thin Film as Hole Transport Materials for Efficient Perovskite Solar Cell Application
M. A. Islam¹, Zarrin Bani¹, Halina Misran¹, Boon Kar Yap¹, Nilofar Asim², Md. Akhtaruzzaman², NOWSHAD AMIN¹
¹Universiti Tenaga Nasional, Malaysia
²Universiti Kebangsaan, Malaysia

2.1MoP.26/757
Stable High Efficiency Two-Dimensional Perovskite Solar Cells via Cesium Dopin
Xu Zhang¹, Kui Zhao², Shengzhong (Frank) Liu³
¹Dalian Institute of Chemical Physics, Chinese Academy of Sciences, China
²Shaanxi Normal University
³Dalian Institute of Chemical Physics, Chinese Academy of Sciences, Shaanxi Normal University, China

2.1MoP.27/749
One-step, in-situ Formation of the Perovskite Layer by Bar-coating of the Polymer-containing Perovskite Ink
Akihiro Okada¹, Marika Ohwada¹, Takeo Suga¹, Kenichi Oyaizu¹, Hiroshi SEGAWA², Hiroyuki Nishide¹
¹Department of Applied Chemistry and Research Institute for Science and Engineering, Waseda University, Tokyo 169-8555, Japan
²Research Center for Advanced Science and Technology, University of Tokyo, Tokyo 153-8904, Japan

2.1MoP.28/688
Record Efficiency Stable Flexible Perovskite Solar Cell Using Effective Additive Assistant Strategy
Jiangshan Feng, Dong Yang, Shengzhong (Frank) Liu
Shaanxi Normal University, China

2.1MoP.29/679
Synergistic Effect of DMF and MACl in Two-step Method Towards Efficient Perovskite Solar Cells
Minna Hou, Ying Tian, Yuzeng Xu, Yan Wu, Changchun Wei, Guangcai Wang, Dekun Zhang, Qian Huang, Yuelong Li, Yi Ding, Guofu Hou, Ying Zhao, Xiaodan Zhang
Nankai University, China

2.1MoP.30/595
Reactive Thermal Evaporated SnO₂ as Electron TransportLayer of Planar Perovskite Solar Cells for Textured Tandem Solar Cells Application
Zhigang Che, Ming Liu, Fengchao Li, Yanbin Shi, Yurong Zhou, Fengzhen Liu, Yuqin Zhou
University of Chinese Academy of Sciences, China
2.1MoP.31/582
Moth-Eye PEDOT:PSS Layer for Improving Light Harvesting Efficiency in p-i-n Perovskite Solar Cells
Yanan Li, Jianing Cheng, Weijie Du, Yiwen Zhang
Shanghai Normal University, China

2.1MoP.32/527
Flexible Perovskite Solar Cells Formed on Brookite TiO$_2$ Nanoparticle Electron Transport Layer
Masao Isomura
Tokai University, Japan

2.1MoP.33/480
Enhanced Efficiency in Perovskite Solar Cells by Eliminating Electron Contact Barrier between the Metal Electrode and Electron Transport layer
Junlei Tao
Hebei University, China

2.1MoP.34/469
Study on Interface Passivation of Perovskite Solar Cells Based on Semiconductor Additives
Shuai Zhang, Zhilei Hu, Wenwen Liu, Li Wang
Changzhou University, China

2.1MoP.35/458
Enhanced Perovskite Crystallization by Polyvinylpyrrolidone Additive for Solar Cells
Jin Yan, Nan Li, Yuqian Ai, Zenggui Wang, Min Zhao, Weichuang Yang, Baojie Yan, Jichun Ye, Jiang Sheng
Ningbo Institute of Materials Technology and Engineering, China

2.1MoP.36/457
Optical Management with Upconversion Nanoparticles for Light Conversion Efficiency Enhancement in Inorganic $\gamma$-CsPbI$_3$ Solar Cells
Liang Lei
Shaanxi Normal University, China
Area 4.1 Thin-film Compound Semiconductor PV

4.1MoP.1/1165
Influence of Deposition Pressure on the Properties of Sputtered-SnS Thin Films and Power Conversion Efficiency of SnS Thin Film Solar Cells
SangWoon LEE1, Juna Kim2, Donghyun Hwang2, Chang-Sik Son2
1Pusan National University, Korea
2Silla University, Korea

4.1MoP.2/1141
Wide Bandgap Cu(InGa)S2 Prepared by Co-evaporation Method
Shinho Kim, Takehiko Nagai, Shogo Ishizuka, Hitoshi Tampo, Shigeru Niki
AIST, Japan

4.1MoP.3/1139
Effect of Pre-mixed Potassium on Selenization of Sputtered Mo and Cu-In-Ga Precursor
Yeungnam University, Korea

4.1MoP.4/1122
Compositional Change of Ge-incorporated Kesterite Solar Cell for High Device Performance
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4.1MoP.5/1117
Effect of Sintering Temperature on the Optoelectronic Properties of Mg and Ga Co-Doped ZnO Thin Films
Jun Sung Jang, Jin Hyeok Kim
Chonnam National University, Korea

4.1MoP.6/1114
Synthesis and Characterization of SnS2 Buffer Layer for Cu(In, Ga)Se2 Thin Film Solar Cell
Salh Alhammadi, Sreedevi Gedi, Yeongju Seo, Doohyung Moon, Euiseon Kim,
Woo Kyoung Kim
Yeungnam University, Korea

4.1MoP.7/1108
Fabrication of Cu2SnS3 Thin Film Solar Cells on Molybdenum Foil Substrates
Eunae Jo, Jin Hyeok Kim
Chonnam National University, Korea
4.1MoP.8/1107
Effect of Annealing Temperature on Morphological Evolution of Stack and Co-puttered Precursors in Cu2ZnSn(S, Se)4 Thin Film Solar Cells
Vijay Chandrakant Karade, Jin Hyeok Kim
Department of Materials Science and Engineering, Chonnam National University, Korea

4.1MoP.9/1102
Studies on of SnS and SnS2 Thin Films for Solar Cells
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2Sri Venkateswara University

4.1MoP.10/1098
Improving the Performance of Sb2Se3 Thin Film Solar Cells Via Optimum Inclusion of Sb0x
Yuseong Jang, Youngjin Kim, Seongcheol Jung, Byungha Shin
Department of Materials Science and Engineering, Korea Advanced Institute of Science and Technology, Korea

4.1MoP.11/1091
Preparation of Cu2GeS3 thin Films by a Co-evaporation Method
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2National Institute of Technology (KOSEN), Miyakonojo College, Japan

4.1MoP.12/1054
Effect of GeSe2 on the Preparation and Properties of Cu2Zn(Sn, Ge)(S, Se)4 Films
Chao Gao
Hebei University, China

4.1MoP.13/1042
16% CIGS Solar Cells Sputtered From a Single Target Without Additional Selenization
Wanlei Dai, Junmin Zhang, Ruobing Wang, Chaowei Xue, Haoyu Xu, Wei Yu
Hebei University, China

4.1MoP.14/1028
Deposition of Earth-Abundant Zinc Tin Nitride Films Free of Oxygen Impurity by Plasma Enhanced Chemical Vapor Deposition
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2Korea Research Institute of Chemical Technology (KRICT), Korea

4.1MoP.15/1018
Enhanced Performance of Solution-processed CZTSSe Thin Film Solar Cells by Selenium Addition in Non-hydrazine Precursor Solution
Xiaojie Yuan1, Jun Zhang2, Feng Peng3, Martin Green1, Xiaojing Hao1
1UNSW, Australia
2Lingnan Normal University, China
3Guangzhou University, China

4.1MoP.16/1000
Understanding the Influence of Seed Layer Towards the Growth of Cubic SnS for Solar Cell Applications
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4.1MoP.17/964
Effect of Sulfurization Temperature on the Properties of SnS Thin Films Sulfurized by Effusion Cell Evaporation
Vasudeva Reddy, Mohan Reddy, Chinho Park
Yeungnam University, Korea

4.1MoP.18/961
Comparison of (Ga, Al):ZnO and Al:ZnO Transparent Conducting Oxide layer On Cu(In, Ga) Se₂ Thin-film Solar Cell
SungWook Cho¹, JiA Oh¹, ShinHyuk Kang², HyungRok Lee², ChanWook Jeon¹
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²Samsung Corning Advanced Glass LLC., Korea

4.1MoP.19/958
Effect of Sulfurization Time on the Efficiency of Monoclinic Cu₂SnS₃ Solar Cells
Mohan Reddy Pallavolu, Vasudeva Reddy Minnam Reddy, Chinho Park
Yeungnam University, Korea

4.1MoP.20/894
Study of the Influence of the Carrier Gas on the Properties of CdS Nanowires Obtained with Bi Nanoparticles as Metal Catalyst
Patricia Gutierrez Zayas-Bazán, Karla Gutierrez Zayas-Bazán, Jorge Sastré Hernández, Jorge R. Aguilar Hernández, Gerardo S. Contreras Puente
Escuela Superior de Física y Matemáticas del Instituto Politécnico Nacional, México

4.1MoP.21/798
Effect of H2S Annealing for Sb-doped Cu₂SnS₃ Thin Films Prepared by Vacuum Evaporation
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²National Institute of Technology (KOSEN), Tsuyama College, Japan
4.1MoP.22/714
Epitaxial Lift-off CdTe/MgCdTe Double Heterostructures for Thin-film and Flexible Solar Cells Applications
Jia Ding, Cheng-Ying Tsai, Zheng Ju, Yong-Hang Zhang
Arizona State University, America

4.1MoP.23/698
Effect of KF-PDT Annealing Time on CIGS Solar Cells
Xianyang Zhang
Hebei Key Laboratory of Optic-Electronic Information Materials, China

4.1MoP.24/695
Addition of Ge in Sn/Cu/Zn Stacked Precursors and the Characterization of the CZTGSxSe Thin Films and Devices
Dae-Ho Son, Seung-Hyun Kim, Se-Yun Kim, Young-Ill Kim, Sammi Kim, Kwangseok Ahn, Shi-Joon Sung, Dae-Kue Hwang, Kee-Jeong Yang, Jin-Kyu Kang, Dae-Hwan Kim
DGIST, Korea

4.1MoP.25/683
Modify Selenization Process to Deposit Cu2ZnSn(S, Se)4 Thin Film Solar Cells
Yiming Wang, Huimin Hao, Jianming Shi, Xin Jian, Ruijian Liu, Yanchun Yang, Chengjun Zhu
Inner Mongolia University, China

4.1MoP.26/663
The Role of Interface Modification in Performance Enhancement of ZnTe:Cu Contacted CdTe Thin Film Solar Cells
Kai Shen, China
Jinan University, China

4.1MoP.27/641
Efficiency Improvement of Kesterite Cu2ZnSnS4 Solar Cell Achieved by Controlling the Donor Concentration in N-type Buffer Layer
Kaiwen Sun, Jiali Huang, Chang Yan, Ao Wang, Xin Cui, Heng Sun, Martin Green, Xiaojing Hao
The University of New South Wales, Australia

4.1MoP.28/626
Effects of Ag Layer on the Inhibited MoS2 in Cu2ZnSnS4 Solar Cells Prepared at above Atmospheric Pressure
Kang Gu, Ruiting Hao, Jie Guo, Abuduwayiti Aierken, XinXing Liu
Yunnan Normal University, China
4.1MoP.29/620
The formation of MoSe$_2$ Layer in the Selenization of Cu/Zn/Sn Metal Precursor at Low Se and SnSex Vapor pressure
Liyong Yao$^1$, Jianping Ao$^2$, Ming-Jer Jeng$^3$, Jinlian Bi$^2$, Zhaojing Zhang$^2$, Guozhong Sun$^2$, Yun Sun$^2$, Liann-Be Chang$^3$
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$^2$Nankai University, China
$^3$Chang Gung University, China

4.1MoP.30/612
Modification of Mo to Suppress the Stratification of CIGS Layer Fabricated by Sputtering from a Quaternary Target
Longlong Zeng, Chunhong Zeng, Yunfeng Liang, Jian Zhou, Peinian Huang, Haofeng Lin, Ruijiang Hong
Sun Yat-sen University, China

4.1MoP.31/593
Numerical Study and Design of Back-contacted CIGS Solar Cells
Nasim Rezaei$^1$, Paul Procel$^1$, Marcel Simor$^2$, Zeger Vroon$^3$, Olindo Isabella$^1$, Miro Zeman$^1$
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$^2$TNO/Solliance, Netherlands
$^3$TNO-Brightlands Materials Center, Netherlands

4.1MoP.32/569
Effect of Metallic Precursor Pre-Annealing Temperature on CuInS$_2$ (CIS) Film Formation
Dwinanri Egyna$^1$, Kazuyoshi Nakada$^2$, Akira Yamada$^2$
$^1$Tokyo Institute of Technology, Indonesia
$^2$Tokyo Institute of Technology, Japan

4.1MoP.33/566
Room-Temperature Surface Sulfurization for High-Performance Kesterite CZTSe Solar Cells
Siyu Wang
Nankai University, China

4.1MoP.34/543
Performance of Cu$_2$ZnSnS$_4$ Solar Cells Annealed in Sulfur-free Atmosphere
Bin Liu, Jie Guo, Ruiting Hao
Yunnan Normal University, China

4.1MoP.35/540
Optimum Back Contact for Flexible and Bifacial CIGS Solar Cells Fabricated by Lift-off Process
Naoto Hamada$^1$, Mikiya Inoue$^1$, Taizo Masuda$^2$, Takahito Nishimura$^1$, Yu Kawano$^1$, Jakapan Chantana$^1$, Takashi Minemoto$^1$
$^1$Ritsumeikan university, Japan
$^2$Toyota Motor Corporation, Japan
**4.1MoP.36/536**

Effect of Oxygen Flux on the S/(S+O) Ratio of Zn(O, S) Buffer Layer for Cd-free CIGS Solar Cells
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**Area 7 Crystalline Silicon Solar Cells and Tandem Solar Cells**

**7MoP.1/49**
Removing By-products and Plasma Damaged Layer of mc-Si Wafer induced by RIE Process
Dongkyun Kang, Hyunjung Park, Yoonmoook Kang, Hae-Seok Lee, Donghwan Kim
Korea University, South Korea

**7MoP.2/111**
The Post-modification of MACE Black Silicon’s Nanosized Texture and its Influences to the Properties of mc-Si Solar Cells
Rui Jia¹, Ke Tao¹, Xiaojing Liang¹, Zhibo Gao¹, Shuai Jiang¹, Yaopei Zhu², Chongyou Zhao³
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²Jiangsu Rongma New Energy, China
³Beijing Zhongkexin Electrical Equipment Co. Ltd, China

**7MoP.3/179**
Optimization of PECVD Aluminium Oxide Thickness for Rear Passivation of PERC Solar Cells
Nagarajan Balaji, Pradeep Padmanath, Naomi Nandakumar, Vinodh Shanmugam, John Woodrofe Rodriguez, Shubham Duttagupta
Solar Energy Research Institute of Singapore (SERIS), National University of Singapore, Singapore

**7MoP.4/454**
A Study on Amorphous Silicon Lifetime, Hydrogen Effusion and Passivation Quality
Huiting Wu, Hieu T. Nguyen, Di Kang, Nikita Gagrani, Wenjie Yang, Daniel Macdonald
The Australian National University, Australia

**7MoP.5/450**
Ag Doped ZnO/ZnO Double Antireflection Layer on Crystalline Silicon Solar Cells
Deb Kumar Shah, Youhyun Son, Ha Ryeon Lee, M. Shaheer Akhtar, O-Bong Yang, Chong Yeal Kim
Chonbuk National University, South Korea

**7MoP.6/442**
Forming Multi-scale Texture on the Diamond-wire-sawed mc-Si Wafer by Introducing Artificial Defects
Chengkun Wu, Shuai Zou, Xiaodong Su
Soochow University, China
21.3%-Efficient n-Type Silicon Solar Cell with a Full Area Rear TiO$_2$/LiF/Al Electron-selective Contact
Wenjie Wang$^{1,2}$, Jian He$^2$, Di Yan$^2$, Chris Samundsett$^2$, Wenzhong Shen$^1$
James Bullock$^3$, Yimao Wan$^2$
$^1$Shanghai Jiaotong University, China
$^2$Australian National University, Australia
$^3$University of Melbourne, Australia

Microstructure Evolution and Passivation Quality of Hydrogenated Amorphous Silicon Oxide (a-SiO$_x$:H) on $\langle 100 \rangle$ and $\langle 111 \rangle$-orientated c-Si Wafers
Shengsheng Zhao, Junfan Chen, Lingling Yan, Huizhi Ren, Can Han, Dekun Zhang, Guangcai Wang, Changchun Wei, Guofu Hou, Ying Zhao, Xiaodan Zhang
Institute of Photoelectronic Thin Film Devices and Technology of Nankai University, China

Phosphorus Treatment To Promote Crystallinity Of The Microcrystalline Silicon Front Contact Layers For Highly Efficient Heterojunction Solar Cells
Chao Lei, Lili Wu
Institute of Solar Energy Materials and Devices, College of Materials Science and Engineering, Sichuan University, China

Surface Passivation of nano-AlOOH Sol Based on Rapid Thermal Processing
Liqi Cao, Hongbo Li, Ning Yang, Shizheng Li, Xiao Yuan, Hua Tong
East China University of Science and Technology, China

On the Nature of Swirl-like Recombination Centers in Czochralski Silicon Solar Cells
Zijing Wang, Deren Yang
State Key Lab of Silicon Materials and Department of Materials Science & Engineering, Zhejiang University, China

19.5% Efficiency of Mass Production with MCCE Textured Solar Cell
Hongfang Wang, Zhuo Xu, Feng Li, Jinchao Shi, Dengyuan Song
Yingli Energy (China) Co. Ltd, ., China

Deep Learning on Electroluminescence Imaging for End-of-Line Cell Binning
Yoann Buratti, Arcot Sowmya, Rhett Evans, Thorsten Trupke, Ziv Hameiri
University of NewSouth Wales, Australia
7MoP.14/221
Beyond 22% Large-Area N-Type PERT Bifacial Solar Cells In Research and Production
Dawei Liu
SPIC Xi’an Solar Power Co., Ltd, China

7MoP.15/172
A Metal-free Additive Texturization Method On Diamond Wire Sawn Multi-Crystalline Silicon Wafers
Likai Li, Yali Ruan, Lei Wang, Deren Yang
State Key Laboratory of Silicon Materials and School of Materials Science and Engineering, Zhejiang University, China

7MoP.16/148
The Role of Glass in Contact Interface Reaction in Ag Paste Electrode Metallization Process
Jiefeng Zhang, Hua Tong, Yunxia Yang, Hongbo Li, Xiao Yuan
East China University of Science and Technology, China

7MoP.17/86
Double-sided Atomic Layer Deposited SiO2 Passivated p-PERC Solar Cells
Shizheng Li1, Jiahui Xu1, Haitao Xiang2, Xiao Yuan1, Cui Liu1, Hongbo Li1
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2Jolywood (SuZhou) Sunwatt Co., Ltd., China

7MoP.18/81
High-Performance Texturization of Multi-crystalline Silicon Wafer by HF/HNO3/H2O/MnO2 System
Huan Liu, Lei Zhao, Hongwei Diao, Wenjing Wang
Institute of Electrical Engineering, the Chinese Academy of Sciences, China

7MoP.19/61
Silicon Based Heterojunction with Hybridized Oxide Layer for Monolithic Tandem Solar Cells
D.Y.Chen1K.J.Wu, H.W.Du2, M.Gao1, X.M.Song1, F.Xu1, F.Hong1, L.Zhao1, Z.Q.Ma1
1Shanghai University, China
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7MoP.20/125
Application of B/Al Paste in Multicrystalline Silicon Passivated Emitter and Rear Cells
Ning Yang, Shizheng Li, Cui Liu, Xiao Yuan, Xiaojun Ye, Hongbo Li
East China University of Science and Technology, China

7MoP.21/1249
Metal Assisted Micro-cale Inverted Pyramids Texturization of Monocrystalline Silicon for Highly Efficient Light Trapping
Subbiramanian Kubendhiran, Hsiao-Ping Hsu, Chung-Wen Lan, National Taiwan National Taiwan University, China
7MoP.22/1156
Investigation of Carrier Selectivity and Thermal Stability of Transition Metal Oxides with Pre-grown Thin SiOx for Si Solar Cells
Jingnan Tong1, Kean Chern Fong1, Wensheng Liang1, Marco Ernst1, Daniel Walter1, Parvathala Narangari1, Stephane Armand1, Sachin Surve1, Teng Kho1, Keith McIntosh2, Matthew Stocks1, Andrew Blakers1
1Australian National University, Australia
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7MoP.23/1140
Study on High Efficiency Mono Crystal Low Surface Composite PERC Solar Cells with Mass Production Efficiency (> 22.5%)
Zhang Peng
Tongwei Solar (Chengdu) Co., Ltd, China

7MoP.24/1129
Research on Bifaciality of Industrial P Type Mono-Si Bifacial PERC Cells
Chenxu He
Chint New Energy (Hai Ning) CO., LTD, China

7MoP.25/1121
Effect of Pulsed Nd:YAG Laser Beam Translation for Texturing Silicon Solar Cells Surfaces
Nurul Huda binti Abdul Razak
Universiti Kebangsaan Malaysia, Malaysia

7MoP.26/1111
Automated Image Process of Island Electrode of Solar Cell Using Image Processing for Metal Ink-jet printing
Sujeong Jeong, Jisung Hwang, Jinsol Kim, Myoungseop Kim, Hae-seok Lee, Yoonmook Kang, Donghwan Kim
Korea University, South Korea

7MoP.27/1044
Panels with Thin PERC Solar Cells for Stratospheric Airship
Shanghai Institute of Space Power Sources, China

7MoP.28/1031
Fabrication of SHJ Solar Cells with p-type a-Si Films Formed from n-a-Si by B Cat-doping
Taiyoh Tsurugai, Keisuke Ohdaira
JAIST(Japan Adv. Inst. Sci. & Tech.), Japan

7MoP.29/1030
Two-cavity Light-tripping Scheme Used in Ultrathin c-Si Solar Cells
XiaoDong Lu, XinXin Wang
BoHai University
7MoP.30/1017
Low-cost and Controllable Texturing for DWS Silicon via Copper-assisted Chemical Etching
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²School of Photovoltaic and Renewable Energy Engineering, University of New South Wales, China Taiwan

7MoP.31/1014
Recovery of Silver from c-Si Solar Cell Using Organic Acid by Fractional Distillation
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7MoP.32/999
Controllable Synthesis of Black Silicon with Inverted Pyramid Arrays Using Copper-assisted Chemical Etching
Shuai Zhao, Qi Wang, Wenqiang Liu, Guodong Yuan
Institute of semiconductors, CAS, China

7MoP.33/982
Development of High Purification Technology of Silicon Using Supercritical CO₂ and Hexane
Hyo Seok Lee, Jaeyeong Heo, Jae Yu Cho
Chonnam National University, South Korea

7MoP.34/934
Influence of NH₃-related Radicals Generated in a Cat-CVD Apparatus on the Passivation Quality of SiNₓ Films
Yoshiaki Sumitomo Keisuke Ohdaira
Japan Advanced Institute of Science and Technology, Japan

7MoP.35/926
Optimization of Laser-Opening Pattern for the Industrial Shingle Type PERC Cell
Chang-sub Park, Yong-Gi Min Haewook Chung, Dong Ho Kim, Byeong Jun Kim, Jong-Youb Lim, Keunkee Hong, Eunjoo Lee, Dong Seop Kim
Shinsung E&G, South Korea

7MoP.36/917
Novel Technique for Large Area (156mm×156mm) n-type Black Silicon Solar Cell by Formation of Nanograin after Diffusion Process
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²Meghnad Saha Institute of Technology, America
³IEST, Shibpur, India
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7MoP.37/847
Light Stability of Ultrathin Electron-selective TiO₂ Contacts with an AlOₓ Tunnel Layer
Hyunju Lee¹, Junsin Yi², Yoshio Ohshita¹
¹Toyota Technological Institute, Japan
²Sungkyunkwan University, South Korea

7MoP.38/785
LID and Regeneration of Boron-doped p-Type Cz-Si Wafers and Solar Cells from One Silicon Rod
Shuai Yuan¹, Bin Ai¹, Daming Chen², Jingsheng Jin³, Xueqin Liang⁴, Xiongxin Ye⁵
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⁵CSG PVTECH Co., Ltd, China

7MoP.39/778
Research on Casting Monocrystalline Silicon Passivated Emitter and Rear Cells
Hanyu Yin
Chint New Energy (Haining) Co., Ltd, China

7MoP.40/773
Numerical Model of Potential-Induced Degradation for p-Type Crystalline Silicon Photovoltaic Modules for Time-Degradation-Analysis
Hiroki Yoshida¹, Fumitaka Ohashi¹, Nobukazu Kameyama¹, Yasushi Sobajima¹, Atsushi Masuda², Shuichi Nonomura¹
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²AIST, Japan

7MoP.41/772
Metal Electrode Firing Temperature Impact on LeTID in CZ Monocrystalline PERC
Hao Yu, Lingxin Fang, Wei San, Sheng He, Weizhi Xu
Chint New Energy (Haining) technology co., LTD, China

7MoP.42/763
Fabrication and Evaluation of Passivated Emitter and Rear Cell with Implanted Selective Emitter (ISE-PERC)
Toshimitsu Mochizuki, Tomihisa Tachibana, Masaaki Moriya, Satoshi Utsunomiya, Yasuhiro Kida, Katsuto Tanahashi, Katsuhiko Shirasawa, Hidetaka Takato
AIST, Japan

7MoP.43/758
A double Sided Diffusion Technique for PERT Solar Cell
He Ren, Chaolei Wu, Yang Ding, Zhiping Huang, Jingwei Chen, Ying Xu, Dengyuan Song
Hebei University, China
7MoP.44/708  
P Doped poly-Si/Oxide Passivating Contact via Spin-on Doping  
Zetao Ding¹, Di Yan¹, Wenhao Chen¹, Sieu Pheng Phang¹,  
Chris Samundsett¹, Zhao Wang²  
¹Australian National University, Australia  
²Jinko Solar, China

7MoP.45/675  
Comparative Study on Temperature Coefficients of Al-BSF Solar Cells and PERC Solar Cells  
Hong Yang  
Xi’an Jiaotong University, China

7MoP.46/667  
Fabrication of Metal-oxide Passivation Films by Mist Chemical Vapor Deposition  
Koji Arafune  
University of Hyogo, Japan

7MoP.47/665  
Study of Aluminum Oxide Passivation Films Deposited by Reactive Sputtering with Low-Inductance-Antenna  
Yudai Kuramochi, Koji Arafune  
University of Hyogo, Japan

7MoP.48/661  
Effect of SiH4 Flow Rates on The Structures and Properties of Poly-Crystalline Silicon Thin Films Deposited by Hot Wire Method  
Yansai Tian  
Inner Mongolia Normal University, China

7MoP.49/651  
Achieving High-Performance Monolithic Perovskite/Silicon Tandem Solar Cells Via Interfacial Passivation  
Hany Elbatal, Shaofei Yang, Yongcai He, Lin Mao, Tian Yang, Minghui Xie, Qing Chang,  
Lei Ding, Bo He, Zhenwei Peng, Cao Yu, Xia Hao, Jingquan Zhang, Hui Yan, Zeguo Tang,  
Xixiang Xu  
Hanergy Thin Film Power Group, China

7MoP.50/507  
Influence of the Annealing Temperature on ALD-Al2O3/NAOS/Si MOS Interface Properties  
Wei Fu¹, Xufang Zhang¹, Hiroshi Umishio², Aboulaye Traore², Hiroshi Yano²,  
Takeaki Sakurai¹  
¹University of Tsukuba, China  
²University of Tsukuba, Japan
7MoP.51/636
The Impact of Narrowing Aluminum Grids for Bifacial Solar Cells
Shota Suzuki, Masahiro Nakahara, Naoya Morishita, Takashi Kuroki, Kosuke Tsuji, Marwan Dhamrin
Toyo Aluminium K.K., Japan

7MoP.52/627
Evaluation of Plasma Induced Damage in Silicon Substrate
Kohei Onishi¹, Yutaka Hara¹, Tappei Nishihara¹, Hiroki Kanai¹, Takefumi Kamioka¹, Yoshio Ohshita², Atsushi Ogura¹
¹Meiji University, Japan
²Toyota Technological Institute, Japan

7MoP.53/615
Research on Back Surface Technology for Low LeTID Mono PERC Cell
Hongfang Wang, Zhuo Xu, Feng Li, Jinchao Shi, Dengyuan Song
Yingli Energy (China) Co. Ltd, China

7MoP.54/613
Temperature-dependent Suns-Voc and Suns-PL method for Advanced Characterization of Solar Cells
Johannes P. Seif¹, Thomas G. Allen², Ziv Hameiri¹
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²King Abdullah University of Science and Technology, Kingdom of Saudi Arabia

7MoP.55/602
The Research on the In-situ Experiment for Determining the Initiation of Micro-crack in Polycrystalline Silicon Photovoltaic Wafer
Yangbo Zhang, Hong Zuo
Xi'an Jiaotong University, China

7MoP.56/590
Industrially Metal Catalyzed Chemical Etch Textured Cells on Mono-like Substrates
Zhuo Xu, Hongfang Wang, Feng Li, Jinchao Shi, Dengyuan Song
Yingli Energy (China) Co.Ltd, China
Area 2.2 Perovskite Solar Cells

2.2TuP.1/456
High Performance Inverted Perovskite Solar Cells by Reducing Electron Capture Region for Electron Transport Layers
Shengnan Zuo
Shaanxi Normal University, China

2.2TuP.2/448
Flexible Perovskite Solar Cells Fabricated by Gradient Heat Treatment Process
Yueyue Xiao
Hebei University of Science and Technology, China

2.2TuP.3/436
Dynamical Transformation of Two-Dimensional Perovskites with Alternating Cations in the Interlayer Space for High-Performance Photovoltaics
Yalan Zhang
ShaanXi Normal University, China

2.2TuP.4/431
The Influence of Light on the Stability of Perovskite Cells was Studied by In-situ Electrochemical Impedance
Xiaobo Zhang, Yichuan Chen, Qi Meng, Xiaqing Chen, Changbao Han, Yongzhe Zhang, Hui Yan
Beijing University of Technology, China

2.2TuP.5/428
Effect of Heat Treatment on the Performance of Perovskite Solar Cells
Qi Meng¹, Yichuan Chen¹, Yueyue Xiao¹, Xiaobo Zhang¹, Junjie Sun¹, Changbao Han¹, Hongli Gao¹, Yongzhe Zhang¹, Hui Yan¹, Yongcai He¹, Zeguo Tang², Xixiang Xu²
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²Hanergy Thin Film Power Group Ltd., China

2.2TuP.6/422
Different Halides Regulated Film Formation of CH₃NH₃PbX₃ (X=Cl, Br, I) for Large-grain Perovskite Solar Cells
Leilei Gu
Jiangsu Collaborative Innovation Centre of Photovoltaic Science & Engineering, Changzhou University, China
2.2TuP.7/420
Photo-mobilized Ions and its Reaction with Free Carriers in Perovskite Solar Cells Revealed by Small Perturbation Techniques
Xiaoqing Chen
Beijing University of Technology, China

2.2TuP.8/410
Natively Textured Surface of Ga-doped ZnO films Electron Transporting Layer for Perovskite Solar Cells: Further performance analysis from Device Simulation
Yichuan Chen¹, Qi Meng¹, Yueyue Xiao¹, Xiaobo Zhang¹, Junjie Sun¹, Yongcai He¹, Linrui Zhang¹, Changbao Han¹, Hongli Gao¹, Yongzhe Zhang¹, Hui Yan¹, Zeguo Tang², Xixiang Xu²
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2.2TuP.9/397
Enhancing Perovskite Solar Cell Performance by TiO2/perovskite Interface Engineering
Anna Nikolskaia, Nikolai Tsvetkov, Sergey Kozlov, Marina Vildanova, Oleg Shevaleevskiy, Liudmila Larina
Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, Russia

2.2TuP.10/391
Forming Intermediate Phase on the Surface of PbI₂ Precursor Films by Short-Time DMSO Treatment for High-Efficiency Planar Perovskite Solar Cells
Haibin Chen
Hebei University, China

2.2TuP.11/388
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2.2TuP.12/371
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2.2TuP.13/363
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Yanfeng Wang¹, Wenchao Wei¹, Lin Mao¹, Xin Dong¹, Ze Wang², Yonghao Zheng²,
Zeguo Tang¹, Bo He¹
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2.2TuP.14/316
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Toshimitsu Mochizuki¹, Akira Ito², Hidetoshi Nakanishi², Iwao Kawayama³,
Masayoshi Tonouchi³, Yoshihiko Nishinara¹, Masayuki Chikamatsu¹,
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²SCREEN, Japan
³ILE, Osaka Univ., Japan

2.2TuP.15/270
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Lili Wu, Yin Yang
Institute of Solar Energy Materials and Devices, Collage of Materials Science and Engineering, Sichuan University, China

2.2TuP.16/234
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National Institute for Materials Science, Japan

2.2TuP.17/222
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Ya-Han Wu, Song-Yuan Dai
North China Electric Power University, China

2.2TuP.18/205
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²Niigata University, Japan
³Tokyo City University, Japan
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Shaanxi Normal University, China

2.2TuP.20/195
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Sichuan University, China

2.2TuP.21/189
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Yuxin Yao, Xuegong Yu
ZheJiang University, China

2.2TuP.22/159
Investigation of Thermochemical Stability of Perovskite Solar Cells with Various Zinc Oxide Electron Transport Layers
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Shaanxi Normal University, China

2.2TuP.23/153
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Pengjie Hang
State Key Laboratory of Silicon Materials and School of Materials Science and Engineering, Zhejiang University, China

2.2TuP.24/133
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Huirong Peng, Molang Cai, Songyuan Dai
North China Electric Power University, China

2.2TuP.25/117
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Qingshan Ma
Institute of Chemical Materials, China Academy of Engineering Physics, China

2.2TuP.26/107
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Haoxu Wang
Shaanxi Normal University, China
2.2TuP.27101
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Feng Gao, Yong Chen, Qiufeng Ye, Zema Chu, Shaiqiang Mu, Jingbi You
Institute of Semiconductors, Chinese Academy of Sciences, China

2.2TuP.28/100
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2Southern University of Science and Technology, China

2.2TuP.29/98
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Xiaodong Ren, Shengzhong (Frank) Liu
Shaanxi Normal University, China

2.2TuP.30/97
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Jingru Zhang1, Dongliang Bai1, Zhiwen Jin2, Hui Bian1, Kang Wang1, Shengzhong (Frank) Liu1
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2.2TuP.31/84
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Biao Shi, Fuhua Hou, Yucheng Li, Changchun Wei, Yi Ding, Yuelong Li, Dekun Zhang Caiguang Wang, Yin Zhao, Xiaodan Zhang
Institute of Photoelectronic Thin Film Devices and Technology of Nankai University, China

2.2TuP.32/78
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Yu Chen, Yihui Wu, Wen-Hua Zhang
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2.2TuP.33/77
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Yinhua LvPeng Wang, Wen-Hua Zhang
Institute of Chemical Materials, Academy of Engineering Physics, China
2.2TuP.34/404
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Koichiro Kamimori, Koki Suwa, Takeo Suga, Kenichi Oyaizu, Hiroshi Segawa, Hiroyuki Nishide
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2.2TuP.35/71
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Kang Wang, Dapeng Wang, Shengzhong (Frank) Liu
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2.2TuP.36/67
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Chao Lingfeng¹, Xia Yingdong², Chen Yonghua², Huang wei¹
¹Northwestern Polytechnical University, China
²Nanjing Tech University, China

2.2TuP.37/689
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Lei Meng
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Ning Wang, Jun Liu
Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, China

3TuP.2/214
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Lulu Sun, Yinhua Zhou
Huazhong University of Science and Technology, China

3TuP.3/1043
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Qiang Guo¹, Erjun Zhou¹, Zhan’ao Tan²
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²State Key Laboratory of Alternate Electrical Power System with Renewable Energy Sources/North China Electric Power University, China
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Zhenzhen Shi¹, Zhan’ao Tan²
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²Beijing University of Chemical Technology, China

3TuP.5/756
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²IIT Delhi, India

3TuP.6/488
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Shahua Huang
Hebei University, China

3TuP.7/462
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Lanzhou University, China

3TuP.8/303
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Xiaohan Chen¹, Zhan’ao Tan²
¹North China Electric Power University, China
²Beijing University of Chemical Technology, China

3TuP.9/292
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Wang Ning, Liu Jun
Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, China

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4.2TuP.1/530
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Xiaozhuang Xu, Jielei Tu
Yunnan normal university, China
4.2TuP.2/492
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Yufeng Zhang, Qiuchen Wu, Ziyao Zhu, Xinlu Lin, Yuhang Liu, Xiangxin Liu
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4.2TuP.3/470
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Haruki Hayashi, Takahito Nishimura, Jakapan Chantana, Yu Kawano, Takashi Minemoto
Ritsumeikan University, Japan

4.2TuP.4/465
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Yufeng Zhang, Yuhang Liu, Qiuchen Wu, Ziyao Zhu, Xinlu Lin, Xiangxin Liu
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4.2TuP.5/447
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Takahito Nishimura¹, Shinho Kim², Jakapan Chantana¹, Yu Kawano¹, Shogo Ishizuka², Takashi Minemoto¹
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²National Institute of Advanced Industrial Science and Technology (AIST), Japan

4.2TuP.6/423
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Jingjing Qu¹, Linrui Zhang¹, Tianyu Ruan¹, Qi Meng¹, Xuemei Song¹, Yongzhe Zhang¹, Hui Yan¹, Minghao Qu², Xixiang Xu²
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²Hanergy Thin Film Power Group Ltd., China

4.2TuP.7/414
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Jianjun Li¹, Baifei Deng², Hongbing Zhu², Yaohua Mai²
¹University of New South Wales (UNSW), Australia
²Jinan University, China

4.2TuP.8/376
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Tsinghua University, China
4.2TuP.9/307
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Bart Vermang$^1$, Guy Brammertz$^1$, Thomas Schnabel$^2$, Erik Ahlswede$^2$, Leo Choubrac$^3$, Nicolas Barreau$^3$, Pieter Bolt$^4$, Patrice Bras$^5$, Samira Khelifi$^6$, Johan Lauwaert$^6$, Regan Wilks$^7$, Marcus Baer$^7$
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$^4$TNO, Netherlands
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$^7$HZB, Germany

4.2TuP.10/304
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School of Materials Science and Engineering, Tsinghua University, China

4.2TuP.11/302
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Chang Yan, Jialiang Huang, Kaiwen Sun, Xiaojing Hao, Martin A. Green
UNSW Sydney, Australia

4.2TuP.12//297
Real-Time Thin Films Thickness Monitoring System by Transmittance Interference of Laser
Zhongming Du$^1$, Ziyao Zhu$^{1,2}$, Xiangxin Liu$^1$
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$^2$University of Chinese Academy of Sciences, China

4.2TuP.13/296
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Yifan Li, Jingmei Li, Jing Dong
Yiting Jiang, Danmin Peng, Qingyue Xue, Lili Wu, Xia Hao, Wenwu Wang
Sichuan University, China

4.2TuP.14/287
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Huan Ning
Chang University, China

4.2TuP.15/286
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Zhaojing Zhang, Jiajia Guo, Qing Gao, Jianping Ao, Guozhong Sun, Zhiqing Zhou, Fangfang Liu, Yi Zhang, Yun Sun
Nankai University, China

4.2TuP.16/284
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Chunyan Wu, Tao Chen, Changfei Zhu
University of Science and Technology, China

4.2TuP.17/276
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Hefei Institutes of Physical Science, Chinese Academy of Sciences, China

4.2TuP.18/271
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Tomohiro Uchimura*1, Shigeyuki Nakamura2, Isao Tsunoda3, Hideaki Araki4, Tetsuya Okuyama5, Seto Satoru6, Toshiyuki Yamaguchi7, Yoji Akaki1
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3National Institute of Technology (KOSEN), Kumamoto College, Japan
4National Institute of Technology (KOSEN), Nagaoka College, Japan
5National Institute of Technology (KOSEN), Kurume College, Japan
6National Institute of Technology (KOSEN), Ishikawa College, Japan
7National Institute of Technology (KOSEN), Wakayama College, Japan

4.2TuP.19/266
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Yaowei Wei, Daming Zhuang*, Ming Zhao, Guoan Ren, Yixuan Wu, Xinchen Li, Xunyan Lyu, Chen Wang
Tsinghua University, China

4.2TuP.20/254
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JiaYi Zhang
Changzhou University, China

4.2TuP.21/232
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Rongfeng Tang, Tao Chen*
Department of Materials Science and Engineering, University of Science and Technology of China, China
4.2TuP.22/229
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Jilin University, China

4.2TuP.23/227
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Yu-Ren Hong, Yi-Cheng Lin*
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4.2TuP.24/204
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4.2TuP.25/194
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Fan He, Lili Wu*
Sichuan University, China

4.2TuP.26/174
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Dong-Hwan Jeon, Dae-Kue Hwang*, Dae-Hwan Kim*, Young-Ill Kim, Kee-Jeong Yang
DGIST, Korea

4.2TuP.27/168
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Lan Hu, Hailei Zhao*, Ning Chen*
University of Science and Technology Beijing, China

4.2TuP.28/158
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Se-Yun Kim, Dae-Ho Son, Young-ill Kim, Seung-Hyun Kim, Sammi Kim, Kwangseok Ahn, Shi-Joon Sung, Dae-Kue Hwang, Kee-Jeong Yang, Dae-Hwan Kim, Jin-Kyu Kang
Daegu-Gyeongbuk Institute of Science and Technology (DGIST), Korea
4.2TuP.29/151
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Yixuan Wu, Ming Zhao*, Daming Zhuang*
Tsinghua University, China

4.2TuP.30/136
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Toshiyuki Yamaguchi*, Hiroya Ogawa1, Mitsuki Nakashima1, Hiroyuki Naoi1, Hironori Katagiri1, Hideaki Araki1, Kazuo Jimbo1, Junji Sasano2, Masanobu Izaki2
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4.2TuP.31/106
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Junhui Lin, Jiaxiong Xu*, Yuanzheng Yang*
Guangdong University of Technology, China

4.2TuP.32/105
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Anhong Hu1, 2, Jie Zhou2, Haibing Ying2, Xinyuan Qin2, Xiaowei Hou2, Yuxia Jiang2, Mengfei Zhang2, Wu Zhan2, Xuanzhi Wu2, Deren Yang1
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2Advanced Solar Power (Hangzhou) Inc., China

4.2TuP.33/96
High Optical Transmission Cadmium Stannate Transparent Conductive Layer with Adjustable Work Function
Ziyao Zhu1, 2, Xiangxin Liu*, Yufeng Zhang1, Qiuchen Wu1, Xinlu Lin1
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2University of Chinese Academy of Sciences, China

4.2TuP.34/95
Radio Frequency Sputtered Films of Copper-Doped Zinc Telluride
Xinlu Lin, Yufeng Zhang, Ziyao Zhu, Qiuchen Wu, Xiangxin Liu*
Institute of Electrical Engineering, University of Chinese Academy of Sciences, China

4.2TuP.35/51
Surface Passivation by Inserting Thin In$_2$S$_3$ Layer to Cu(In, Ga)Se$_2$/CdS Photovoltaic Interface
Doohyung Moon, Sreedeevi Gedi, Sahh Alhammadi, Woo Kyoung Kim*
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**4.2TuP.36/39**  
10.7% Efficient Kesterite Solar Cells: Modification of Absorber Surface by LiCl Post Deposition Treatment  
*Mingrui He¹, Jinhyeok Kim², Xiaojing Hao*¹  
¹University of New South Wales, Australia  
²Chonnam National University, Korea

**4.2TuP.37/20**  
Amorphous GaOx and Its Alloying For Use As Electron Transport Layer in CIGSe Solar Cells  
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PVcomB / Helmholtz Zentrum Berlin für Materialien und Energie GmbH, Germany

**4.2TuP.38/13**  
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*Weimin Li*, Kaili Li, Sheng Shi, Chenghan Yi, Shuda Xu, Bing Yang, Lin Yao, Xin Li, Ming Chen, Wenjie Li, Ye Feng, Chunlei Yang  
Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China

**4.2TuP.39/130**  
Transparent Conducting Oxide Back Contact with Improved Stability for the Processing of CIGS thin Film Solar Cells  
*Won Mok Kim*¹, Sungbin Choi², Jeung-hyun Jeong², In-gyu Lee³  
¹Korea Institute of Science and Technology, Korea  
²Samsung Electronics, Korea  
³Korea Aerospace University, Korea

**4.2TuP.40/129**  
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*Tamotsu Okamoto*  
National Institute of Technology, Kisarazu College, Japan

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Research on Radio-frequency Magnetron Sputter-deposited ITO thin Film and Its Application as Back Electrode in CdTe Solar Cell  
Jingmei Li¹, Lili Wu², Yifan Li²  
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**11TuP.1/1125**  
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*Young Chul JU, Woo Gyun SHIN, Hye Mi HWANG, Gi Hwan KANG, Suk Whan KO*  
Korea Institute of Energy Research, Korea
**11TuP.2/997**
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Ronnie Serfa Juan¹, Hyeongwoo Lee², Byeongjun Choi², Hi Seok Kim², Jeha Kim*²
¹Cheongju University, Philippines
²Cheongju University, Korea

**11TuP.3/976**
Optimal Operation of Economic Dispatch of Multi-energy Flow Regional Integrated Energy System Considering Renewable Energy Consumption
Zhitong Chen*, Xinsheng Huang
TBEA Xi’an Electric Design Co., Ltd, China

**11TuP.4/975**
Research on Harmonic Problems of Grid-connected System of Complex Mountain Photovoltaic Power Station
Jiahuan He*, Bin Ji
TBEA Xi’an Electric Design Co., Ltd, China

**11TuP.5/774**
Optimization of Module Size Based on Fixed Bracket and Foundation
Liying Luo*, Lingyong Wu, Lili Ju
Xi’an LONGi Clean Energy Co., Ltd., China

**11TuP.6/699**
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Zhidong Li *, Lingyong Wu, Jun Ren
Xi’an LONGi Clean Energy Co., Ltd., China

**11TuP.7/600**
Method of Improving MPPT Efficiency by Software Layout in PV Field
Na Su*, Zhong Wang, Zongjun Yang, Pengpeng Chen
SUNGROW POWER SUPPLY CO., LTD, China

**11TuP.8/525**
The Influence of Inverter OveRload Capacity on PV System
Pengpeng Chen, Zongjun Yang, Yanhu Zhang, Qingmin Lv, Na Su
SUNGROW POWER SUPPLY CO., LTD, China

**11TuP.9/435**
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Pengcheng Wang, Xiaoqiang Du
Faculty of Mechanical Engineering and Automation, Zhejiang Sci-Tech University, China

**11TuP.10/385**
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Xiang Hao, Yingchun Xu, Lang Huang, Liangliang Zhao, Pili Shi
TBEA Sunoasis Co., Ltd, China
11TuP.11/384
Maximum Efficiency Modulation for Dual Active Bridge Operating Over Wide Range Under Frequency Domain Analysis
Xiang Hao, Tao Liu, Zhi Li, Lang Huang, WenJian Zhao, XianGen Yu
TBEA Sunoasis Co., Ltd, China

11TuP.12/382
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Yang Xuan, Zhi Li, Tao Liu, Xiang Hao
TBEA Sunoasis Co., Ltd, China

11TuP.13/380
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Xiang Hao, Ruiqiang Si, Yun Liu, Lang Huang, Liangliang Zhao
TBEA Sunoasis Co., Ltd, China

11TuP.14/377
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Li Zhi
TBEA Sunoasis Co., Ltd, China

11TuP.15/375
Research on the Optimal Cleaning Time of Photovoltaic Power Station Module
YongXia Liu
TBEA Sunoasis Co., Ltd, China

11TuP.16/374
Australia’s New Energy Market and Project Development
XieSi Yu
TBEA Sunoasis Co., Ltd, China

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He Yu
TBEA Xinjiang Sunoasis Co., LTD, China

11TuP.18/369
Comparative Analysis of Vertical single-Axis Tracking System and Fixed Tilted System
WenFu Fan, DongMing Zhou
TBEA Sunoasis Co., Ltd, China

11TuP.19/368
Analysis of Factors Affecting Power Generation of Photovoltaic Tracking System
WenFu Fan, JiaWei Liu
TBEA Sunoasis, Co., Ltd, China
11TuP.20/367
A Novel Maximum Power Point Tracking Approach Using Hybrid Control for Building-integrated photovoltaics
YuHang Liu, XiangXin Liu, YuFeng Zhang
Institute of Electrical Engineering, Chinese Academy of Sciences, China

11TuP.21/285
A Study of Power Gain from Utilization of inter-Row Light In A PV Array
Lin Hu1,2, QingGuo Zeng2, Heng Zhang2, Lang Zhou2, Jian Shi3, Hui Yang1,4
1Information Engineering School, Nanchang University, China
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4School of Electrical and Electronic Engineering, East China Jiaotong University, China

11TuP.22/260
An Analysis of The Influence of Different Parameters on LCOE
JiaWei Liu, ShengZhong Zhang
TBEA Sunoasis. Co.Ltd, Xi’an, China

11TuP.23/192
~26% Greater Energy; After Dust Cleaning InaA photovoltaic-Array
Yasuhiro Matsumoto2, Nun Pitalúa-Díaz1, Ramon Peña2, Jose Antonio Urbano2, Miguel Angel Luna2, Jose Saul Arias2, Rene Asomosa2
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2CINVESTAV-IPN, Mexico

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A Study On The Performance Diagnosis Method of PV Plant Considering Aging and Soiling
Suk Whan, KO, Woo Gyun, SHIN, Hye Mi, HWANG, Young Chul. JU, Gi Hwan, KANG
Korea Institute of Energy Research, Korea

11TuP.25/50
Solar Irradiance Onto Car Body Using Mobile Multiple Pyranometer Array System for vehicle-Integrated Photovoltaic applications – Measurement and Modeling
Kenji Araki1, Yasuyuki Ota2, Taizo Masuda3, Daisuke Sato1, Masafumi Yamaguchi1
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2University of Miyazaki, Japan
3Toyota Motor Corporation, Japan

11TuP.26/
Research and Application of High-precision Set Numerical Weather Forecasting Technology Based on Gridded Historical Meteorological Resources in Yunnan
WenLin Yan, Han Yan, Yongqiang Yang
Yunnan Electric Power Center of Dispatching and Control, China
Area 12 PV System Integration Including Smart Grid

12TuP.1/1006
Selection and Laying of Cables on Floating Photovoltaic Power Generation System
ShunQing Tian
Share Power Co., Ltd., China

12TuP.2/1003
Photovoltaic Power System Technology Combined with Agriculture
XiaoWu Zhuang, HaiKun Zhu
Share Power Co., Ltd., China

12TuP.3/994
Research on Design and Application Technology of Anchorage System for Floating Photovoltaic Power Plant
Xia Deng
Share Power Co., Ltd., China

12TuP.4/992
Installation of Flexible Photovoltaic Support
LiLi Yan, JiHong Liu
Share Power Co., Ltd., China

12TuP.5/991
Research on New Special Anchor Technology for Floating Photovoltaic Power Plant
HuaMin Gu
Share Power Co., Ltd., China

12TuP.6/990
Design and Application of Inverter Concrete Floating Platform for Floating Photovoltaic Power Plant
ZhiHui Tang
Share Power Co., Ltd., China

12TuP.7/983
Model Predictive Control for t-Type Photovoltaic Three-level Three-phase Converters Based on Virtual Voltage Vectors
WeiBo Zeng, Yong Yang, Gang Fang, JinJun Lu, Tao Liu
Jiangsu GoodWe Power Supply Technology CO., LTD, China

12TuP.8/389
Series-type Active Ripple Suppression and Damping Control of a Novel Grid-Connected Inverter
MiaoMiao Wei, YiBo Wang, Huan Wang, Yu Zhou, YuBo Zhang, JunLong Lu
Institute of Electrical Engineer, Chinese Academy of Science, China
12TuP.9/343
Research on Fault Location and Monitoring System of Smart Distribution Network
Fan Qin, Wei Dou, WeiWei Chen, YiBo Wang
Institute of Electrical Engineering, Chinese Academy of Sciences, China

12TuP.10/309
Optimal Planning of High Penetration Distributed Photovoltaic with Considering Grid Reinforcement
BiBin Huang, QiongHui Li, Jing Hu, BoWen Hong, Hu Yan, Kai Feng
SGERI, China

12TuP.11/259
Very Short-term Irradiance Forecasting Based on A Low-Cost Sky Imager
Xi Shao, Zhen Zhang, ZengWei Zhu, QiYuan Zhang
Hohai University, China

12TuP.12/244
Research on Wind-Photovoltaic-Battery Microgrid Configuration Optimization Based on Reliability Constraints
WeiWei Chen*, LiDong Guo, YiBo Wang
Institute of Electrical Engineering Chinese Academy of Sciences, China

12TuP.13/237
Power Dispatching Strategy for Microgrid with Controllable Heating Loads
MingYu Lei*, LiDong Guo, ZiLong Yang, YiBo Wang
Institute of Electrical Engineering, Chinese Academy of Sciences, China

12TuP.14/216
A control System with PV Inverters Connected to The Grid in Series
Xian Gao*1, 2, YiBo Wang1
1Institute of Electrical Engineering, Chinese Academy of Sciences, China
2University of Chinese Academy of Sciences, China

12TuP.15/716
Photovoltaic Systems Integration using On Load Tap Change Transformers for High Penetration Mitigation Issues: Case Study Malta, Europe
Brian Bartolo*, Brian Azzopardi*
Malta College of Arts, Science and Technology (MCAST), Malta

12TuP.16/650
Design of Earthing System for Floating Photovoltaic Power Station
XiLiang Liu*, ChengYuan Yu
Xi’an LONGi Clean Energy Co., Ltd, China
12TuP.17/735
A Method to Estimate The Installed Capacity of PV Systems in Residential Feeders
**Navid Haghdadi***1, **Ziba Gandomkar**2, **Anna Bruce**1, **Iain MacGill**1
1UNSW, Australia
2University of Sydney, Australia

12TuP.18/134
**LiDong Guo**
Institute of Electrical Engineering, Chinese Academy of Sciences; University of Chinese Academy of Sciences, China

12TuP.19/183
A SPV Array Optimal Configuration with Novel Bypass-Switching Topology for Partial Shading Mismatch Mitigation
**Rui Zhang***, **Yibo Wang**, **HongHua Xu**
Institute of Electrical Engineering, Chinese Academy of Sciences, Chinese Academy of Sciences University, China

12TuP.20/165
An Optimal Voltage Control Strategy for Rural Networks with High Proportion of PV
**Xian Gao***, **Yibo Wang**
Institute of Electrical Engineering, Chinese Academy of Sciences; University of Chinese Academy of Sciences, China

12TuP.21/971
Technical Problems During Access to Distribution Network by High-Permeability Distributed Power and Countermeasures
**QiongHui Li**, **XiaoNing Ye***, **BoWen Hong**, **BiBin Buang**
Department of New Energy and Energy Statistics, State Grid Energy Research Institute Company LTD, Beijing, China

12TuP.22/552
Three-dimensional Numerical Analysis of Excitation Coil of Forced oil-Cooled Magnetic Separator
**YuBo Zhang***, **Huan Wang**, **Yu Zhou**, **JunLong Lu**, **MiaoMiao Wei**
Institute of Electrical Engineering Chinese Academy of Sciences, P.R. China, China

12TuP.23/551
The Design and Simulation Research of New Interleaved DC / DC Converter
**Yu Zhou**, **Yibo Wang***, **Huan Wang**, **Yubo Zhang**, **Junlong Lu**
Institute of Electrical Engineering, Chinese Academy of Sciences, China, China
12TuP.24/548
Voltage Balance Control of The DC/DC Converter in DC Series-Parallel PV Collection System Based on Energy Storage System
XinKe Huang*
Institute of Electrical Engineering, Chinese Academy of Sciences, China

12TuP.25/545
Quasi Z-Source based Full Bridge Isolated DC/DC Topology as A Basic Module for DC-Series PV Converter Connected to HVDC Grid
XinKe Huang*
Institute of Electrical Engineering, Chinese Academy of Sciences, China

12TuP.26/544
A Control Strategy of Low Voltage Ride-through for Grid-connected Photovoltaic Inverter
Ying Zhang *, ZiLong Yang, Yibo Wang
Institute of Electrical Engineering, Chinese Academy of Sciences, China

12TuP.27/542
A High Step-Up DC–DC Converter with Integrated Cascade Structure
Lu JunLong*, YiBo Wang, Huan Wang, MiaoMiao Wei, Yu Zhou, Yubo Zhang
Institute of Electrical Engineering Chinese Academy of Sciences, China

12TuP.28/472
A Control Strategy of Microgrid Inverter for Unbalance Voltage Compensation
JiDong Lai*, JiaLiang Liu, JianHui Su, TianYue Xie, ChenGuang Zhou, MingRui Xie
Hefei University of Technology, China

Area 13 PV Energy Storage and Novel PV Application

13TuP.1/1096
Spatial Decoupling Light Absorption and Catalytic Reaction in n-Si Photocathode for Efficient and Stable Solar Water Splitting
ShuJie Wang
Tianjin University, China

13TuP.2/1046
Enhanced near-Infrared Response of p-Si Photocathode with Surface Hydroxylation for Unassisted Solar Water Splitting
HuiMin Li
Tianjin University, China

13TuP.3/978
Application Study of CIGS Solar Products in Mobile Energy
DongDong Shen, Lei Shi, PengFei Wang, O Haijin, Hou Jian, Gu Lu, XiaoHua Xu *
MiaSole Photovoltaic Technology Co.Ltd, China
13TuP.4/939
Weather Effect on Photovoltaic Module Adaptation in Coastal Areas
Nnamdi Bethel Onyejinaka
University of Nigeria Nsukka

13TuP.5/801
Design of Multishell Microsphere of Transition Metal Oxides for Lithium Ion Battery
Youcai Ding, Linhua Hu
University of Science and Technology of China, China

13TuP.6/769
Designing and Running of a PV-FC-LIB Independent Power Charging System and an Analysis of the System Efficiency and its Optimization
Lin Hu¹, Qinguo Zeng¹, Zhihao Yue¹, Lang Zhou*¹, GuangSheng Liang², Yue Yu², Qiang Zhang²
¹Nanchang University, China
²Beijing Hirek Science Development Ltd, China

13TuP.7/682
3D Curved Photovoltaic Module with Triangular Si Solar Cells
Yoshitaka Hayakawa¹, Hikaru Komiyama¹, Tomohiro Hase¹, Kenji Araki², Taizo Masuda², Masafumi Yamaguchi², Noboru Yamada*¹
¹Nagaoka University of Technology, Japan
²Toyota Technological Institute, Japan

13TuP.8/563
TiN/TiSiN/SiN Solar Selective Absorbing Coatings Prepared via Modulated Pulse Power Magnetron Sputtering
Hongwen Yu*, Xiaobin Zhu, Qian Zhang, Hui Yan, Jun Ouyang
Beijing University of Technology, China

13TuP.9/491
Comparative Investigation of Performances for HIT-PV and PVT Systems
Wei Pang, Yanan Cui, Qian Zhang, Hongwen Yu, Yongzhe Zhang, Hui yYan*
Lang Gu(Tianjin) New Energy Technology Co., Ltd, China

13TuP.10/425
Preliminary Study on Optimal PV Cell Size for PV-Powered Vehicles
Kakeru Matsuta*, Ryuto Shigenobu, Masakazu Ito
University of Fukui

13TuP.11/352
Modelling of Daily Heating Demand of Mongolian Ger with ETS Heater and Solar PV
Bat-Erdene Bayandelger*, Yuzuru Ueda, Amarbayar Adiyabat
Tokyo University of Science, Japan
13TuP.12/293
Design and Simulation on the Dust Collector Using Supersonic Airflow for Photovoltaic Panels
Xiaoqiang Du, Feng Jiang*, Hongli Chen, Bo Yan
Zhejiang Sci-tech University, China

13TuP.13/113
Optimal Allocation Method of Multi-area Energy Storage Capacity with Large-scale Photovoltaic Power Generation
Wei Yuan*, Caixia Wang, Xiaoning Ye, Qionghui Li, Xuejiao Lei, Ziqian Li, Zhiyong Shi
Department of New Energy and Energy Statistics, State Grid Energy Research Institute Company LTD, China

Area 14 PV Deployment, Markets, Policies and Financing

14TuP.1/719
The Jump2 Excel Initiative: Joint Universal Activities for Mediterranean PV Integration Excellence
Brian Azzopardi*, Renata Mikalauskiene1, Vibhu Jately1, Joseph Mutale2, Monica Aguado Alonso3, Maria Jesus Rodriguez Henche3, Sophie Mailley4, Antoine Guerin de Montgareuil4
1Malta College of Arts, Science and Technology (MCAST), Malta
2The University of Manchester, UK
3Centro Nacional de Energia Renovables (CENER), Spain
4The French Alternative Energies and Atomic Energy Commission (CEA), France
16:30-18:30 Thursday, November 4

**Area 5 III-V Compound Semiconductor, Concentrator and Space PV Technologies**

**5ThP.1/44**
Large Area High Efficiency Flexible Thin Film Modules with IMM 3J GaAs Solar Cells
J.K. Yang, X.Y. Jiao, Y. Yang, X.S. Wang, L.L. Song, J. Xue, Z.C. Chen
Shanghai Institute of Space Power Sources, China

**5ThP.2/10521**
MeV Electron Erradiation Effects on GaInP/GaAs Double Solar Cells and Component Subcells
Maliya Heini¹, Xiaofan Zhao¹, Aierken Abuduwayiti², Qi Guo¹, Shulong Lu³
¹Xinjiang Technical Institute of Physics & Chemistry, Chinese Academy of Sciences, China
²Yunnan Normal University, China
³Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, China

**5ThP.3/1020**
Absolute Electroluminescence Characterization for InGaAs PV Cell Lattice-Matched to InP Substrate
Kentaroh Watanabe, Hao Xu, Riko Yokota, Hassanet Sodabanlu, Yoshiaki Nakano, Masakazu Sugiyama
The University of Tokyo, Japan

**5ThP.4/980**
Towards the Green Preparation of Cu(In, Ga)Se₂ Nanoparticles by a Sonochemical Method
Trang T.T Le, Sung-wook Cho, Chinho Park
Yeungnam University, South Korea

**5ThP.5/977**
The Characteristics Study of Concentrated Solar Cell
MingLe Ma
TBEA Xi’an Electric Design Co., Ltd, China

**5ThP.6/832**
Modeling the Error Tolerance of Micro-CPV with an Uncertainty Analysis
Kan-Hua Lee¹, Michihiko Takase¹, Nobuhiko Hayashi¹, Shutetsu Kanayama¹, Kenji Araki², Masafumi Yamaguchi²
¹Connected Solutions Company, Panasonic Corporation, Japan
²Toyota Technological Institute, Japan
5ThP.7/795
Heat-resistant 2D-metal Selenides as a Mechanical Cleavage Layer for the GaAs Lift-off
Nobuaki Kojima, Yu-Cian Wang, Kei Kawakatsu, Akio Yamamoto, Yoshio Ohshita
Masafumi Yamaguchi
Toyota Technological Institute, Japan

5ThP.8/747
Thin Film Triple-junction III-V Solar Cells
Liyong Yao, Chao Xue, Yitong Yang, Mingxu Jiang, Lirui Liu, Yu Wang, Qiming Zhang, Qiang Sun
Tianjin Insitute of Power Sources, China

5ThP.9/744
Development of 2.0~2.2eV Bandgap AlGaInP Solar Cells Grown by MOCVD
Heng Zhang, Rubin Liu, Qiming Zhang, Chao Xue, Qiang Sun
Tianjin Institute of Power Sources, China

5ThP.10/742
Effect of the Double Grading on the Electric Field and the Generation Rate in Cu(In, Ga)Se₂ Solar Cells
Alban Lafuente-Sampietro, Katsuhsisa Yoshida, Katsuhiro Akimoto, Nobuyuki Sano, Takeaki Sakurai
University of Tsukuba, Japan

5ThP.11/741
Effect of the off-cut Direction of Si(111) Substrate on 2D-In₂Se₃ Twin Formation as a Mechanical Cleavage Layer for the GaAs Lift-off
Kei Kawakatsu, Yu-Cian Wang, Nobuaki Kojima, Yoshio Ohshita, Masafumi Yamaguchi
Toyota Technological Institute, Japan

5ThP.12/738
Flexible GaInP/AlGaAs/InGaAs/InGaAs Inverted Metamorphic (IMM) Four-junction Solar Cell
Xinping Huang, Junhua Long, Dongying Wu, Qiangjian Sun, Wenxian Yang, Xuefei Li, Shulong Lu
Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, China

5ThP.13/707
Growth of AlInGaP by Hydride Vaper Phase Epitaxy Using AlCl₃ for Application to InGaP Solar Cells
Yasushi Shoji¹, Ryuji Oshima¹, Kento Aihara¹, Kikuo Makita¹, Akinori Ubukata², Takeyoshi Sugaya¹
¹National Institute of Advanced Industrial Science and Technology, Japan
²Taiyo Nippon Sanso Corporation, Japan
5ThP.14/644
Electrical Performance Simulation of GaAs Triple-junction Photovoltaic Power Converters
Shi Linfeng¹, Guo Hongliang², Wu Yiyong¹
¹Harbin Institute of Technology, China
²Science and Technology on Power Sources Laboratory, China

5ThP.15/246
High-Efficiency Low-Concentration III-V//Si 3-Junction Solar Cells Using Smart Stack Technology
Kikuo Makita¹, Hidenori Mizuno¹, Takeshi Tayagaki¹, Taketo Aihara¹, Ryuji Oshima¹, 
Yasushi Shoji¹, Hidetaka Takato¹, Ralph Müller², Paul Beutel², David Lackner², 
Jan Benick², Martin Hermle², Frank Dimroth², Takeyoshi Sugaya¹
¹Advanced Industrial Science and Technology, Japan
²Fraunhofer Institute for Solar Energy Systems ISE, Germany

5ThP.16/213
The Model of Photon Recycle in III-V Multijunction Solar Cells
Hongliang Guo¹, Yiyong Wu², Qiang Sun¹, Rubin Liu¹
¹Science and Technology on Power Sources Laboratory
²Harbin institute of Technology

5ThP.17/611
Degradation of InGaN/GaAs/Ga-3 Junction Solar Cells with an Electroless Platinum Black Catalyst for Hydrogen Generation Reaction
Yuichi Mikami¹, Yuki Nakamura¹, Kei Odashima¹, Kota Yoshida¹, Kiryu Yamamoto¹, 
Ryoki Sugita¹, Nonoka Abe¹, Koki Ito¹, Taiga Shibuya¹, Yuma Aoki¹, Xuefei Li², 
Wenxian Yang², Shulong Lu², Shiro Uchida¹
¹Chiba Institute of Technology, Japan
²Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Science, China

5ThP.18/553
Design and Preparation of TiOx/Al2O3/MgF2 Anti-reflection Coating for GaAs-based Multi-junction Solar Cells
Guan-yu Song, Jie-lei Tu, Xiao-zhuang Xu, Ping-yuan Yan, Wei-nan Zhang, Xiao-yu Sun
Yunnan Normal University, China

5ThP.19/533
Research Progress of InGaAs Materials Applied in Multi-junction Solar Cells
Weinan Zhang, Jielei Tu
Yunnan Normal University, China
5ThP.20/701
Flexible High Efficiency Thin Film Muti-Junction Inverted Metamorphic Solar Cells
Junhua Long1, Xinping Huang1, Qiangjian Sun1, Xuefei Li1, Dongying Wu1, Sai Ye1, Minghui Song2, Shulong Lu1
1Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, China
2Tianjin San'an Optoelectronics Co., LTD. China

5ThP.21/496
Optical Optimization for III-V/Si Multijunction Solar Cells
Caixia Li
UNSW, Australia

5ThP.22/476
Anti-radiation of Space Four-junction GaAs Solar Cell Based on Bragg Reflector Structure
Pingyuan Yan, Jielei Tu, Weinan Zhang, Xiaozhuang Xu, Guanyu Song, Xiaoyu Sun
Solar Energy Research Institute, Yunnan Normal University, China

5ThP.23/475
Performance Evaluation of Low-concentration Static CPV Module with Smooth 3D Curved Surface
Daisuke Sato1, Kenji Araki1, Masafumi Yamaguchi1, Noboru Yamada2
1Toyota Technological Institute
2Nagaoka University of Technology

5ThP.24/473
Influence of the Sulfurization Temperature on Cu2ZnSnS4 (CZTS) Thin Films Prepared by Sol-gel Process
Mengqi Wang, Wei Li, Jiao Wang, Yuan Wang, Yanping Wang, Haoran Li, Jinlian Bi, Kailiang Zhang
School of Electrical and Electronic Engineering, Tianjin Key Laboratory of Film Electronic & Communication Devices, Tianjin University of Technology, Tianjin, 300384, China

5ThP.25/383
Influence of Diffuse Light on Conversion Efficiency Measurement of 4-junction Solar Cells Under Real Concentrated Sunlight
Shinya Honda1, Yoshihito Imamatsu1, Shogo Murayama1, Hideo Teramoto1, Yuki Nakamura1, Ryota Jomen1, Yoshiaki Ajima1, Shu Takahashi1, Tomoya Kamata1, Shunsuke Hayashi1, Naoki Saito1, Yuichi Mikami1, Masayoshi Kawahara1, Yasuyuki Ota2, Pan Dai3, Shulong Lu3, Shiro Uchida1
1Chiba Institute of Technology, Japan
2University of Miyazaki, Japan
3Suzhou Institute of Nano-tech and Nano-bionics, Chinese Academy of Sciences, China
5ThP.26/162
Optical Wireless Power Transmission Using GaAs Solar Cell with Distributed Bragg Reflector
Fumiaki Tanaka, Yuki Komuro, Shinya Honda, Daiki Morita, Yuichi Mikami, Shiro Uchida
Chiba Institute of Technology, Japan

5ThP.27/379
Investigation of Optical Wireless Power Transmission Using GaAs Solar Cell with Cross-type Grid Electrode
Yuki Komuro, Shinya Honda, Daiki Morita, Fumiaki Tanaka, Shiro Uchida
Chiba Institute of Technology, Japan

5ThP.28/524
Multi-step Growth of GaAs on 4o Vicinal Si (111) with Metallic Selenide Buffers
Yu-Cian Wang, Nobuaki Kojima, Kei Kawakatsu, Akio Yamamoto, Yoshio Ohshita, Masafumi Yamaguchi
Toyota Technological Institute, Japan

Area 6 Silicon feedstock & wafers

6ThP.1/197
Behaviour of Metal Impurities in the LeTID of Mc-Si
Zechen Hu1, Xuegong Yu1, Andrej Kuznetsov2, Deren Yang1
1State Key Lab of Silicon Materials and Department of Materials Science & Engineering, Zhejiang University, Hangzhou, China
2Department of physics, university of Oslo, Norway

6ThP.2/142
Behavior of Iron-acceptor in B/Ga Co-doped Silicon
Xiaotong Hou, Deren Yang
State Key Laboratory of Silicon Materials and School of Materials Science and Engineering, Zhejiang University, Hangzhou, Zhejiang, China

6ThP.3/35
LID Control of PERC Using Industrially Produced Ga, B Co-doped Wafer
Woosok Nam, Boram Lee
Woongjin Energy Co. Ltd., South Korea

6ThP.4/1247
Silicon Ingot Growth from Nitride Crucibles Made from Kerf-Loss Silicon During Diamond Wire Sawing
A. Lan, Chia-En Liu, Hao-Ting Yu, Han-Lin Yang, Chung-Wen Lan
National Taiwan University, China Taiwan
6ThP.5/325  
Behavior of High-pressure Phases and Defects in Slurry and Diamond Wire Sawn Silicon  
Hangfei Li, Deren Yang  
Zhejiang University, China

6ThP.6/1214  
Horizontal Distribution Formula of Phosphorus during Directional Solidification for N-type Multicrystalline Silicon  
Zhiqiang Hu, Zilong Wang, Ming Lin, Yi Tan, Pengting Li  
School of Materials Science and Engineering Dalian University of Technology, China

6ThP.7/709  
Research on Influences of Cutting Fluid Properties on Diamond Wire Saw Cutting Behavior and Wafer Qualities  
Daming Di  
LONGI Green Energy Technology Co. Ltd, China

6ThP.8/1204  
Real-time Monitoring Method of Crystal/Melt Interface Shape during Czochralski Silicon Crystal Growth  
Junling Ding, Lijun Liu  
Xi’an Jiaotong University, China

6ThP.9/1193  
Application of Heater-generating Magnetic Field in the Directional Solidification of Silicon Ingots for Solar Cells  
Zaoyang Li, Wenchao Liu, Lijun Liu  
Xi’an Jiaotong University, China

6ThP.10/1154  
Bubble Size Control in Quartz Crucible used for Czochralski Silicon Process  
Yeongju Seo, Hyeonwook Park, Salh Alhammadi, Younggyun Yoo, Seong-yeop Eum, Joon-Hyeong Oh, Woo Kyoung Kim  
1Yeungnam University, South Korea  
2QUARTZ TECH, South Korea

Area 8 Thin film, IBC and HJT Solar Cells

8ThP.1/1147  
Development and Manufacturing of Silicon Heterojunction Solar Cells  
Jianqiang Wang  
Beijing University of Technology, China
8ThP.2/132
The Simulated Evolution of 24% IBPC Solar Cell Based on Experimental IBC
Sung-Yu Chen, Shih-Ting Liao, Han-Chen Chang, Jen-Chuan Chang, Chorn-Gjye Huang
Industrial Technology Research Institute, Taiwan, China

8ThP.3/104
Influence of the Front Surface Field and Defect State of A-si:h/c-si Interface on the Hit Solar Cells
Sunhwa Lee1, Duy Phong Pham1, Sangho Kim2, Youngkuk Kim3, Jinjoo Park4,
Eun-Chel Cho1, Junsin Yi1
1Sungkyunkwan University, South Korea
2Sangho Kim, South Korea
3Youngkuk Kim, South Korea
4Cheongju University, South Korea

8ThP.4/94
Effect of ITO Workfunction in the Silicon Heterojunction Solar Cells
Sehyeon Kim, Sunhwa Lee, Sangho Kim, Youngkuk Kim, Junsin Yi
Sungkyunkwan university, South Korea

8ThP.5/90
Loss Analysis and Recovery for Laser Separated HIT Solar Cells
Yunlai Yuan, Qizhong Zhang, Jun Lv, Jason, Chen Zhu
LONGi Solar Technology Co., Ltd.China

8ThP.6/362
TCO Stack for High Performance Silicon Heterojunction Solar Cells
Gangqiang Dong1, Shi Yin1, Ge Cui1, Yu Cao1, Wei Long1, Hongyu Li2,
Jingquan Zhang2, Xixiang Xu1
1Hanergy Thin Film Power Group, China
2Sichuan University, China

8ThP.7/361
Improving a-Si:H/c-Si Interface Passivation Quality in Silicon Heterojunction Solar Cell with Ultra-thin SiOx:H Buffer Layer
Xiaoning Ru1, Minghao Qu1, Jianqiang Wang2, Tianyu Ruan2, Zongyou Jiang1,
Fan Chen1, Hao Chen1, Shibin Gu1, Xixiang Xu1
1Hanergy Thin Film Power Group, China
2Beijing University of Technology, China

8ThP.8/355
Crystallization of Electron-Beam-Evaporated Amorphous Si Films on Textured Glass Substrates by FLA
Aimi Yago, Keisuke Ohdaira*
Japan Advanced Institute of Science and Technology, Japan
8ThP.9/351
The Influence of Front Surface Passivation Structure on The Performance of Heterojunction -interdigitated back Contact (HBC) Solar Cell
Jianhui Bao1, Ke Tao2, Rui Jia*2, Shuai Jiang3, Yaopei Zhu4, Jie Zhu4, Xuhuan Liu4, Lei Tang4
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4Jiangsu Rongma New Energy, 3# Changjiang road, Siyang, Jiangsu province, 223700, China

8ThP.10/338
High Efficiency Silicon Heterojunction Solar Cells with Electroplated Copper Grid Electrodes
Xin Shu, Lihui Xu, Chunmei Liu, Bo Liu, Lin Liu, Huaichao Wang, Wei Long, Shi Yin, Hongfan Wu, Yu Cao, Xixiang Xu
Hanergy Thin Film Power Group, China

8ThP.11/334
Studies on Preparation and Microstructure of Si-rich Silicon Nitride Thin films Containing Si Quantum Dots
Bingqing Zhou*, Xinxin Bu, Desong Ding
Inner Mongolia Normal University, China

8ThP.12/332
Effects of Radio-frequency Power and Deposition Pressure on Structures and Properties of Silicon-rich Silicon Nitride Thin Films
Jiaxin Sun, Bingqing Zhou*, Xin Gu, Xiuzhang Weng
Inner Mongolia Normal University, China

8ThP.13/330
Simulation of Full-size Multi-busbar IBC Solar Cell
Zhenzhen Xi*, Yonggang Guo, Xiang Wu
SPIC Xi’an Solar Power Co., Ltd. Xi’an, 710000, China

8ThP.14/326
Back-Contacted Silicon Solar Cells with Dopant-free Heterojunctions
Pingqi Gao*1, Hao Lin2, Wenzhong Shen2
1Sun Yat-sen University, China
2Shanghai Jiao Tong University, China
8ThP.15/60
A Mechanism for Ag Electrode Formation with Low Resistance and Superior Aspect Ratio for Improving Electrical Properties
Donghyun Oh1, Muhammad Quddamah Khokha2, Junsin Yi*2
1School of Information and Communication Engineering, Sungkyunkwan University, Suwon, 16419, Korea
2School of Information and Communication Engineering, Sungkyunkwan University, Suwon, 1641, Korea

8ThP.16/1106
The Interfacial Behavior and Stability Analysis of p-type Crystalline Silicon Solar Cells Based on Hole-selective MoOX/Metal Contacts
Shuangying Cao1, Jingye Li3, Yinyue Lin1, Tianyu Pan1, Guanlin Du1, Juan Zhang2, Liyou Yang1, Xiaoyuan Chen1, Linfeng Lu1, Na Min3, Min Yin1, Dongdong Li1
1Shanghai Advanced Research Institute, Chinese Academy of Sciences, China
2Jinneng Clean Energy Limited Company, China
3Shanghai University, China

8ThP.17/1097
Effect of Boron Concentration on counter-doping of Boron Doped Amorphous Silicon by PH3 Plasma Ion Implantation
Huynh Thi Cam Tu*, Noboru Yamaguchi2, Hideki Matsumura1, Keisuke Ohdaira1
1Japan Advanced Institute of Science and Technology, Japan
2ULVAC Inc, Japan

8ThP.18/1086
Deposition of Tungsten Oxide by HWCVD for Hole Transport Layer of Silicon Solar Cells
Chen Shiyuan, Yuta Shiratori, Shinsuke Miyajima*
Tokyo Institute of Technology, Japan

8ThP.19/1073
Effect of Substrate Temperature on the Growth Properties of Ag-doped SnS Thin Film Deposited by Sputtering Method for Solar Cell Application
Vinaya Kumar Arepalli, Sungjun Kim, Byeong Chan Lee, Jeha Kim*
Cheongju University, Korea

8ThP.20/1065
Bifacial Passivation of n-silicon metal-insulator-semiconductor Photoelectrodes for Efficient Photoelectrochemical Oxygen and Hydrogen Evolution
Bin Liu
Tianjin University, China
8ThP.21/776
Controlling the Photogenerated Carriers Transport via Silver Nanoparticles embedded In a-Si:H Solar Cells
Tiantian Li1, Qi Shan1, Ke Zhong1, Zilun Sheng1, Ying Zhao2, Xiaodan Zhang2
1Inner Mongolia University, China
2Nankai University, China

8ThP.22/723
Fabrication of Silicon Heterojunction Solar Cells with high-quality i-a-Si:H Deposited by Facing Target Sputtering Technique
Yuta Shiratori1, Shinsuke Miyajima2
1Tokyo Institute of technology, JSPS research fellowship for young scientists DC1, Japan
2Tokyo Institute of technology, Japan

8ThP.23/715
Amorphous Si Quintuple-Junction Solar Cells on Graphene Layer for IoT Applications
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2Tokyo City University, Japan

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2Geckos Technology Corp, TaiWan, China
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⁴JASRI, Japan
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Graduate School of Engineering, Nagoya University, Japan
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¹ULVAC, inc., Japan
²Toyo Aluminium K.K.Japan

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Yunpeng Li¹, Feng Ye¹, Yujiao Liu¹, Yingying Qin¹, Yushan Nie¹, Jingjing Shen¹,
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Shuahui Sun², Yong Li²
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Ministry of Education, Yunnan Normal University, China

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Hebei University, China

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2SCenergy, China

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Canadian Solar Inc. China

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Industrially TOPCon Solar Cells Based on Phosphorus Diffused poly-Si and Thin Dielectric Interlayers
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2Shunfeng Photovoltaic Technology, China
3Jiangsu Rongma New Energy, China
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Naoya Morishita*
Toyo Aluminium K.K.Japan

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Japan Advanced Institute of Science and Technology, Japan
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Zhang Yang*, Sunny Zhao  
DSM, China

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Liwei Zhou, Lixia Peng, Baoxin Lliu, Tao Xu*  
Canadian Solar Manufacturing (Changshu) Inc.China

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National Center of Supervision and Inspection on Solar Photovoltaic Product Quality(CPVT), China

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Weixin Zhou¹, Lunzheng Sun², Qiangzhong Zhu², Jun Lv²  
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²Longi Solar Technology Co., Ltd., China

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Firoz Khan¹, Jae Hyun Kim²  
¹King Fahd University of Petroleum and Minerals, Saudi Arabia  
²DGIST, Korea

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Shota Asano¹, Takanori Morimoto¹, Sachiko Jonai², Yukiko Hara², Atsushi Masuda², Norihiro Umeda¹, Kentaro Iwami¹
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Hyung-Jun Song¹, Byeong-Guk Jeong², Donghyo Hahm¹, Jun Young Kim³, Myungsang Jeong⁴, Min Gu Kang⁴, GilHwan Kang⁴, Wanki Bae²
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³Gyeongsang National University, Korea
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Lei Wang¹, Zhen Zhang¹, Minyan Wu¹, Yue Lu¹, Chuanjia Xu¹, Peng Quan²
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Fumitaka Ohashi1, Ryo Fuseya1, Taishi Furuya1, Go Sian Huai1, Nobukazu Kameyama1, Yasushi Sobajima1, Yasushi Tachibana2, Hiroki Yoshida1, Atsushi Masuda3, Shuichi Nonomura1
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Tomoyasu Suzuki1, Seira Yamaguchi1, Kyotaro Nakamura2, Atsushi Masuda3, Keisuke Ohdaira1
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2National Institute of Advanced Industrial Science and Technology, Japan

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Hiroshi Noge*, Makoto Konagai
Tokyo City University, Japan

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Tanokkorn Chenvidhya*, Yaowanee Sangponsanont, Dhirayut Chenvidhya, Chamnan Limsakul, Krissanapong Kirtikara
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Li Feng*, Sebastian.Hempelmann, Cem.Basoglu, Frank.U. Hamelmann
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Jn Jaubert1, Gang Yan1, Yue Lu1, Yuanjie Yu1, Zhen Zhang*2, Jianwei Xiao1
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Yongfei Wang, Jialin Shen, Zhifu He, Chen Zhu, Shengkai Fan, Xiaochun Tan, Xiaoqiang Zhao, Chao Zhong, Qiangzhong Zhu, Jun Lv
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Yuji Ino*, Shuichi Asao, Katsuhiko Shirasawa, Hidetaka Takato
National Institute of Advanced Industrial Science and Technology (AIST), Japan

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Yongyuan Xu*, Xiaoning Ru, Atiye Bayman2, Ricky Dunbar2, Tao Wei1, Hehui Chen1, ChaoHsiung Huang1, Chihung Hsiao1
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Hiroto Koshirae*, Kanako Kawasaki1, Yuzuru Ueda1, Yoshihiro Hishikawa2
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Jianbin Fan*
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Tian shun Feng*, Jingna Jiang, Jianxiong Ni, Dandan Rong, Yabin Li
Yingli Group Company Limited, China

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Interconnect-shingling: Maximizing the Active Module Area to Surpass 22% Module Efficiency with Bifacial Contacted Solar Cells
Henning Schulte-Huxel*, Susanne Blankemeyer¹, Heiko Mehlich², Frank Allenstein², Marcel König², Rolf Brendel³, Marc Köntges¹
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²SINGYES Green Building Technology, China
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Yoshimasa Suzuki¹, Kanako Kawasaki*¹, Hiroto Koshirae*¹, Yuzuru Ueda*¹, Osamu Takase*², Chiaki Kato*², Mitsuhiro Minoda², Satoru Maeshima²
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Ryo Shimizu*, Kensuke Nishioka
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²Longi Solar Technology Co., Ltd. /Electronic Information Engineering College of Sanjiang University / The School of Photovoltaic and Renewable Energy Engineering, The University of New South Wales, China
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2Arizona State University, USA
3Canadian Solar, China

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Karen Forberich
Helmholtz-Institute Erlangen-Nürnberg, Germany

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Study of Effects of Dust Deposition on Performance of PV Systems in Thailand and Proposed Method for Data Analysis
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Overall Analysis of Long-term Performance Degradation of Photovoltaic Modules with Different Technologies
Kai Zhang1, Huili Han1, Jiapei Huang1, Rensheng Liu1, Hui Shen*2
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Ying Zhang*, Jianxiong Ni, Jingna Jiang, Dandan Rong, Yabin Li, Yafei Geng, Chao Ma, Jinchao Shi, Dengyuan Song
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Analysis of PID on the Back of P-PERC Bifacial PV Module
Yuanyuan Li*
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Assessment of Solar Photovoltaic Potential in Thailand using Self-developed Simulation Tool
Amornrat Limmanee*, Sasiwimon Songtrai, Perawut Chinnavornrungsee, Natthawan Suwannajit, Visut Savangsuk, Ekkachan Rattanalerdnusorn, Kobsak Srirapha
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Aging Behavior and Degradation of Different Backsheets Used in the Field Under Various Climates in China
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