CONFERENCE PROGRAMME

Please note, that this Programme may be subject to alteration and the organisers reserve the right to do so without giving prior notice. The current version of the Programme is available at ***www.photovoltaic-conference.com.***

(i) = invited

Monday, 24 September 2018

OPENING

PLENARY SESSION 1AP.1

08:30 - 10:00 Routes to High Efficiency Photovoltaics

Chairpersons:
Nicholas Ekins-Daukes
UNSW Australia, Australia
Erwin Kessels
Eindhoven University of Technology, Netherlands

1AP.1.1 **Hybrid III-V/SiGe Solar Cells Grown on Si Substrates through Aggressive Buffer Layers**
P. Caño Fernández, L. Cifuentes & I. Rey-Stolle
UPM, Madrid, Spain
H. Nguyen, A. Morgan & A.D. Johnson
IQE, Cardiff, United Kingdom

1AP.1.2 **High-Efficiency Monolithic Perovskite/Silicon Tandem Solar Cells**
C. Ballif, F. Sahli, J. Werner, M. Bräunigner, R. Monnard, T.-J. Yang, P. Fiala, F. Fu, M. Boccard & Q. Jeangros
EPFL, Neuchâtel, Switzerland
B.A. Kamino, B. Paviet-Salomon, L. Barraud, L. Ding, J.J. Diaz Leon, D. Sacchetto, G. Cattaneo, A. Walter, S.-J. Moon, M. Despeisse, B. Niesen & S. Nicolay
CSEM, Neuchâtel, Switzerland

1AP.1.3 **Electronic Ratchets as Necessary Stepping Stones for New PV Concepts**
A. Delamarre, Z. Jehl Li Kao, Y. Okada & M. Sugiyama
University of Tokyo, Japan
D. Suchet
LPICM, Palaiseau, France
N. Cavassilas
IM2NP - CNRS, Marseille, France
J.-F. Guillemoles
CNRS, Palaiseau, France

1AP.1.4 **Current Overview of PV Technologies and Visions for the Future**
M.A. Green
UNSW Australia, Sydney, Australia

Opening Addresses

Moderated Panel Discussion

Becquerel Prize Ceremony

Monday, 24 September 2018

ORAL PRESENTATIONS 1AO.1

13:30 - 15:00 Fundamental Studies

Chairpersons:
Lenneke H. Slooff
ECN part of TNO, Netherlands
Louise Hirst
University of Cambridge, United Kingdom

1AO.1.1 **Analysis for Non-Radiative Recombination in Quantum Dot Solar Cells and Materials**
M. Yamaguchi, K.-H. Lee, K. Araki & N. Kojima
Toyota Technological Institute, Nagoya, Japan
L. Zhu & H. Akiyama
University of Tokyo, Kashiwa, Japan
Y. Kanemitsu
Kyoto University, Japan

1AO.1.2 **Control of Hot Carriers in Type-II Quantum Well Solar Cell Absorbers**
H. Esmaielpour, V.R. Whiteside, S. Vijeyaragunathan, B. Wang, T.D. Mishima, M.B. Santos & I.R. Sellers
University of Oklahoma, Norman, United States
H. Piyathilaka & A.D. Bristow
West Virginia University, Morgantown, United States
K.P. Roberts
University of Tulsa, United States

1AO.1.3 **The Use and Abuse of Woc as a Figure of Merit**
N. Ekins-Daukes & A. Pusch
UNSW Australia, Sydney, Australia

1AO.1.4 **Luminescent Coupling in Multi-Junction Photovoltaic Devices Studied by Transient Voltage Measurements**
T. Tayagaki
AIST, Tsukuba, Japan
S.K. Reichmuth, H. Helmers & G. Siefer
Fraunhofer ISE, Freiburg, Germany

1AO.1.5 **The Electronic Structure and Passivation Mechanism of CZTS Grain Boundaries Revealed by Comparative Study with CIGS Using Scanning Probe Microscopy**
G. Chen, K. Zhou, Y. Feng, H. Luo, G. Zhong, W. Li & C. Yang
CAS, Shenzhen, China

1AO.1.6 **Transition Metal Oxides as Passivated Hole-Contacts Layer for Silicon Wafer PERC Solar Cells: Intrinsic and Extrinsic Defects in MoO3 from First-Principles Calculations**
M.A. Hossain, S.N. Rashkeev, V. Erkkara Madhavan, N. Tabet & A.A. Abdallah
HBKU, Doha, Qatar
T. Zhang, C.-Y. Lee & B. Hoex
UNSW Australia, Sydney, Australia

ORAL PRESENTATIONS 2AO.4

13:30 - 15:00 Characterisation and Modelling of Silicon Cells

Chairpersons:
Rolf Brendel
ISFH, Germany
Stefan Rein
Fraunhofer ISE, Germany

2AO.4.1 **Opto-Electrical Modelling of Periodic Nanostructures, Integrated into Two-Side Contacted Silicon Heterojunction Devices**
A. Razzaq, V. Depauw, M. Filipic, I. Gordon, J. Szlufcik & J. Poortmans
imec, Leuven, Belgium

2AO.4.2 **Optical Investigation of High-Efficiency Silicon-Based Solar Cells with Multi-Scale Interface Textures Enabled by Coupled Modelling Approach**
B. Lipovsek, Z. Lokar, J. Krc & M. Topic
University of Ljubljana, Slovenia
A. Razzaq, V. Depauw, I. Gordon & J. Poortmans
imec, Leuven, Belgium

2AO.4.3 **Synergistic Efficiency Gain Analyses for the Photovoltaic Community: An Easy to Use SEGA Simulation Tool for Silicon Solar Cells**
C.N. Kruse, K. Bothe, B. Lim, T. Dullweber & R. Brendel
ISFH, Emmerthal, Germany

2AO.4.4 **Capacitive Effects in High-Efficiency Solar Cells During IV-Curve Measurement: Considerations on Error of Correction and Extraction of Minority Carrier Lifetime**
H. Vahlman
Aalto University, Espoo, Finland
J. Hyvärinen, A. Tolvanen & S. Hyvärinen
Endeas, Espoo, Finland

2AO.4.5 **Characterization of Heterojunction Rib-Si Solar Cells by EL and DLIT Imaging**
M. Konagai, R. Kondo & Y. Ichikawa
Tokyo City University, Japan
Y. Ishikawa
NAIST, Ikoma, Japan

2AO.4.6 **Characterization of the Reverse Breakdown Inhomogeneity of ZEBRA IBC Solar Cells**
S. Großer, M. Werner & C. Hagendorf
Fraunhofer CSP, Halle, Germany

ORAL PRESENTATIONS 6AO.7

13:30 - 15:00 BIPV Products, Approaches and Technical Issues

Chairpersons:
Francesco Frontini
SUPSI, Switzerland
Roland M. E. Valckenborg
SEAC, Netherlands

6AO.7.1 **A Simulation Approach for View Factor Calculation Usable for Bifacial and Building Integrated PV Systems Based on Ray Casting**
F.F. Sönmez, H. Ziar, O. Isabella & M. Zeman
Delft University of Technology, Netherlands

Monday, 24 September 2018

6AO.7.2 **PV Quality Issues Applying Building Integrated Photo Voltaic (BIPV) on Façade and Roof When Deep Renovating a 50 Years Old Apartment Building**
A. Andersson
RISE Research Institute of Sweden, Boras, Sweden
D.-E. Archer
Emulsionen, Göteborg, Sweden
Z. Norwood
University of Gothenburg, Göteborg, Sweden

6AO.7.3 **CONIPHER: A Photovoltaic Cladding Element for Façade Renovation. Experimental Determination of Thermal Resistances and Electrical Production**
J. Rudy, P. Thony & P. Messaoudi
CEA, Le Bourget du Lac, France
E. Schmitt
Vicat, L'Isle-d'Abeau, France
O. Bizzini
ARaymond, Saint-Egrève, France

6AO.7.4 **Versatile and Lightweight Transparent Composite Technology for BIPV and Other PV-Integrated Applications**
J.M. Vega de Seoane, M. Machado, E. Román Medina, A. Astigarraga Erleaga, I. Arrizabalaga, N. Yurrita, O. Zubillaga, I. Aizpurua, G. Imbuluzketa, A. Sanz Martinez & P. Cano
TECNALIA R&I, San Sebastián, Spain

6AO.7.5 **Mosaic Module Concept for Cost-Efficient and Aesthetic BIPV Modules**
M. Mittag, H.R. Wilson, T. Fellmeth, M. Heinrich & U. Eitner
Fraunhofer ISE, Freiburg, Germany

6AO.7.6 **Measurement of Solar Heat Gain Coefficient for Semi-Transparent Building Integrated Photovoltaics in Tropics**
V. Shabunko & T. Reindl
SERIS, Singapore, Singapore

VISUAL PRESENTATIONS 2AV.1

13:30 - 15:00 Feedstock, Crystallisation, Wafering, Defect Engineering

Detailed information on this session is presented in the section entitled 'Visual Presentations'.

ORAL PRESENTATIONS 1AO.2

15:15 - 16:45 Advanced Material Combinations for n-Terminal Multijunctions

Chairpersons:
Andreas W. Bett
Fraunhofer ISE, Germany
Antonio Martí Vega
UPM, Spain

1AO.2.1 **Nearly 30% High Efficiency Low Concentration InGaP/GaAs//Si 3-Junction Solar Cells Using Smart Stack Technology**
K. Makita, H. Mizuno, R. Oshima, T. Tayagaki, T. Aihara, H. Takato & T. Sugaya
AIST, Tsukuba, Japan
M. Baba & N. Yamada
Nagaoka University of Technology, Japan
T. Nakamoto
Tokyo City University, Japan

1AO.2.2 **Exploring New Convergencies between PV Technologies for High Efficiency Tandem Solar Cells: Wide Band Gap Epitaxial CIGS Top Cells on Silicon Bottom Cells with III-V Intermediate Layers**
D. Lincot
CNRS, Palaiseau, France

1AO.2.3 **Performance Optimization of a Four-Terminal Cu2O/c-Si Tandem Heterojunction Solar Cell**
O. Nordseth & S.E. Foss
IFE, Kjeller, Norway
R. Kumar, K. Bergum, E. Monakhov & B.G. Svensson
University of Oslo, Norway
F. Dragan, D. Craciunescu & L. Fara
University Politehnica of Bucharest, Romania
I. Chilibon
INOE-2000, Magurele, Romania

1AO.2.4 **Three-Terminal Tandem Solar Cells Combining Bottom Interdigitated Back Contact and Top Heterojunction Subcells: A New Architecture for High Power Conversion Efficiency**
J.-P. Kleider, W. El-Huni, Z. Djebbour & A. Migan Dubois
CNRS, Gif-sur-Yvette, France

1AO.2.5 **Optimization of Transport and Buffer Layers for Tandem Perovskite/Silicon Solar Cells**
E. Lamanna, F. Matteocci, E. Calabrò & A. Di Carlo
University of Rome, Italy
L. Serenelli, L. Martini, F. Menchini, M. Izzi & M. Tucci
ENEA, Rome, Italy

1AO.2.6 **Screening Selective Contact Material Combinations for Novel Crystalline Si Cell Structures**
R. Brendel, C. Kruse, A. Merkle & R. Peibst
ISFH, Emmerthal, Germany

ORAL PRESENTATIONS 2AO.5

15:15 - 16:45 **Characterisation and Modelling of Materials and Surfaces for Silicon Photovoltaics**

Chairpersons:
Francesca Ferrazza
eni spa, Italy
Jozef Szlufcik
imec, Belgium

2AO.5.1 **Evaluations of Oxidized Silicon Surfaces with Laser Terahertz Emission Microscope (LTEM) and Corona Charging**
T. Mochizuki, K. Tanahashi, K. Shirasawa & H. Takato
AIST, Koriyama, Japan
A. Ito & H. Nakanishi
SCREEN, Kyoto, Japan
I. Kawayama & M. Tonouchi
Osaka University, Japan

2AO.5.2 **A Novel Experimental Method for the Thermal Characterization of PV Module Materials and Entire Module Stacks**
I. El -Chami
KU Leuven, Belgium
H. Oprins & V. Cherman
imec, Heverlee, Belgium
I.T. Horvath, H. Goverde, J. Govaerts, T. Borgers & E. Voroshazi
imec, Genk, Belgium
J. Poortmans
imec, Leuven, Belgium

2AO.5.3 **Measurement of Doping Profiles by a Contactless Method of IR Reflectance under Grazing Incidence**
J. Holovsky, Z. Remes & A. Poruba
ASCR, Prague, Czech Republic
D. Franta
Masaryk University, Brno, Czech Republic
B. Conrad, L. Abelová & D. Bušek
CTU, Prague, Czech Republic

2AO.5.4 **Prediction of Local Temperature Dependent Efficiency of Silicon Solar Cells**
R. Eberle, A. Fell, F. Schindler & M.C. Schubert
Fraunhofer ISE, Freiburg, Germany

2AO.5.5 **Challenges for the Quantification of Metal Induced Recombination Losses Using Calibrated Photoluminescence Imaging**
D. Herrmann, S. Lohmüller, H. Höffler & A. Wolf
Fraunhofer ISE, Freiburg, Germany

2AO.5.6 **Influence of Emitter Layers on LeTID Kinetics in mc-Silicon**
A. Otaegi & J.C. Jimeno
UPV/EHU, Bilbao, Spain
D. Skorka, A. Schmid, A. Zuschlag & G. Hahn
University of Konstanz, Germany

ORAL PRESENTATIONS 6AO.8

15:15 - 16:45 **Optimisation of Formal-Visual and Efficiency Aspects of BIPV Applications and Components**

Chairpersons:
Wiep Folkerts
SEAC, Netherlands
Gabriele C. Eder
OFI, Österreichisches Forschungsinstitut für Chemie und Technik, Austria

6AO.8.1 **Outdoor Characterization of Colored and Textured Prototype PV Façade Elements**
C. Tzikas, R.M.E. Valckenborg, M.N. van den Donker & W. Folkerts
SEAC, Eindhoven, Netherlands
A. Bognar, D. Duque Lozano, R. Loonen & J.L.M. Hensen
Eindhoven University of Technology, Netherlands

6AO.8.2 **BIPV Meets Customizable Glass: A Dialogue between Energy Efficiency and Aesthetics**
E. Saretta, P. Bonomo & F. Frontini
SUPSI, Canobbio, Switzerland

6AO.8.3 **Experimental Analysis of Different Cell and Module Technologies in a BIPV Façade Test Set Up**
J. Lehmann, J. Goncalves, G.H. Yordanov, K. Baert & D. Saelens
KU Leuven, Heverlee, Belgium
A.S.H. van der Heide & H. Goverde
EnergyVille, Genk, Belgium

6AO.8.4 **Dutch Solar Design BIPV: Optimizing Power Output and Aesthetic Performance in Architectural Design**
L.H. Slooff, J.A.M. van Roosmalen & L.A.G. Okel
ECN, Petten, Netherlands
T. Minderhoud & G. Gijzen
UNStudio, Amsterdam, Netherlands
L.C. Polinder & F. Goethals
Design Innovation Group, Utrecht, Netherlands
T. Sepers
TS Visuals, Oudkarspel, Netherlands

6AO.8.5 **Towards Maximum Efficiency of Colorful Photovoltaics**
J. Halme & P. Mäkinen
Aalto University, Finland

6AO.8.6 **Decorated Building Integrated Photovoltaic Modules: Power Loss, Color Appearance and Cost Analysis**
C. Kutter, M. Mittag, M. Heinrich, C. Ferrara, B. Bläsi, T. Kuhn, T. Kroyer & O. Höhn
Fraunhofer ISE, Freiburg, Germany

VISUAL PRESENTATIONS 2AV.2

15:15 - 16:45 **Homojunction Solar Cells**

Detailed information on this session is presented in the section entitled 'Visual Presentations'.

ORAL PRESENTATIONS 1AO.3

17:00 - 18:30 **Advanced Materials for Solar Cells**

Chairpersons:
Jef Poortmans
imec, Belgium
Jonathan Govaerts
imec, Belgium

1AO.3.1 **Simple Yet Efficient Chemically Deposited Ag Rear Side Metallization on ITO for High-Efficiency c-Si Solar Cells**
H. Nagel, M. Glatthaar & S.W. Glunz
Fraunhofer ISE, Freiburg, Germany
D. Sontag
Meyer Burger, Hohenstein-Ernstthal, Germany

1AO.3.2 **2d Materials and Nanoabsorbers for PV: New Potential Applications and Other Advantages**
V. Steenhoff, N. Osterthun, K. Gehrke, M. Vehse & C. Agert
DLR, Oldenburg, Germany

Monday, 24 September 2018

1AO.3.3 **Perovskite Photovoltaics: The Role of Graphene and Related 2D Materials for Stability and Scalability**
A. Agresti, S. Pescetelli, A.L. Palma & A. Di Carlo
University of Rome, Italy
L. Najafi, A.E. Del Rio Castillo, S. Bellani & F. Bonaccorso
Italian Institute of Technology, Genoa, Italy

1AO.3.4 **Fabrication of Ultra-Smooth and Stable Perovskite Films Using an Aqueous Solvent under Ambient Condition**
H. Ait Dads, L. Nkhaili, A. El Kissani, H. El Aakib, M. Chaik, M. Ait Ali & A. Outzourhit
Cadi Ayyad University, Marrakech, Morocco
Y. Jouane
University of Limoges, France

1AO.3.5 **Whisperonic Solar Cells**
C. Chandran, T.K. Das & P. Ilaiyaraja
IIT Madras, Chennai, India

1AO.3.6 **Towards Cost-Effective Novel Ultrathin Crystalline Silicon Wafer Production by Ultra-Fast Laser Deep Subsurface Processes Followed by Selective Etching: From Slice Production to Solar Cell Fabrication**
M. Zolfaghariborra, H. Nasser, T. Colakoglu, I. Pavlov, R. Turan & A. Bek
METU, Ankara, Turkey
A. Turnali, P. Deminskyi, O. Tokel & F.O. Ilday
Bilkent University, Ankara, Turkey

ORAL PRESENTATIONS 2AO.6

17:00 - 18:30 **Industrial Processes for c-Si Solar Cells / Thin Film Silicon Cells**

Chairpersons:
Derk L. Bätzner
Meyer Burger Research, Switzerland
Paola Delli Veneri
ENEA, Italy

2AO.6.1 **Improved Inline Texturing & Edge-Isolation for Diamond-Wire-Sawed Multi-Crystalline Material (DWS-mc) with an Electrochemical Approach**
B. Straub, B. Burgenmeister, J. Burschik, C. Schmitt & H. Kühnlein
RENA, Freiburg, Germany

2AO.6.2 **Introduction of Smart Technologies in PV Production Equipment**
M. Zimmer, L. Mohr, B. Broese, T. Krick & J. Rentsch
Fraunhofer ISE, Freiburg, Germany
B. Mandlmeier, L. Papp, M. Menschick & R. Kogler
Singulus Technologies, Fürstenfeldbruck, Germany
A. Strauch
camLine, Dresden, Germany
T. Will & V. Meckelin
MIB, Breisach am Rhein, Germany
P. Mutz & D. Korner
SICK, Waldkirch, Germany
M. Kremer
Jumo, Fulda, Germany

2AO.6.3 **Fabrication of APCVD PSG Emitter-Based Industrial PERC Solar Cells Reaching 21% Conversion Efficiencies**
B. Kafle, P. Saint-Cast, U. Belledin, S. Lohmüller, A. Wolf & M. Hofmann
Fraunhofer ISE, Freiburg, Germany
H. Zunft & H. Knauss
Gebr. Schmid, Freudenstadt, Germany
P. Palinginis, C. Kusterer, R. Köhler & T. Zehl
SolarWorld Industries, Freiberg, Germany

2AO.6.4 **Bulk Contacts and Laser-Based Fabrication Steps for n-Type Silicon Thin-Film Solar Modules**
S. Garud, S. Kühnapfel, O. Franke, N. Kersten, S. Severin, S. Gall & B. Rech
HZB, Berlin, Germany

2AO.6.5 **Flexible Transparent a-Si:H Solar Cells on Polyimide Substrates**
J.W. Lim & G. Kim
ETRI, Daejeon, Korea South
M. Shin
Korea Aerospace University, Goyang-City, Korea South
J.-D. Kwon
KIMS, Changwon, Korea South

2AO.6.6 **Optimization of Inline Processes for the Production of Freestanding Epitaxially Grown Thin Films for Solar Cells**
A. Ivanov, R. Sorgenfrei, E. Gust, P. Barth, S. Kühnhold-Pospischil, S. Riepe & S. Janz
Fraunhofer ISE, Freiburg, Germany
K. Van Nieuwenhuysen
imec, Leuven, Belgium

ORAL PRESENTATIONS 6AO.9

17:00 - 18:30 **Overview of Innovative Application of Photovoltaics in Built Environment and Infrastructures**

Chairpersons:
Urs Muntwyler
BUAS, Switzerland
Philippe Malbranche
CEA, France

6AO.9.1 **Building the World's Largest Bifacial Solar Noise Barrier**
M.M. de Jong & W. Folkerts
SEAC, Eindhoven, Netherlands
J.C.P. Kester
ECN, Petten, Netherlands
D. van der Graaff
Rijkswaterstaat, Utrecht, Netherlands
S. Verkuilen
Heijmans Infra, Rosmalen, Netherlands

6AO.9.2 **System Integration of Thin Film PV Modules in Road Restraint Systems**
K. Sewalt
TNO, Delft, Netherlands
D. Roosen-Melsen
TNO, Eindhoven, Netherlands

Monday, 24 September 2018

6AO.9.3 **Application of Semi-Transparent Photovoltaics in Transportation Infrastructure for Energy Savings and Solar Electricity Production: Towards Novel Net-Zero Energy Tunnel Design**
D. Sun & A.K. Athienitis
Concordia University, Montreal, Canada
K. D'Avignon
ETS, Montreal, Canada

6AO.9.4 **Performance Analysis of Vertically Mounted Bifacial PV Modules on Green Roof System**
T. Baumann, F. Carigiet, R. Knecht, M. Klenk, H. Nussbaumer & F.P. Baumgartner
ZHAW, Winterthur, Switzerland
A. Dreisiebner
Solarspar, Sissach, Switzerland

6AO.9.5 ***EU PVSEC Student Award Winner Presentation:*** **Solar Hybrid Energy Powering Quadcopter**
C.-F. Lin, H. Lan, W.-S. Liao, J.-Y. Lin & H.-J. Syu
NTU, Taipei, Taiwan
T.-J. Lin & C.-H. Chiu
Jianguo High School, Taipei, Taiwan

6AO.9.6 **Solutions for a Fully Integrated > 1000 Wp Solar Electric Vehicle Body**
B.K. Newman & L.A.G. Okel
ECN, Petten, Netherlands
A. van der Ham, S. Regondi, J. Steenbeek & J. Maar
Lightyear, Helmond, Netherlands

VISUAL PRESENTATIONS 2AV.3

17:00 - 18:30 **Heterojunction Solar Cells**

Detailed information on this session is presented in the section entitled 'Visual Presentations'.

Tuesday, 25 September 2018

ORAL PRESENTATIONS 2BO.1

08:30 - 10:00 New Materials and Processes for Silicon Photovoltaics

Chairpersons:
Anis Jouini
CEATECH-INES, France
Chung-Wen Lan
NTU, Taiwan

2BO.1.1 A Proposal of Improved CZ Growth Technique of Monocrystalline Silicon for PV Cells
T. Fukuda, K. Tanahashi, K. Shirasawa & H. Takato
AIST, Koriyama, Japan
Y. Horioka
Frontier Technology, Koriyama, Japan
K. Fujiwara
Tohoku University, Sendai, Japan

2BO.1.2 Approaching 22% Solar Cell Efficiency with Mono-Like Silicon
M.M. Kivambe, B. Aissa, A.A. Abdallah, A. Belaidi & N. Tabet
QEERI, Doha, Qatar
J. Haschke, M. Boccard, J. Cattin & C. Ballif
EPFL, Neuchâtel, Switzerland
J. Horzel, F. Debrot & M. Despeisse
CSEM, Neuchâtel, Switzerland

2BO.1.3 Development of High Performance Multicrystalline Silicon with Controlled Seeding
A. Hess, P. Krenckel, T. Trötschler, T. Fehrenbach & S. Riepe
Fraunhofer ISE, Freiburg, Germany

2BO.1.4 Multicrystalline Informatics to Realize Ideal Crystalline Silicon for Solar Cells
N. Usami, Y. Hayama, T. Muramatsu, K. Tajima, S. Kamibeppu, K. Kutsukake, T. Matsumoto & H. Kudo
Nagoya University, Japan

2BO.1.5 Metal Contamination in the Diamond Wire Sawing Process of Silicon and Influence on the Solar Cell Efficiency
L. Lottspeich & T. Kaden
Fraunhofer THM, Freiberg, Germany

2BO.1.6 Diamond Wire Wafering: A Model-Based Evaluation of Different Control Strategies
D. Treyer, S. Gaulocher & S. Niederberger
FHNW, Windisch, Switzerland
H. Rafael & G. Frech
Meyer Burger, Gwatt, Switzerland
A. Ams
Freiberg University of Technology, Germany

Tuesday, 25 September 2018

ORAL PRESENTATIONS 6BO.5

08:30 - 10:00 Soiling in PV

Chairpersons:
Sarah R. Kurtz
NREL, United States
Benjamin Figgis
QEERI, Qatar

6BO.5.1 Evaluation of Soiling Rates for PV Modules Installed at Different Tilt Angles in Dubai, UAE
A. Elnosh, J.J. John, A. Alnuaimi, J. Quadir, M. Stefancich & P. Banda
DEWA, Dubai, United Arab Emirates

6BO.5.2 Investigating the Technical Effectiveness of Different Photovoltaic Cleaning Methods in Dust-Intensive Climates
F.G. Alzubi, A. Alkandary & A.T. Al-Asfour
KISR, Safat, Kuwait

6BO.5.3 Business Cases for Anti-Soiling Coatings in The Netherlands
C. Tzikas & W. Folkerts
SEAC, Eindhoven, Netherlands
M. Cappa & G.P.J. Verbong
Eindhoven University of Technology, Netherlands
M.N. van den Donker
ECN, Eindhoven, Netherlands
P.M. Sommeling
ECN, Petten, Netherlands

6BO.5.4 Mars Soiling Sensor™
M. Gostein, K. Miller & B. Stueve
Atonometrics, Austin, United States

6BO.5.5 Electrodynamic Cleaning of PV Module
A. Faes, M. Despeisse, J. Champliaud, J. Levrat, N. Badel, J. Geissbühler, B. El Roustom & C. Ballif
CSEM, Neuchâtel, Switzerland
D. Petri, N. Wyrsch & A. Hessler-Wyser
EPFL, Neuchâtel, Switzerland
G. McKarris & G.-O. Gétaz
CleanFizz, Geneva, Switzerland

6BO.5.6 Predicting Future Soiling Losses Using Environmental Data
L. Micheli & M.G. Deceglie
NREL, Golden, United States

ORAL PRESENTATIONS 5BO.9

08:30 - 10:00 Bifacial PV Modules

Chairpersons:
Tom Betts
Loughborough University, United Kingdom
William J. Gambogi
DuPont, United States

5BO.9.1 **Special Introductory Presentation: Type Approval and Safety Considerations for Bifacial PV Modules: Requirements for IEC 61215 and IEC 61730**
B. Jaeckel
UL International, Neu-Isenburg, Germany
G. Volberg
TÜV Rheinland, Cologne, Germany
C. Monokroussos
TÜV Rheinland, Shanghai, China
G. Mülhöfer
Fraunhofer ISE, Freiburg, Germany
A. Roth
VDE Renewables, Offenbach, Germany

5BO.9.2 **Design Study of a Double-Side Illumination Solar Simulator for Bifacial Silicon PV Modules Characterisation Based on Low-Cost LED Bias Light**
D. Shaw, J. Lopez-Garcia, R. P. Kenny, L. Pinero-Prieto & E. Ozkalay
European Commission JRC, Ispra, Italy

5BO.9.3 **Comparison of Layouts for Shingled Bifacial PV-Modules in Terms of Power Output, Cell to Module Factor and Bifaciality**
A. Mondon, N. Klasen, M. Mittag, C. Hilger, M. Heinrich, U. Eitner & H. Wirth
Fraunhofer ISE, Freiburg, Germany

5BO.9.4 **Rear Face Spectral Irradiance at 1-Sun and Application to Bifacial Module Power Rating**
C. Monokroussos, X.Y. Zhang, E. Lee, Y.H. Wang & C. Zou
TÜV Rheinland, Shanghai, China
J. Bonilla Castro, M. Schweiger & W. Herrmann
TÜV Rheinland Energy, Cologne, Germany

5BO.9.5 **Impact of Using Spectrally Resolved Ground Albedo Data for Performance Simulations of Bifacial Modules**
M.R. Vogt, T. Gewohn, K. Bothe & R. Brendel
ISFH, Emmerthal, Germany
C. Schinke
Leibniz University of Hannover, Germany

VISUAL PRESENTATIONS 6BV.1

08:30 - 10:00 Solar Resource and Forecasting / Building, Infrastructure, Landscape and other Applications of PV / Grid and Energy System Integration

Detailed information on this session is presented in the section entitled 'Visual Presentations'.

Tuesday, 25 September 2018

PLENARY SESSION 2BP.1

10:30 - 12:10 Silicon Photovoltaics

Chairpersons:
Stefan W. Glunz
Fraunhofer ISE, Germany
Wim C. Sinke
ECN part of TNO, Netherlands

2BP.1.1 **Learning from the Past to Look Beyond the Roadmap of PERC Si Solar Cell Mass Production**
P.P. Altermatt, Y. Yang, Y. Chen, D. Chen, X. Zhang, G. Xu & Z. Feng
Trina Solar Energy, Changzhou, China

2BP.1.2 **Inline Characterization of Diamond Wire Sawn Multicrystalline Silicon Wafers**
J. Haunschild, N. Bergmann, T. Hammer, K. Krieg, N. Wöhrle & S. Al-Hajjawi
Fraunhofer ISE, Freiburg, Germany
O. Anspach
PV Crystalox Solar, Erfurt, Germany
H. Schremmer
Hennecke Systems, Zülpich, Germany

2BP.1.3 **Overview of Cell Fabrication Options for Thin (< 50 µm) Kerfless Epitaxial Silicon Foils: Recent Progress and Challenges**
H. Sivaramakrishnan Radhakrishnan, J. Cho, M. Xu, T. Bearda, V. Depauw, K. Van Nieuwenhuysen, I. Gordon, J. Szlufcik & J. Poortmans
imec, Leuven, Belgium
E. Neubauer & Z. Kovacova
RHP-Technology, Seibersdorf, Austria
T. Kaden
Fraunhofer THM, Freiberg, Germany
J. Röth
Anhalt University of Applied Sciences, Köthen, Germany

2BP.1.4 **Status of the EU H2020 Disc Project: European Collaboration in Research and Development of High Efficient Double Side Contacted Cells with Innovative Carrier-Selective Contacts**
B. Min, T. Wietler, S. Bordihn & R. Peibst
ISFH, Emmerthal, Germany
T. Desrues, P. Carroy & J. Jourdan
CEA, Le Bourget du Lac, France
M. Hermle, F. Feldmann & J. Bartsch
Fraunhofer ISE, Freiburg, Germany
C. Allebé, L. Ding, J. Horzel & A. Lachowicz
CSEM, Neuchâtel, Switzerland
A. Ingenito & F.-J. Haug
EPFL, Neuchâtel, Switzerland
E. Schneiderlöchner, V. Linss & K. Lüdemann
VON ARDENNE, Dresden, Germany
A. Campa, M. Bokalic & M. Topic
University of Ljubljana, Slovenia
M. Zwegers
Meco Equipment Engineers, Drunen, Netherlands
B. Hartlin
ERM, London, United Kingdom
B. Field
ERM, Paris, France
B. Bénédicte
Meyer Burger, Thun, Switzerland
Z. Adam
EcoSolifer Modulgyarto, Budapest, Hungary
J. Penaud & S. Filonovich
TOTAL, Paris la Defense, France
E. Marcon, J. Chupin & F. Tamini
Ayming, Brussels, Belgium

2BP.1.5 **Silicon Solar Cells by "DESIJN"**
A. Cuevas, D. Yan, S.P. Phang, Y. Wan & D. Macdonald
ANU, Canberra, Australia

ORAL PRESENTATIONS 2BO.2

13:30 - 15:00 **Defect Engineering in Silicon**

Chairpersons:
Markus Rinio
University of Karlstad, Sweden
Oliver Anspach
PV Crystalox Solar, Germany

2BO.2.1 **Minority Carrier Trapping in Czochralski Silicon: Influence of Thermal Donors and the Doping Density**
M. Siriwardhana, D. Macdonald & F.E. Rougieux
ANU, Canberra, Australia
F.D. Heinz
Fraunhofer ISE, Freiburg, Germany

2BO.2.2 **Impact of Low-Temperature Annealing before Firing on LeTID in Multicrystalline Silicon**
J. Lindroos, A. Schmid, A. Zuschlag, D. Skorka, J. Fritz & G. Hahn
University of Konstanz, Germany

Tuesday, 25 September 2018

2BO.2.3 **Kinetics of the Degradation and Regeneration of p-Type Multicrystalline Silicon under Dark Anneal**
C. Vargas Castrillon, D. Payne, C. Chan & Z. Hameiri
UNSW Australia, Sydney, Australia
G. Coletti
ECN, Petten, Netherlands

2BO.2.4 ***EU PVSEC Student Award Winner Presentation:*** **Elimination of Light-Induced Degradation by Black Silicon**
T.P. Pasanen, C. Modanese, V. Vähänissi, H.S. Laine & H. Savin
Aalto University, Espoo, Finland
F. Wolny, A. Oehlke, C. Kusterer & M. Wagner
SolarWorld Industries, Bonn, Germany

2BO.2.5 **Bulk Lifetime Improvement by Applying n-Type Poly-Si Passivating Contacts**
J. Liu, M.K. Stodolny, P.C.P. Bronsveld & I.G. Romijn
ECN, Petten, Netherlands

2BO.2.6 **Defects in Epitaxially Grown Silicon Wafers Causing Lifetime Patterns**
M. Drießen, P. Beu, F. Heinz, T. Fehrenbach, E. Gust, F. Schindler & S. Janz
Fraunhofer ISE, Freiburg, Germany

ORAL PRESENTATIONS 6BO.6

13:30 - 15:00 **Advanced Inspection and Failure Detection in PV Systems**

Chairpersons:
Peter Lechner
ZSW, Germany
Dezso Sera
Aalborg University, Denmark

6BO.6.1 **Photoluminescence Outdoor Measurement System (PLOMS)**
M. Koch & B. Bucher
HSR, Rapperswil, Switzerland

6BO.6.2 **DUBIO: A Fully Automatic IR Inspecting System for Large PV Plants**
M. Colaprico, M.F. de Ruvo & F. Marino
APIS, Bari, Italy
S. Vergura
Polytechnic University of Bari, Italy
G. Leotta
ENEL Green Power, Catania, Italy
M.L.T. Lo Trovato & F. Bizzarri
ENEL Green Power, Rome, Italy

6BO.6.3 **Solar Module Inspection Drone**
N. Treutner, S. Stübing, S. Hellwig & B. Meffert
HU Berlin, Germany
M. Menz & J. Killat
greateyes, Berlin, Germany

6BO.6.4 **Better Fault Detection and Diagnosis with Artificial Intelligence: Methods, Examples and Business Cases**
A. Woyte, B. Sarr, K. de Brabandere, M. Richter & W. Coppye
3E, Brussels, Belgium

6BO.6.5 **Advanced Diagnostic Approach of Failures for Grid-Connected PV Systems**
A. Livera, M. Theristis, G. Makrides & G.E. Georghiou
University of Cyprus, Nicosia, Cyprus
J. Sutterlueti
Gantner Instruments, Schruns, Austria

6BO.6.6 **Performance Analysis of Precracked PV-Modules at Cyclic Loading Conditions**
C. Buerhop-Lutz, T. Winkler, T. Patel, J. Hauch & C. Camus
ZAE Bayern, Erlangen, Germany
C.J. Brabec
FAU, Erlangen, Germany

ORAL PRESENTATIONS 5BO.10

13:30 - 15:00 **PV Module Characterisation and Calibration for Mono and Bifacial Modules**

Chairpersons:
Stefan Winter
PTB, Germany
Yoshihiro Hishikawa
AIST, Japan

5BO.10.1 **Towards IEC 60904-1-2: Assessing the Requirements for Irradiance on the Non-Illuminated Side of Bifacial PV Modules with Single Light Source Testing**
T.S. Liang, M. Pravettoni, J.P. Singh, Y. Wang & Y.S. Khoo
SERIS, Singapore, Singapore

5BO.10.2 **Characterization of Bifacial PV Mini-Modules Using Front- and Double-Side Illumination**
S. Dittmann, S. Krause & J. Bagdahn
Anhalt University of Applied Sciences, Köthen, Germany
H. Park, S.-Y. Oh & W.K. Kim
Yeungnam University, Gyeongsan, Korea South
S. Esefelder & T. Brammer
Wavelabs Solar Metrology Systems, Leipzig, Germany
B.S. Kim & S. Chang
LG Electronics, Gumi, Korea South

5BO.10.3 **Hot-Spot Endurance Test - Modifications for Bifacial Photovoltaic Modules**
D. Philipp, H. Manuel & G. Mülhöfer
Fraunhofer ISE, Freiburg, Germany

Tuesday, 25 September 2018

5BO.10.4 **Interlaboratory Comparison of Methodologies for Measuring the Angle of Incidence Dependence of Solar Cells**
N. Riedel, A.A. Santamaria Lancia, M. Amdemeskel, S. Thorsteinsson, P.B. Poulsen, A. Thorseth, C. Dam-Hansen & G.A. dos Reis Benatto
Technical University of Denmark, Roskilde, Denmark
F. Plag & I. Kröger
PTB, Braunschweig, Germany
L.H. Slooff, M.J. Jansen, A.J. Carr & P. Manshanden
ECN, Petten, Netherlands
M. Bliss & T.R. Betts
Loughborough University, United Kingdom
I. Petrina Jauregui & M. Ezquer Mayo
CENER, Sarriguren-Navarra, Spain
J.L. Balenzategui
CIEMAT, Madrid, Spain
R. Roldán
SUPSI, Canobbio, Switzerland
U. Kräling & G. Baarah
Fraunhofer ISE, Freiburg, Germany
B. Iandolo & R.S. Davidsen
Technical University of Denmark, Kongens Lyngby, Denmark

5BO.10.5 **Quantitative Evaluation of PV Device Linearity with the Two-Lamp Method**
H. Müllejans & E. Salis
European Commission JRC, Ispra, Italy

5BO.10.6 **Practical Assessment of Power Rating Uncertainties for Industrial Silicon Modules**
H.W. Wilterdink, A.L. Blum, C.L. Sainsbury & R.A. Sinton
Sinton Instruments, Boulder, United States

VISUAL PRESENTATIONS 3BV.2

13:30 - 15:00 **CI(G)S, CdTe and Related Thin Film Solar Cells and Modules**

Detailed information on this session is presented in the section entitled 'Visual Presentations'.

ORAL PRESENTATIONS 2BO.3

15:15 - 16:45 **PERX and Selective Phosphorous Emitters**

Chairpersons:
Thorsten Dullweber
ISFH, Germany
Marko Topic
University of Ljubljana, Slovenia

2BO.3.1 **Large Area Monofacial Screen-Printed Rear-Emitter nPERT Cells Approaching 23% Efficiency**
L. Tous, J. Chen, P. Choulat, S. Singh, M. Aleman, I. Kuzma-Filipek, J. John, F. Duerinckx & J. Szlufcik
imec, Leuven, Belgium

2BO.3.2 **LID-Free PERC+ Solar Cells with Stable Efficiencies Up to 22.1%**
B. Lim, A. Merkle, R. Peibst & T. Dullweber
ISFH, Emmerthal, Germany
Y. Wang & R. Zhou
LONGi Clean Energy, Xi'an, China

2BO.3.3 **Change of the Bulk Carrier Lifetime of High Quality Silicon Wafers during PERC Solar Cell Processing**
M. Müller, F. Wolny, G. Fischer, A. Krause & H. Neuhaus
SolarWorld Innovations, Freiberg, Germany

2BO.3.4 **Selective Emitter Using APCVD PSG Layers as Doping Source**
P. Saint-Cast, U. Belledin, E. Lohmüller, B. Kafle, J. Weber, A. Wolf & M. Hofmann
Fraunhofer ISE, Freiburg, Germany
S. Seren
SCHMID Group, Freudenstadt, Germany

2BO.3.5 **Non Mass Separation Type Ion Implantation System for Bifacial PERT Cell Fabrication**
K. Nakamura
Meiji University, Kawasaki, Japan
K. Muramatsu
Namics, Niigita, Japan
N. Yamaguchi
ULVAC, Susono, Japan
Y. Ohshita
Toyota Technological Institute, Nagoya, Japan

2BO.3.6 **Laser-Doped Selective Emitter - Process Development and Speed-Up**
J. Weber, S. Gutscher, S. Lohmüller, E. Lohmüller & A.A. Brand
Fraunhofer ISE, Freiburg, Germany

ORAL PRESENTATIONS 6BO.7

15:15 - 16:45 Operation, Maintenance and Performance Optimisation of PV Systems

Chairpersons:
Gerhard Mütter
Alternative Energy Solutions, Austria
George Elias Georghiou
University of Cyprus, Cyprus

6BO.7.1 **Optimum Condition for Accurate Measurement of Photovoltaic Array Temperature**
K. Okumoto, K. Miyamura & K. Nishioka
University of Miyazaki, Japan

6BO.7.2 **PV System Performance Evaluation by Clustering Production Data to Normal and Non-Normal Operation.**
O. Tsafarakis & W.G.J.H.M. van Sark
Utrecht University, Netherlands
K. Sinapis
SEAC, Eindhoven, Netherlands

6BO.7.3 **Understanding the Time Evolution of the PVGIS Performance Model Parameters and the Temperature Coefficients**
P. Ingenhoven, G. Belluardo, S. Lindig & D. Moser
EURAC, Bolzano, Italy

6BO.7.4 **Automated Module Failure Identification and Proposal of Repowering in Operating Solar Plants for Continuous Optimum Operation**
H.-J. Rodríguez San Segundo, A. Calo López & C. de Vicente Suso
The South Oracle, Sevilla, Spain

6BO.7.5 **How to Maximize the kWh/kWp Ratio: Simulations of Single-Axis Tracking in Bifacial Systems**
G.J.M. Janssen, A.R. Burgers, A.J. Carr, B.B. Van Aken & I.G. Romijn
ECN, Petten, Netherlands

Tuesday, 25 September 2018

6BO.7.6 **Operation, Performance and Maintenance of First Utility-Scale Solar Photovoltaic Plant in Kuwait Oil Kuwait for the Operation of Electric Submersible Pumps**
R.A. Sherif, A. Al-Qudaihi, H. Alsaqabi, A. Najaf, E. Safar & R. Al-Ajmi
Kuwait Oil Company, Ahmadi, Kuwait

ORAL PRESENTATIONS 5BO.11

15:15 - 16:45 Imaging Techniques for PV Modules

Chairpersons:
Ralph Gottschalg
Fraunhofer CSP, Germany
Henning Nagel
Fraunhofer ISE, Germany

5BO.11.1 **1st International Round Robin on EL Imaging: Automated Camera Calibration and Image Normalization**
K.G. Bedrich, J. Chai, Y. Wang, A.G. Aberle, R. Gottschalg & Y. S. Khoo
SERIS, Singapore, Singapore

5BO.11.2 **Electroluminescence Power Loss Prediction of Photovoltaic Modules**
T. Kropp, M. Schubert & J.H. Werner
University of Stuttgart, Germany

5BO.11.3 **Performance and Electroluminescence Analysis on Reliability and Lifetime of Thin-Film Photovoltaics (PEARL TF-PV)**
V. Huhn
Forschungszentrum Jülich, Germany
A.W. Weeber
Delft University of Technology, Netherlands
A. Martin
Crystalsol, Vienna, Austria
B. Rau
HZB, Berlin, Germany
E.J. Achterberg
Solar Tester, Schinnen, Netherlands
M. Rennhofer
AIT, Vienna, Austria
M. Theelen
TNO, Eindhoven, Netherlands
T. Weber
PI Berlin, Germany

5BO.11.4 **A Photovoltaic Module Diagnostic Setup for Lock-in-Thermography and Lock-in Electroluminescence Imaging**
H.R. Parikh, S.V. Spataru & D. Sera
Aalborg University, Denmark
C. Mantel, S. Forchhammer, G.A. dos Reis Benatto, N. Riedel, S. Thorsteinsson & P.B. Poulsen
Technical University of Denmark, Roskilde, Denmark
M. Larsen, H. Voss & M. Messerschmidt
Sky-Watch, Nordjylland, Denmark
K.H.B. Frederiksen
Kenergy, Horsens, Denmark
J. Vedde
SiCon, Birkerod, Denmark

5BO.11.5 **A Novel Method for PV: Spatially Resolved Magnetic Field Mapping for Defect Analysis**
D. Lausch, M. Patzold, C.-M. Lin, J. Fröbel & K. Kaufmann
Fraunhofer CSP, Halle (Saale), Germany

5BO.11.6 **Utilising Digital Light Processing and Compressed Sensing for Photo-Current Mapping of Encapsulated Photovoltaic Modules**
G. Koutsourakis
NPL, Teddington, United Kingdom
M. Bliss, T.R. Betts & R. Gottschalg
CREST, Loughborough, United Kingdom

VISUAL PRESENTATIONS 3BV.3

15:15 - 16:45 Perovskite, Organic and Dye-Sensitised Devices

Detailed information on this session is presented in the section entitled 'Visual Presentations'.

ORAL PRESENTATIONS 2BO.4

17:00 - 18:30 Silicon Surface Passivation

Chairpersons:
Jan Schmidt
ISFH, Germany
Barbara Terheiden
University of Konstanz, Germany

2BO.4.1 **SiO2 Passivation Layers – From the Past to the Future**
S.W. Glunz & F. Feldmann
Fraunhofer ISE, Freiburg, Germany

2BO.4.2 **Development of 4 nm-Thin PECVD Aluminium Oxide Using Plasma Analysis and Its Application to PERC Solar Cells and Modules**
M. Hofmann, D. Wagenmann, C. Teßmann, P. Saint-Cast, D. Eberlein & A. Kraft
Fraunhofer ISE, Freiburg, Germany
T. Dippell, F. May, M. Dörr & B. Cord
Singulus Technologies, Kahl am Main, Germany
T. Schütte & P. Neiß
Plasus, Mering, Germany
L. Eichhorn & M. Klick
Plasmetrex, Berlin, Germany
U. Richter
SENTECH, Berlin, Germany
M. Siemers
Fraunhofer IST, Braunschweig, Germany
P. Wiedemuth
TRUMPF Hüttinger, Freiburg, Germany

2BO.4.3 **Efficient Silicon Nitride SiNx:H Antireflective and Passivation Layers Deposited by Atmospheric Pressure PECVD for Low Cost PERC Solar Cells**
J.-F. Lelièvre, P. Brunet & F. Massines
CNRS, Perpignan, France
B. Kafle & P. Saint-Cast
Fraunhofer ISE, Freiburg, Germany

Tuesday, 25 September 2018

2BO.4.4 **Well Passivating and Highly Temperature Stable Aluminum Oxide Deposited by Atmospheric Pressure Chemical Vapor Deposition for PERC and PERT Solar Cell Concepts**
J. Engelhardt, B. Gapp, F. Mutter, G. Hahn & B. Terheiden
University of Konstanz, Germany

2BO.4.5 **Invited**

2BO.4.6 **Evidence of Rear Surface Related Degradation in Cz-Si PERC-Type Solar Cells**
A. Herguth, C. Derricks & D. Sperber
University of Konstanz, Germany

ORAL PRESENTATIONS 6BO.8

17:00 - 18:30 Performance Analysis and Evalution of PV Systems

Chairpersons:
Alessandro Virtuani
O'Sole, Italy
Christian Camus
ZAE Bayern, Germany

6BO.8.1 **Introducing 'PEARL-PV': Performance and Reliability of Photovoltaic Systems: Evaluations of Large-Scale Monitoring Data**
A.H.M.E. Reinders
University of Twente, Enschede, Netherlands
D. Moser
EURAC, Bolzano, Italy
W.G.J.H.M. van Sark
Utrecht University, Netherlands
G. Oreski
PCCL, Leoben, Austria
N.M. Pearsall
Northumbria University, Newcastle upon Tyne, United Kingdom
A. Scognamiglio
ENEA, Portici, Italy
J. Leloux
UPM, Madrid, Spain

6BO.8.2 **Fully Automated Photovoltaic System Modelling for Low Cost Energy Management Applications Based on Power Measurement Data**
B. Hanke, M. Bottega, D. Peters, N. Maitanova, J.-S. Telle, K. von Maydell & C. Agert
DLR, Oldenburg, Germany
M. Grottke
Hammer Real, Munich, Germany

6BO.8.3 **A More Accurate Machine Learning PV System Performance Analyser by Using Fuzzy Logic**
S. Rodrigues
University of Lisbon, Funchal, Portugal
J.P. Carvalho & H. Geirinhas Ramos
University of Lisbon, Portugal
F. Morgado-Dias
University of Madeira, Funchal, Portugal

6BO.8.4 **Remote I-V Curve Measurement for Photovoltaic Monitoring and Fault Detection**
S. Sarikh, M. Raoufi & A. Bennouna
Cadi Ayyad University, Marrakech, Morocco
A. Benlarabi & B. Ikken
IRESEN, Rabat, Morocco

6BO.8.5 **Outdoor Performance of Various PV Module Technologies at Different Locations**
H. Goverde, A.S.H. van der Heide, J. Govaerts, E. Voroshazi & J. Poortmans
imec, Leuven, Belgium
K. Spiliotis, J. Lehmann, G.H. Yordanov & K. Baert
KU Leuven, Heverlee, Belgium
B. Aldalali
Kuwait University, Safat, Kuwait

6BO.8.6 **Simulation of Bifacial PV Modules in Nordic Conditions for Low and High Albedo**
E. Molin & E. Wäckelgård
Dalarna University, Falun, Sweden
B. Stridh
Mälardalen University, Västerås, Sweden
A. Molin
PPAM Solkraft, Ljungsbro, Sweden

ORAL PRESENTATIONS 5BO.12

17:00 - 18:30 Durability and Reliability of PV Modules

Chairpersons:
Eszter Voroshazi
imec, Belgium
Tony Sample
European Commission JRC, Italy

5BO.12.1 **Field Analysis and Degradation of Modules and Components in Distributed PV Applications**
H. Hu & O. Fu
DuPont, Shanghai, China
W.J. Gambogi, K. Roy-Choudhury, T. Felder, S. MacMaster & T.-J. Trout
DuPont, Wilmington, United States
L. Garreau-Iles
DuPont, Geneva, Switzerland

5BO.12.2 **Trend Analysis of PV Module Failure Occurrence in Different Climate Zones**
M. Halwachs, K.A. Berger, M. Schwark & R. Ebner
AIT, Vienna, Austria
L. Maul & S. Dimitriadis
UAS Technikum Vienna, Austria
L. Neumaier, N. Vollert, W. Mühleisen & C. Hirschl
CTR, Villach, Austria
Y. Voronko
OFI, Vienna, Austria
A. Omazic
PCCL, Leoben, Austria

5BO.12.3 **Degradation of Photovoltaic Performance due to Outdoor Exposure at AIST Kyushu Center in Japan**
S. Choi, R. Sato, Y. Chiba & A. Masuda
AIST, Tosu, Japan
T. Ishii
CRIEPI, Yokosuka-shi, Japan

Tuesday, 25 September 2018

5BO.12.4 **Climate-Specific Damage Accumulation of Solder Bonds in Silicon Photovoltaic Modules**
M. Owen-Bellini
NREL, Golden, United States
J. Zhu & T.R. Betts
Loughborough University, United Kingdom
R. Gottschalg
Fraunhofer CSP, Halle (Saale), Germany

5BO.12.5 **Evaluation of Technology-Dependent Maximum Power Point Current and Voltage Degradation in a Temperate Climate**
S. Lindig, P. Ingenhoven, G. Belluardo & D. Moser
EURAC, Bolzano, Italy
M. Topic
University of Ljubljana, Slovenia

5BO.12.6 **Delamination of CIGS Thin Film Photovoltaic Module in Desert Climate**
A.A. Abdallah, A. Abotaleb & M. Buffière
QEERI, Doha, Qatar
S. Großer & C. Hagendorf
Fraunhofer CSP, Halle (Saale), Germany

VISUAL PRESENTATIONS 4BV.4

17:00 - 18:30 III-V-Based Devices for Terrestrial and Space Applications

Detailed information on this session is presented in the section entitled 'Visual Presentations'.

Wednesday, 26 September 2018

ORAL PRESENTATIONS 1CO.1

08:30 - 10:00 Advanced Material Development and Analysis for High Performance PV Modules

Chairpersons:
Rasit Turan
METU, Turkey
Holger Neuhaus
SolarWorld Innovations, Germany

1CO.1.1 Analysis of Grain-Size Distribution and Yield Strength of Interconnector Ribbons and Wires at Different Stretching Condition Using Color Etching
J. Walter, J. Stegmaier, A. Kraft & U. Eitner
Fraunhofer ISE, Freiburg, Germany

1CO.1.2 Electrically Conductive Adhesives for Cell Interconnection in Shingled Module Technology: Impact of Material Properties on Minimodule Performance
M. Estruga, L. Theunissen, A. Ardizzone, B. Willems & A. Henckens
Henkel, Westerlo, Belgium

1CO.1.3 Progress in Encapsulant-Integrated Multi-Wire Interconnection
J. Govaerts
imec, Genk, Belgium
T. Borgers, P. Nivelle, A.S.H. van der Heide, E. Voroshazi, J. Szlufcik & J. Poortmans
imec, Leuven, Belgium
R. Van Dyck, I. El -Chami, I. Isaa & T. Hoogewijs
KULeuven, Belgium

1CO.1.4 DSM Innovative Endurance Backsheet Outdoor Validation in Hot and Humid Climate
M. Mrcarica, P. Tummers, K. Van Durme, I. Goudswaard & A. Hoek
DSM, Geleen, Netherlands
P. Pathak
DSM, Pune, India

1CO.1.5 Optically Engineered Bifacial Modules for Maximum Power for All Cell Types
A.J. Carr, B.K. Newman, M.J.H. Kloos & A. Gutjahr
ECN, Petten, Netherlands
I.J. Bennett & J. Gaury
DSM Innovation, Geleen, Netherlands

1CO.1.6 Novel Light-Trapping Structures in Module Non-Active Area for Boosting Efficiency and CTM Ratio
M. Falsini
Firenze, Italy

Wednesday, 26 September 2018

ORAL PRESENTATIONS 4CO.5

08:30 - 10:00 III-V-Based Devices for Terrestrial and Space Applications

Chairpersons:
Giovanni Flamand
imec, Belgium
Carla Signorini
European Space Agency, Netherlands

4CO.5.1 The Potential and Design Principle for Next-Generation Spectrum-Splitting Photovoltaics: Targeting 50% Efficiency through Built-In Filters and Generalization of Concept
D. Lan & M.A. Green
UNSW Australia, Sydney, Australia

4CO.5.2 GaAs p-n Solar Cells with MOVPE Growth Rate of 120 µm/h
H. Sodabanlu, K. Watanabe, Y. Nakano & M. Sugiyama
University of Tokyo, Japan
A. Ubukata
TNSC, Tokyo, Japan
T. Sugaya
AIST, Tsukuba, Japan

4CO.5.3 Broadband Antireflection Coating Using Intermediate Alumina and Titania Compounds
J. Buencuerpo, S. Christensen & J.F. Geisz
NREL, Golden, United States

4CO.5.4 Effects of Irradiation on Triple and Single Junction InGaP/GaAs/Ge Solar Cells
C. Baur
ESA, Noordwijk, Netherlands
R. Campesato, M. Casale & E. Greco
CESI, Milan, Italy
M. Gervasi, P.G. Rancoita, D. Rozza & M. Tacconi
INFN, Milan, Italy
E. Gombia & A. Kingma
CNR, Parma, Italy

4CO.5.5 Progress towards High Efficiency Thin-Film III-V Quantum Dot Solar Cells for Space
T. Aho, A. Tukiainen, J. Lyytikäinen, E. Halonen, T. Niemi & M. Guina
Tampere University of Technology, Finland
F. Elsehrawy, A. Khalili & F. Cappelluti
Polytechnic University of Turin, Italy

4CO.5.6 Solar Generators for Bepi Colombo Mission to Mercury
T. Andreev
Airbus, Taufkirchen, Germany

ORAL PRESENTATIONS 2CO.9

08:30 - 10:00 Industrial Production of Silicon Solar Cells

Chairpersons:
Peter Fath
RCT-Solutions, Germany
Peter Wohlfart
SINGULUS TECHNOLOGIES, Germany

2CO.9.1 **Development of p-Cz PERC Solar Cells Approaching 23% Efficiency for Gigawatt-Level Production**
B.G. Lee, I. Höger, T. Ballmann, M. Kauert, S. Laube, M. Neuber, S. Geißler, T. Rudolph, K. Duncker, R. Lantzsch, M. Bartzsch, F. Fertig, M. Schaper & J.W. Müller
Hanwha Q CELLS, Bitterfeld-Wolfen, Germany

2CO.9.2 **Industrially Feasible PERC Cells on Diamond Wire Sawing Multi-Crystalline Silicon Wafers Textured by RIE towards 21.31% Efficiency**
Q. Ye, W. Wei, W. Wang, J. Dong, S. Yuan, J. Sheng & C. Zhang
GCL, Suzhou, China

2CO.9.3 **Effective Lightly Doped Emitter Manufacturing Approach for Nanotextured Black Silicon Solar Cells**
C.-J. Hung, S.P. Su & P.S. Huang
Motech Industries, Taoyuan, Taiwan

2CO.9.4 **Production Compatible Remedy Against LeTID in High-Performance Multicrystalline Silicon Solar Cells**
D. Bredemeier, D.C. Walter & J. Schmidt
ISFH, Emmerthal, Germany
T. Pernau & O. Romer
centrotherm international, Blaubeuren, Germany

2CO.9.5 **Less is More: Compact, Cost-Effective, High Performance Wet Chemical Process for HJT Solar Cell Manufacturing**
V. Breus, A. Wissen, A. Waltinger & M. König
Meyer Burger, Hohenstein-Ernstthal, Germany
D.L. Bätzner & R. Kramer
Meyer Burger Research, Hauterive, Switzerland

2CO.9.6 **Bifacial Shingle pSPEER Solar Cells for Shingle Modules**
P. Baliozian, N. Wöhrle, E. Lohmüller, T. Fellmeth & R. Preu
Fraunhofer ISE, Freiburg, Germany

VISUAL PRESENTATIONS 5CV.1

08:30 - 10:00 PV Module Design, Manufacture, Performance and Reliability

Detailed information on this session is presented in the section entitled 'Visual Presentations'.

PLENARY SESSION 3CP.1 / 4CP.2

10:30 - 12:00 Progress in Thin Film PV / Progress in Concentrating PV

Chairpersons:
Ayodhya Nath Tiwari
EMPA, Switzerland
Erminio Greco
CESI, Italy

3CP.1.1 **Keynote Presentation: Characterization and New Concepts Applied to Cu(In,Ga)Se2 Solar Cells: Advancements through EU Project Sharc25**
W. Witte, P. Jackson, D. Hariskos, F. Kessler & M. Powalla
ZSW, Stuttgart, Germany
S. Buecheler, R. Carron, E. Avancini, B. Bissig, T. Weiss, J. Löckinger & A. Tiwari
EMPA, Dubendorf, Switzerland
S. Siebentritt, F. Werner & M. Wolter
University of Luxembourg, Belvaux, Luxembourg
P. Pareige, S. Duguay, E. Cadel, C. Castro & A. Vilalta-Clemente
INSA Rouen, Saint Etienne du Rouvray, France
R. Menozzi, G. Sozzi & S. Di Napoli
University of Parma, Italy
E. Bourgeois, G. Degutis & R. Gehlhaar
imec, Leuven, Belgium
M. Bär, R. Wilks, T. Kunze, E. Handick & J. Bombsch
HZB, Berlin, Germany
S. Sadewasser & N. Nicoara
INL, Braga, Portugal
M. Puska, M. Malitckaya, H.-P. Komsa & V. Havu
Aalto University, Finland
P. Reinhard
Flisom, Dubendorf, Switzerland
B. Dimmler & R. Wächter
NICE Solar Energy, Schwäbisch Hall, Germany

3CP.1.2 **CIGS Productive Technology above 18%**
P. Kratzert, S. Weeke, M. Zimmer, S. ten Haaf, S. Hartnauer, S. Jander, R. Hunger & M. Vogl
Solibro, Bitterfeld-Wolfen, Germany
O. Lundberg, E. Wallin, V. Gusak & L. Stolt
Solibro Research, Uppsala, Sweden

3CP.1.3 **Large Area (>140 cm2) Perovskite Solar Modules Made by Sheet to Sheet and Roll to Roll Fabrication with 14.5% Efficiency**
F. Di Giacomo, H. Fledderus, H. Gorter, G. Kirchner, I. de Vries, I. Dogan, V. Zardetto, F. Biascioli, F. Isabelli, H. Lifka, Y. Galagan, P. Groen & R.A.J.M. Andriessen
Holst Centre - TNO, Eindhoven, Netherlands
T. Aernouts & Y. Kuang
imec, Leuven, Belgium
W. Verhees, M. Najafi, D. Zhang & S.C. Veenstra
ECN, Eindhoven, Netherlands

4CP.2.1 **Final Results of CPVMatch - Concentrating Photovoltaic Modules Using Advanced Technologies and Cells for Highest Efficiencies**
G. Siefer, D. Lackner, O. Höhn, S.P. Philipps, M. Wiesenfarth & A.W. Bett
Fraunhofer ISE, Freiburg, Germany
B. Schineller
AIXTRON, Herzogenrath, Germany
R. Parmesani
ASSE, Trieste, Italy
T. Kubera
AZUR SPACE, Heilbronn, Germany
P. Voarino
CEA, Le Bourget du Lac, France
J. Payet
CYCLECO, Ambérieu-en-Bugey, France
I. Antón Hernández
UPM, Madrid, Spain
G. Abagnale, N. Armani, M. Cornelli, A. Minuto, G. Timò & F. Trespidi
RSE, Milan, Italy
R. Alonso & E. Román Medina
TECNALIA, San Sebastián, Spain

ORAL PRESENTATIONS 1CO.2

13:30 - 15:00 Novel Approaches for Special PV Applications

Chairpersons:
Francesco Roca
ENEA, Italy
Ignacio Rey-Stolle
UPM - Technical University of Madrid, Spain

1CO.2.1 **Glued Solar Cells - A Sophisticated Technology for PV Modules**
W. Mühleisen, L. Neumaier & C. Hirschl
CTR, Villach, Austria
J. Scheurer & B. Stoesser
Polytec PT, Karlsbad, Germany
W. Pranger & A. Schütz
Ulbrich of Austria, Müllendorf, Austria
F. Vollmaier
PVP Photovoltaik, Wies, Austria
T. Fischer & R. Lorenz
Teamtechnik, Freiberg, Germany
M. Schwark & R. Ebner
AIT, Vienna, Austria

1CO.2.2 **Wet Chemical Texturization of Glass Substrate Using AZO as Sacrificial Layer for Improved Light Management in Thin Film Silicon Solar Cells**
S. Bose, G. Das, A. Kole, S. Mukhopadhyay & A.K. Barua
IIEST Shibpur, Howrah, India
S. Mandal
IIT Delhi, New Delhi, India

1CO.2.3 **Design of Coloured Bragg Reflectors with Heating Prevention Capability for BIPV Modules**
J.C. Ortiz Lizcano, P. Seoane da Silva, O. Isabella & M. Zeman
Delft University of Technology, Netherlands

Wednesday, 26 September 2018

1CO.2.4 **Research on New Materials for Building Integrated Photovoltaic Applications: AiSoVol Project**
O. González, R. Castelo, A. Alvarez, P. Hernández, E. Llarena, C. Montes, D. Molina, A. Pío, L. Ocaña, C. Quinto, M. Friend & M. Cendagorta
ITER, Granadilla de Abona, Spain
A. Linares
AIET, Granadilla de Abona, Spain
A.B. Cueli
CENER, Sarriguren-Navarra, Spain

1CO.2.5 **High-Efficiency GaAs Based Laser Power Converters: A Direct Optical Fiber Coupling**
J. Garnier Le Pallec, A. Takrouni, K. Thomas, E. Pelucchi & B. Corbett
Tyndall National Institute, Cork, Ireland
D. O'Mahony
Cork Institute of Technology, Ireland
P. Doguet
Synergia Medical, Mont-Saint-Guibert, Belgium

1CO.2.6 **Spatial Light Modulator Based Laser Microfabrication of Volume Optics Inside Solar Modules**
B. Lamprecht, V. Satzinger, G. Peharz & F.P. Wenzl
Joanneum Research, Weiz, Austria
V. Schmidt
Rebeat Innovation, Weiz, Austria

ORAL PRESENTATIONS 3CO.6

13:30 - 15:00 CIGS Devices and Processing

Chairpersons:
Wiltraud Wischmann
ZSW, Germany
Bernhard Dimmler
NICE Solar Energy, Germany

3CO.6.1 **Sputtered-ZnOS Buffer Layers in CIGS Modules at 18% Efficiency**
P. Eraerds, M. Algasinger, R. Lechner, T. Dalibor & J. Palm
Avancis, Munich, Germany

3CO.6.2 **Special Introductory Presentation: Recent Advances in High Efficiency CIGS Solar Cells on Polymer Substrates: New Results on Ga Grading and Alkali Fluorides**
F. Donsanti, M. Balestrieri, V. Achard, T. Hildebrandt, L. Lombez, S. Béchu, M. Jubault & N. Naghavi
IPVF, Palaiseau, France
M. Bouttemy & A. Etcheberry
UVSQ, Versailles, France
D. Lincot
CNRS, Palaiseau, France

3CO.6.3 **The Optimization of CIGS Absorbers Obtained from Atmospheric Selenium-Sulphur Annealing of Electrodeposited Precursors on a 30x30 cm2 Pilot Line**
M. Theelen, A. Hovestad, M. Simor, M. Van der Vleuten, H.L.A.H. Steijvers & H. Linden
TNO, Eindhoven, Netherlands
K. van der Werf, D. Zhang & M. Dörenkämper
ECN, Eindhoven, Netherlands
W. Luk, W.T.J. Lee & S. Yang
ADPV, Hong Kong, China

3CO.6.4 **Characterization of High Performance Cu(In,Ga)Se2 Bottom Cells in Thin Film Solar Tandem Applications**
H. Elanzeery, F.-S. Babbe, M. Melchiorre, F. Werner & S. Siebentritt
University of Luxembourg, Belvaux, Luxembourg

3CO.6.5 ***EU PVSEC Student Award Winner Presentation:*** **Narrow Bandgap CI(G)S for Tandem Application**
T. Feurer, T. Moser, T.P. Weiss, E. Avancini, S. Buecheler & A.N. Tiwari
EMPA, Dubendorf, Switzerland

ORAL PRESENTATIONS 2CO.10

13:30 - 15:00 **Poly-Si Based Passivating Contacts**

Chairpersons:
Giso Hahn
University of Konstanz, Germany
Arthur W. Weeber
ECN part of TNO, Netherlands

2CO.10.1 ***EU PVSEC Student Award Winner Presentation:*** **Intrinsic Poly-Crystalline Silicon Region in between the p+ and n+ POLO Contacts of an 26.1%-Efficient IBC Solar Cell**
C. Klamt, M. Rienäcker, F. Haase, N. Folchert, R. Brendel & R. Peibst
ISFH, Emmerthal, Germany
V. Krausse & J. Krügener
Leibniz University of Hannover, Germany

2CO.10.2 **Highly Passivating and Blister-Free PECVD Poly-Silicon for Large Area Silicon Solar Cells**
A. Morisset, R. Cabal, B. Grange & S. Dubois
CEA, Le Bourget du Lac, France
C. Marchat
IPVF, Palaiseau, France
J. Alvarez, M.E. Gueunier-Farret & J.-P. Kleider
CNRS, Gif-sur-Yvette, France

2CO.10.3 **Novel Schemes of p+poly-Si Hydrogenation Implemented in Industrial 6" Bifacial Front-and-Rear Passivating Contacts Solar Cells**
M.K. Stodolny, J. Anker, C.J.J. Tool, A.A. Mewe, P. Manshanden & I.G. Romijn
ECN, Petten, Netherlands
M. Lenes
Tempress, Vaassen, Netherlands

2CO.10.4 **LPCVD Polysilicon-Based Passivating Contacts for Plated Bifacial n-Type PERT Solar Cells**
M. Recamán Payo, R. Russell, S. Singh, V. Depauw, I. Kuzma-Filipek, Y. Li, M. Firat, L. Tous, J. John, F. Duerinckx, J. Szlufcik & J. Poortmans
imec, Leuven, Belgium
J.R.M. Luchies & M. Lenes
Tempress, Vaassen, Netherlands

2CO.10.5 **Electron Beam Evaporation of Silicon for Polysilicon/SiO2 Passivated Contacts**
J. Lossen, J. Hoß & S. Eisert
ISC Konstanz, Germany
D. Amkreutz & M. Muske
HZB, Berlin, Germany
G. Andrä
IPHT, Jena, Germany

2CO.10.6 **High-Thermal Budget c-Si Heterojunction Solar Cells with Poly-SiOx Carrier-Selective Passivating Contacts**
G. Yang, P.Q. Guo, R. Santbergen, G. Limodio, A.W. Weeber, O. Isabella & M. Zeman
Delft University of Technology, Netherlands

VISUAL PRESENTATIONS 6CV.2

13:30 - 15:00 **Design and Installation of PV Systems**

Detailed information on this session is presented in the section entitled 'Visual Presentations'.

ORAL PRESENTATIONS 6CO.3

15:15 - 16:45 **Modelling for PV Systems**

Chairpersons:
Adriano Sabene
ENEL Green Power, Italy
Kari Lappalainen
Tampere University of Technology, Finland

6CO.3.1 **Simplified Method for Partial Shading Losses Calculation for Series Connected PV Modules with Experimental Validation**
M. Dallapiccola, P. Ingenhoven & D. Moser
EURAC, Bolzano, Italy
J.S. Stein
Sandia National Laboratories, Albuquerque, United States

6CO.3.2 **A Lower TC: In the Future Maybe Not Always the Best Idea?**
J. Govaerts, I. Horvath & H. Goverde
imec, Genk, Belgium
B. Aldalali
Kuwait University, Khaldiya, Kuwait
J. Poortmans
imec, Leuven, Belgium

6CO.3.3 **From BIPV Module to System: A Modelica-Developed Framework for Building Energy Simulations Including BIPVs**
K. Spiliotis, J. Goncalves, K. Baert, J. Driesen & D. Saelens
KU Leuven, Belgium

6CO.3.4 **Predicting Yields of Bifacial PV Power Plants – What Accuracy Is Possible?**
M. Chiodetti
EDF, Moret-Loing-Orvanne, France
J. Kang & C. Reise
Fraunhofer ISE, Freiburg, Germany
A. Lindsay
EDF, Los Altos, United States

6CO.3.5 **Mititgating Snow on Rooftop PV Systems for Higher Energy Yield and Safer Roofs**
B.B. Aarseth
University of Oslo, Kjeller, Norway
M.B. Øgaard, J. Zhu, J.A. Tsanakas, J.H. Krogh Selj & E.S. Marstein
IFE, Kjeller, Norway
T. Strömberg
Innos, Etterstad, Norway

6CO.3.6 **Load Flow Simulation of a Low-Voltage PV-Battery Based DC Micro-Grid to Supply Small Isolated Communities**
P. Ferreira Torres, M. Barros Galhardo, W. Negrao-Macedo & J. Tavares Pinho
UFPA, Belém, Brazil
J. de Arimatéia Alves Vieira Filho, V. Lima Chaar Junior & L. Ferreira de Araújo
UFPA, Belem, Brazil
S. Williamson
University of Bristol, United Kingdom

ORAL PRESENTATIONS 3CO.7

15:15 - 16:45 **CIGS Characterisation**

Chairpersons:
Alex Redinger
University of Luxembourg, Luxembourg
James R. Sites
Colorado State University, United States

3CO.7.1 **Discrimination of Trapping and Front Surface Recombination for Double Graded Cu(In,Ga)Se2**
T.P. Weiss, R. Carron, J. Löckinger, E. Avancini, S. Buecheler & A.N. Tiwari
EMPA, Dubendorf, Switzerland

3CO.7.2 **Defects, Buffer Layer, or Artefact – What Do We See in Capacitance Measurements of Thin-Film Solar Cells?**
F. Werner, F.-S. Babbe, J. Burkhart, H. Elanzeery & S. Siebentritt
University of Luxembourg, Belvaux, Luxembourg

3CO.7.3 **Reduced Recombination in a Surface-Sulfurized Cu(InGa)Se2 Thin-Film Solar Cell**
S. Kim, J. Nishinaga, H. Tampo, H. Shibata & S. Niki
AIST, Tsukuba, Japan

3CO.7.4 **Impact of Chalcogen Atmosphere during KF-Post Deposition Treatment on Cu(In,Ga)Se2/CdS Interface Formation and PV Performance**
S. Harel, T. Lepetit, L. Arzel & N. Barreau
University of Nantes, France
P. Zabierowski
Warsaw University of Technology, Poland

3CO.7.5 **Service Life Prediction for CIGS Modules Regarding Potential-Induced Degradation**
P. Lechner, J. Schnepf & S. Hummel
ZSW, Stuttgart, Germany

Wednesday, 26 September 2018

ORAL PRESENTATIONS 2CO.11

15:15 - 16:45 **Transparant Passivating Layers for Silicon Cells**

Chairpersons:
Joachim John
imec, Belgium
Jörg Müller
Hanwha Q CELLS, Germany

2CO.11.1 **Nanocrystalline n-Type Silicon Front Surface Field Layers: From Research to Industry Applications in Silicon Heterojunction Solar Cells**
A.B. Morales-Vilches, L. Mazzarella, L. Korte, R. Schlatmann & B. Stannowski
HZB, Berlin, Germany
D. Decker & D. Sontag
Meyer Burger, Hohenstein-Ernstthal, Germany

2CO.11.2 **SiCx- and SiOx-Based Passivating Contacts for High-Efficiency Silicon Solar Cells**
F.-J. Haug, J. Stückelberger, G. Nogay, P. Wyss, M. Lehmann, L. Gnocchi, A. Ingenito & C. Ballif
EPFL, Neuchâtel, Switzerland
C. Allebé, J. Horzel & M. Despeisse
CSEM, Neuchâtel, Switzerland

2CO.11.3 **Passivating Contacts for Silicon Solar Cells Made of Al2O3 and TiOx Nanolayer Systems**
M. Grube, D. Tröger, M. Materano & T. Mikolajick
NaMLab, Dresden, Germany
M. Knaut, J. Reif & J.W. Bartha
Technical University of Dresden, Germany

2CO.11.4 **Implementation of Full-Area-Deposited Electron-Selective TiOx Layers into Silicon Solar Cells**
V. Titova & J. Schmidt
ISFH, Emmerthal, Germany

2CO.11.5 **Electron-Selective Contact Using i-a-Si:H/TiOx and Yb for Silicon Heterojunction Solar Cells**
J. Cho, M. Recamán Payo, M. Debucquoy, H. Sivaramakrishnan Radhakrishnan, I. Gordon, J. Szlufcik & J. Poortmans
imec, Leuven, Belgium

2CO.11.6 **Transparent Passivating Contacts for Front Side Application**
J. Stückelberger, G. Nogay, P. Wyss, L. Gnocchi, M.J. Lehmann, L. Antognini, F.-J. Haug, A. Ingenito & C. Ballif
EPFL, Neuchâtel, Switzerland
J.J. Diaz Leon, L. Ding, J. Horzel, C. Allebé, S. Nicolay & M. Despeisse
CSEM, Neuchâtel, Switzerland

VISUAL PRESENTATIONS 5CV.3

15:15 - 16:45 **PV Module Design, Manufacture, Performance and Reliability / Inverters and Balance of System Components / Sustainability and Recycling**

Detailed information on this session is presented in the section entitled 'Visual Presentations'.

ORAL PRESENTATIONS 6CO.4

17:00 - 18:30 Design and Calculations

Chairpersons:
Hans Goverde
imec, Belgium
Elias Garcia Goma
Delft University of Technology, Netherlands

6CO.4.1 **Open Source Tool for a Better Design of BIPV+ Battery System: An Applied Example**
M. Lovati, J. Adami & D. Moser
Eurac Research, Bolzano, Italy

6CO.4.2 **Size of a Basic Simulation Unit in PV System Partial Shading Studies**
K. Lappalainen & S. Valkealahti
Tampere University of Technology, Finland

6CO.4.3 **Special Presentation: Economic Validation of Large Power PV Irrigation Systems**
R.H. Almeida, I.A. Barata Carrêlo, C. Lorenzo Navaro & L. Narvarte Fernández
UPM, Madrid, Spain

6CO.4.4 **Design of Hybrid-Minigrids in South African Rural Areas under Consideration of Social and Cultural Aspects**
M. Kühnel, B. Hanke & K. von Maydell
DLR, Oldenburg, Germany
Y. Baranova
DEULA-Nienburg, Germany
O. Weigel & S. Maebe
GIZ, Hamburg, Germany
I.W. Stuermer
MU-Niedersachsen, Hannover, Germany
A. McMaster
DEDEAT, East London, South Africa

6CO.4.5 **Comparison of Vertically Mounted PV on Land and on Water**
A.J. Carr & B.B. Van Aken
ECN, Petten, Netherlands
H. Lok, L.S. Bosma & T. Jansma
Hanze University, Groningen, Netherlands
W. Vermeulen
Tempress, Vaassen, Netherlands
S. Eggink & R. Kreiter
Sunfloat, Bennekom, Netherlands
W. Otto
MARIN, Wageningen, Netherlands

Wednesday, 26 September 2018

ORAL PRESENTATIONS 3CO.8

17:00 - 18:30 CdTe and CZTS

Chairpersons:
Takahiro Wada
Ryukoku University, Japan
Susanne Siebentritt
University of Luxembourg, Luxembourg

3CO.8.1 **Increased Efficiency with CdSeTe Layer in Front of CdTe**
J.R. Sites, T. Song & A. Huss
Colorado State University, Fort Collins, United States
M. Lingg
EMPA, Dubendorf, Switzerland

3CO.8.2 **Introduction of Copper by Wet Deposition in CdTe Solar Cells**
E. Artegiani, D. Menossi, M. Leoncini, M. Cavallini & A. Romeo
University of Verona, Italy

3CO.8.3 **In-Line MOCVD of Al Doped ZnS: A Path to High Performance CdTe Solar Cells**
A.J. Clayton, P.J. Siderfin, S. Jones, G. Kartopu, O. Oklobia, A.C. Teloeken, D.A. Lamb & S.J.C. Irvine
Swansea University, St. Asaph, United Kingdom

3CO.8.4 **Towards Cd-Free R2R CZTSSe-Monograin-Membrane PV-Module Production**
P. Santos Ortiz, S. Lopez, S. Edinger, M. Ursprung, L. Plessing, C. Waldauf & D. Meissner
Crystalsol, Vienna, Austria
J. Mangalam, T. Rath, P. Poelt & G. Trimmel
Graz University of Technology, Austria
C. Neubauer
Tallinn University of Technology, Estonia

3CO.8.5 **SWInG – Development of Thin Film Solar Cells Based on WIde Band Gap Kesterite Absorbers**
B. Vermang, G. Brammertz, S. Sahayaraj, S. Ranjbar, M. Aniket, S. Garud & M. Meuris
imec, Leuven, Belgium
T. Schnabel & E. Ahlswede
ZSW, Stuttgart, Germany
L. Choubrac, S. Harel, C. Cardinaud, L. Arzel & N. Barreau
CNRS, Paris, France
J. van Deelen & P.J. Bolt
TNO/Solliance, Eindhoven, Netherlands
P. Bras, Y. Ren & E. Jaremalm
Midsummer, Järfälla, Sweden
S. Khelifi, S. Yang & J. Lauwaert
Ghent University, Gent, Belgium
X. Kozina, E. Handick, Y. Zhang, R.G. Wilks & M. Bär
HZB, Berlin, Germany

3CO.8.6 **Electronic Structure of CdS/Cu2ZnGeSe4 Heterointerface**
T. Nagai, H. Tampo, S. Kim, H. Shibata, K. Matsubara & S. Niki
AIST, Tsukuba, Japan
K. Tanigawa, Y. Iwamoto, H. Hamada, N. Ohta, T. Shimamura & N. Terada
Kagoshima University, Japan

ORAL PRESENTATIONS 2CO.12

17:00 - 18:30 Metallisation and Structuring

Chairpersons:
Jörg Horzel
CSEM, Switzerland
Florian Clement
Fraunhofer ISE, Germany

2CO.12.1 **Ultra-Short Laser Processing for Damage-Free Back-Contacted Silicon Hetero-Junction Solar Cells**
A. Singh, B. Turan, S. Haas, A. Lambertz, K. Ding & U. Rau
Forschungszentrum Jülich, Germany

2CO.12.2 **Benefits of Pattern Transfer Printing Method for Finger Metallization on Silicon Solar Cells**
A. Adrian, D. Rudolph & J. Lossen
ISC Konstanz, Germany
M. Matusovsky
Utilight, Yavne, Israel

2CO.12.3 **Progress on Bifacial Ni/Ag Plated nPERT Cells for Module Fabrication with SWCT**
L. Tous, R. Russell, S. Jambaldinni, A. van der Heide, G. Doumen, F. Duerinckx, E. Voroshazi & J. Szlufcik
imec, Leuven, Belgium
Y. Yao & B. Bonnet-Eymard
Meyer Burger, Gwatt, Switzerland

2CO.12.4 **Plated Fine Line Metallization for PERC Solar Cells**
S. Kluska, A. Lorenz, B. Grübel, A. Büchler, G. Cimiotti, F. Clement, V. Arya, A.A. Brand, J. Nekarda, J. Bartsch & M. Glatthaar
Fraunhofer ISE, Freiburg, Germany
S. Hörnlein & A. Mette
Hanwha Q CELLS, Bitterfeld-Wolfen, Germany

2CO.12.5 **Processing Routes and Costs for Copper Plating on Bifacial Heterojunction Cells**
A. Lachowicz, J. Geissbühler, A. Faes, J. Champliaud, J. Horzel, C. Ballif & M. Despeisse
CSEM, Neuchâtel, Switzerland
M. Sciuto & A. Battaglia
3SUN, Catania, Italy
J.-F. Lerat, D. Muñoz & P.-J. Ribeyron
INES, Le Bourget du Lac, France
P. Papet & B. Strahm
Meyer Burger Research, Hauterive, Switzerland

2CO.12.6 **Novel Methods of Efficient Metallization for Silicon Heterojunction Solar Cells**
G.K. Zhavnerko, I. Paribok & V.Y. Shiripov
Izovac Technologies, Minsk, Belarus
O.V. Sergeev
DLR, Oldenburg, Germany

VISUAL PRESENTATIONS 1CV.4

17:00 - 18:30 Fundamental Studies / New Materials and Concepts for Photovoltaic Devices

Detailed information on this session is presented in the section entitled 'Visual Presentations'.

Thursday, 27 September 2018

PLENARY SESSION 5DP.1

08:30 - 10:00 Photovoltaic Modules and BoS Components

Chairpersons:
Werner Herrmann
TÜV Rheinland Energy, Germany
Mariska De Wild-Scholten
SmartGreenScans, Netherlands

5DP.1.1 **Keynote Presentation: Standards for PV - Overview of IEC Related PV Standards and How They Contribute to Reduced Costs of Energy**
T. Sample
European Commission JRC, Ispra, Italy

5DP.1.2 **Overview of Bifacial Module Technologies, Applications and Costs**
R. Kopecek
ISC Konstanz, Germany

5DP.1.3 **Storage for Increasing Self Consumption**
K.-P. Kairies
RWTH Aachen University, Germany

5DP.1.4 **Environmental Aspects of Crystalline Silicon PV Module Recycling Technologies**
K. Komoto, S. Oyama, T. Sato & H. Uchida
Mizuho IR Institute, Tokyo, Japan

PLENARY SESSION 6DP.2

10:30 - 12:00 PV Systems Performance, Applications and Integration

Chairpersons:
Franz P. Baumgartner
ZHAW, Switzerland
Alessandra Scognamiglio
ENEA, Italy

6DP.2.1 **Keynote Presentation: Visions from the Future: The Interaction between Curtailment, Spinning Reserve Settings and Generator Limits on Australian Projects with Medium to High Renewable Energy Fractions**
B. Herteleer, G. Dickeson, L. McLeod, B. van Ree, C. Paynter & L. Frearson
Ekistica, Alice Springs, Australia
D. Airen, P. Maker & S. Latz
Power and Water, Alice Springs, Australia
A. Dobb & S. Rodgers
ARENA, Canberra, Australia

6DP.2.2 **Demonstrating Novel Building Integrated Photovoltaic Technologies with the PVSITES Project**
M. Machado, R. Alonso & J.M. Vega de Seoane
Tecnalia, San Sebastián, Spain
I. Weiss & S. Challet
WIP - Renewable Energies, Munich, Germany
V.K. Nguyen & P. Alamy
CADCAMation, Onex, Switzerland
F. Noris
R2M Solution, Pavia, Italy
E. Rico
Onyx Solar Energy, Avila, Spain
T. Reijenga
BEAR-iD, Gouda, Netherlands
P. Brassier
Nobatek, Anglet, France
P. Surguy
Film Optics, Watchfield, United Kingdom
V. Francisco
CTCV, Coimbra, Portugal
J. Perrenoud
Filsom, Dübendorf, Switzerland
H. Delgado
CRICURSA, Barcelona, Spain
F. Burgun
CEA, Le Bourget du Lac, France
J.C. Esteban
Acciona Infraestructuras, Madrid, Spain
D. Déramaix
Format D2, Sirault, Belgium
A. Bogucka
Vilogia, Paris, France

6DP.2.3 **An Overview of Floating PV Worldwide**
M.M. de Jong, K. Sinapis & W. Folkerts
SEAC, Eindhoven, Netherlands

6DP.2.4 **Infrared and Electroluminescence Imaging for PV Field Applications: An Overview of the Latest Report by IEA PVPS Task 13**
J.A. Tsanakas
imec, Heverlee, Belgium
U. Jahn & M. Herz
TÜV Rheinland Energy, Cologne, Germany
M. Köntges
ISFH, Emmerthal, Germany
D. Parlevliet
Murdoch University, Perth, Australia
M. Paggi
IMT School for Advanced Studies, Lucca, Italy
J.S. Stein
Sandia National Laboratories, Albuquerque, United States
K.A. Berger
AIT, Vienna, Austria
S. Ranta
Turku University of Applied Sciences, Finland
R. French
Case Western Reserve University, Cleveland, United States
M. Richter
3E, Brussels, Belgium
T. Tanahashi
AIST, Tsukuba, Japan

Thursday, 27 September 2018

ORAL PRESENTATIONS 2DO.1

13:30 - 15:00 Heterojunction Silicon Cells

Chairpersons:
Christophe Ballif
EPFL, Switzerland
Delfina Muñoz
CEA, France

2DO.1.1 **Special Introductory Presentation: Engineering of Thin Film Silicon Materials for High Efficiency Crystalline Silicon Solar Cells**
M. Despeisse, B. Paviet-Salomon, A. Descoeudres, L.-L. Senaud, C. Allebé, J. Levrat, J. Horzel, A. Lachowicz, F. Debrot, J. Champliaud, A. Faes, N. Badel, J. Geissbühler, S. Martin de Nicolàs, G. Christmann, J.J. Diaz Leon, L. Ding & S. Nicolay
CSEM, Neuchâtel, Switzerland
M. Boccard & C. Ballif
EPFL, Neuchâtel, Switzerland

2DO.1.2 **Silicon Heterojunction Solar Cells with Open-Circuit-Voltage above 750mV**
A. Danel, S. Harrison, F. Gérenton, R. Varache & J. Veirman
CEA, Grenoble, France

2DO.1.3 **Selective Deposition of a-Si:H: A Proof-of-Concept Study**
M. Xu, T. Bearda, M. Hasan, H. Sivaramakrishnan Radhakrishnan, I. Gordon, J. Szlufcik & J. Poortmans
imec, Leuven, Belgium

2DO.1.4 **Passivation and Transport Modification Upon Light Soaking of Silicon Heterojunction Solar Cells**
J. Cattin, J. Haschke, O. Dupré, M. Boccard & C. Ballif
EPFL, Neuchâtel, Switzerland

2DO.1.5 **Implementation of a Novel Silicon Heterojunction IBC Process Flow Using Partial Etching of Doped a-Si:H with Efficiencies Close to 23%**
H. Sivaramakrishnan Radhakrishnan, M.D. Gius Uddin, M. Xu, J. Cho, I. Gordon, J. Szlufcik & J. Poortmans
imec, Leuven, Belgium

ORAL PRESENTATIONS 3DO.4

13:30 - 15:00 Characterisation, Stability and Outdoor Performance of Emerging PV Technologies

Chairpersons:
Sjoerd Veenstra
ECN part of TNO, Netherlands
Quentin Jeangros
EPFL, Switzerland

3DO.4.1 **Worldwide Standardization Activity on Emerging Photovoltaic Devices: Guidance for the Measurement of Organic, Dye Sensitized and Perovskite PV Devices**
G. Bardizza & H. Müllejans
European Commission JRC, Ispra, Italy
T. Matsuyama
University of Tokyo, Japan
C.J. Fell
CSIRO Energy Technology, Mayfield West, Australia

3DO.4.2 **Outdoor Monitoring of MAPI and FMC Mini-Modules**
V. Stoichkov
Bangor University, United Kingdom
J. Troughton, K. Hooper, F. de Rossi & T.M. Watson
Swansea University, United Kingdom
J. Kettle
University of Bangor, United Kingdom

3DO.4.3 **Outdoor Measurements of MPP-Tracked Perovskite Solar Cells**
C. Ulbrich, M. Riedel, S. Pingel, S. Neubert & R. Schlatmann
PVcomB, Berlin, Germany
A. Abate
HZB, Berlin, Germany
M. Jankovec, B. Glažar & M. Topic
University of Ljubljana, Slovenia
C. Schultz
University of Applied Sciences, Berlin, Germany

3DO.4.4 **Towards Long-Term Thermally Stable Highly Efficient Perovskite Solar Cells**
W. Song, J.P. Bastos, L. Rakocevic, W. Qiu, T. Merckx, G. Uytterhoeven, R. Gehlhaar, T. Aernouts & J. Poortmans
imec, Heverlee, Belgium

3DO.4.5 **Probing Photoinduced Degradation of CH3NH3PbI3 Perovskite Films by Kelvin Probe and Photoluminescence Techniques**
A. Peter Amalathas, L. Abelová, B. Conrad & B. Dzurnak
CTU, Prague, Czech Republic
M. Ledinsky & J. Holovsky
ASCR, Prague, Czech Republic

3DO.4.6 **Development of Imaging Tools for Degradation Study of Organic Photovoltaic Cells and Modules under Illumination**
M.-A. Llobel, M. Matheron, S. Cros & S. Berson
CEA, Le Bourget du Lac, France
C. Arrivé, S. Courtel, G. Rivière & M. Bertrand
ARMOR, Nantes, France

ORAL PRESENTATIONS 5DO.7

13:30 - 15:00 **Qualification and Testing of Glass, Encapsulation and Backsheet Materials**

Chairpersons:
Mike Van Iseghem
EDF R&D, France
Hartmut Nussbaumer
ZHAW, Switzerland

5DO.7.1 **New Test Method for Performance Evaluation of Anti-Soiling Coatings**
K. Ilse, M.Z. Khan, V. Naumann & C. Hagendorf
Fraunhofer CSP, Halle (Saale), Germany
N. Voicu
DSM Advanced Solar, Geleen, Netherlands

5DO.7.2 **PV Module and Solar Glass Trickling Sand Testing**
G. Mathiak, D. Grimm, L. Falk, L. Rimmelspacher, W. Herrmann, F. Reil & J. Althaus
TÜV Rheinland Energy, Cologne, Germany
A. Morlier
ISFH, Hamelin, Germany

Thursday, 27 September 2018

5DO.7.3 **Do PV Modules Optimized for Different Climatic Conditions Make Sense? Discussion by Using the Example of Backsheet and Encapsulant Films**
G. Oreski & A. Omazic
PCCL, Leoben, Austria
G.C. Eder & Y. Voronko
OFI, Vienna, Austria
L. Neumaier & C. Hirschl
CTR, Villach, Austria
R. Ebner
AIT, Vienna, Austria
M. Edler
ISOVOLTAIC, Lebring, Austria

5DO.7.4 **Climate Specific Accelerated Ageing Tests & Evaluation of Ageing Induced Electrical, Physical and Chemical Changes**
G.C. Eder & Y. Voronko
OFI, Vienna, Austria
S. Dimitriadis & K. Knöbl
University of Applied Sciences Vienna, Austria
G. Újvári & K.A. Berger
AIT, Vienna, Austria
L. Neumaier
CTR, Villach, Austria

5DO.7.5 **Backsheet Chalking: Background and Relation to Backsheet Cracking**
P. Gebhardt, L. Pitta Bauermann & D. Philipp
Fraunhofer ISE, Freiburg, Germany

5DO.7.6 **Combined-Accelerated Stress Testing for Advanced Reliability Assessment of Photovoltaic Modules**
M. Owen-Bellini, P. Hacke, M. Kempe & D.C. Miller
NREL, Golden, United States
S.V. Spataru
AAU, Aalborg, Denmark
L. Schelhas & S. Moffitt
SLAC, Menlo Park, United States

ORAL PRESENTATIONS 6DO.10

13:30 - 15:00 **Solar Radiation**

Chairpersons:
Christos Protogeropoulos
EEPS, Greece
Jan Remund
Meteotest, Switzerland

6DO.10.1 **Improving the Accuracy of the National Solar Radiation Database (1998-2016)**
M. Sengupta, A. Habte, A. Lopez & Y. Xie
NREL, Golden, United States

6DO.10.2 **Disaggregation of Local Photovoltaic Generation from Composite Power Flows with Direct Measuring and Sattelite Estimations of the Irradiance: A Comparison**
F. Sossan, E. Scolari & M. Paolone
EPFL, Lausanne, Switzerland

6DO.10.3 **Solar Irradiation on Roof Surfaces: Generating Spatially Resolved Hour-by-Hour Time Series for Buildings in the Netherlands**
N. Nortier, W.G.J.H.M. van Sark & B.B. Kausika
Utrecht University, Netherlands
M. Paardekooper
Geodan, Amsterdam, Netherlands

6DO.10.4 **Modeling Reflected Irradiance in Urban Environments – A Case Study for Simulation-Based Measurement Quality Control for an Outdoor PV Test Site**
A. Bognar, R. Loonen & J.L.M. Hensen
Eindhoven University of Technology, Netherlands
R.M.E. Valckenborg
SEAC, Eindhoven, Netherlands

6DO.10.5 **Direct Normal Irradiance Measurements Using a Tracker-Less Sunshine Duration Measurement Concept**
J.M. Pó & K. Hoogendijk
EKO Instruments, Den Haag, Netherlands
I. Chiba & A. Akiyama
EKO Instruments, Tokyo, Japan
W. Beuttell
EKO Instruments, San Jose, United States

6DO.10.6 **Radiometer Response Time and Irradiance Measurement Accuracy**
A. Driesse
PV Performance Labs, Freiburg, Germany

VISUAL PRESENTATIONS 6DV.1

13:30 - 15:00 **Operation, Performance and Maintenance of PV Systems**

Detailed information on this session is presented in the section entitled 'Visual Presentations'.

ORAL PRESENTATIONS 2DO.2

15:15 - 16:45 **Transparent Conductive Oxides**

Chairpersons:
Yoshio Ohshita
Toyota Technological Institute, Japan
David Young
NREL, United States

2DO.2.1 **Transparent Conductive Oxide Screening on High Temperature Passivating Contact Solar Cells for Improved Passivation and Cell Efficiency**
J.J. Diaz Leon, L. Ding, G. Christmann, C. Allebé, M. Despeisse & S. Nicolay
CSEM, Neuchâtel, Switzerland
G. Nogay, J. Stückelberger, P. Wyss, F.-J. Haug, A. Ingenito & C. Ballif
EPFL, Neuchâtel, Switzerland

2DO.2.2 **Optoelectronic Performance of TCOs on Silicon Heterojunction Rear Emitter Solar Cells**
A. Cruz, S. Neubert, A.B. Morales-Vilches, D. Erfurt, F. Ruske, B. Stannowski & R. Schlatmann
HZB, Berlin, Germany
S. Koerner & B. Szyszka
Berlin University of Technology, Germany

Thursday, 27 September 2018

2DO.2.3 **Zr-Doped In2O3: Combining High-Doping and High-Mobility in a Water-Free Ultra-Transparent Electrode for SHJ Solar Cells**
M. Boccard, R. Monnard, E. Rucavado, M. Morales-Masis & C. Ballif
EPFL, Neuchâtel, Switzerland

2DO.2.4 **High Mobility Transparent Conductive Oxides for Silicon Heterojunction Solar Cells Deposited by Rotatable Magnetrons**
M. Dimer, J. Löhnert, U. Graupner, M. Thumsch & E. Schneiderlöchner
VON ARDENNE, Dresden, Germany
A. Cruz, S. Neubert, A.B. Morales-Vilches & B. Stannowski
HZB, Berlin, Germany

2DO.2.5 **High Mobility IWO for Improved Current in Heterojunction Technology Solar Cells**
L. Ding, J.J. Diaz Leon, G. Christmann, L.-L. Senaud, L. Barraud, A. Descoeudres, N. Badel, M. Despeisse, S. Nicolay & C. Ballif
CSEM, Neuchâtel, Switzerland

2DO.2.6 **Analysis of Infrared Light Trapping on Bifacial Silicon Heterojunction Solar Cells**
F. Gérenton, S. Harrison, P. Carroy, A. Valla, A. Danel & D. Muñoz
CEA, Le Bourget du Lac, France

ORAL PRESENTATIONS 3DO.5

15:15 - 16:45 **Increasing the Efficiency of Perovskite Solar Cells**

Chairpersons:
Uli Würfel
Fraunhofer ISE, Germany
Rutger Schlatmann
PVcomB, Germany

3DO.5.1 **Special Introductory Presentation: Passivation of Grain Boundaries by Phenethylammonium in Formamidinium-Methylammonium Lead Halide Perovskite Solar Cell**
D.S. Lee, J.S. Yun, J. Kim, A. Mahboubi-Soufiani, S. Chen, Y. Cho, X. Deng, J. Seidel, S. Lim, S. Huang & A.W.Y. Ho-Baillie
UNSW Australia, Sydney, Australia

3DO.5.2 **Perovskite Solar Cells with Mixed Metal SnPb and SnGe (Pb-Free) Light Harvesting Layer**
N. Ito, T.S. Ripolles, M.A. Kamarudin, Y. Ogomi, S. Iikubo, T. Kinoshita & S. Hayase
Kyushu Institute of Technology, Kitakyushu, Japan
G. Kapil, T. Bessho & H. Segawa
University of Tokyo, Japan
K. Hamada, Q. Shen & T. Toyoda
University of Electro-Communication, Chofu, Japan
K. Yoshino
University of Miyazaki, Japan
T. Minemoto
Ritsumeikan University, Shiga, Japan

3DO.5.3 **Stable and Highly Transparent Perovskite Cell and Module for High Efficiency Perovskite/c-Si 4-Terminal Tandems**
M. Najafi, D. Zhang, M. Dörenkämper, W. Verhees & S.C. Veenstra
ECN, Eindhoven, Netherlands
V. Zardetto, H. Fledderus, F. Di Giacomo, H. Lifka, P. Poodt & R.A.J.M. Andriessen
TNO, Eindhoven, Netherlands
M. Jaysankar & T. Aernouts
imec, Leuven, Belgium
G. Coletti & B. Geerligs
ECN, Petten, Netherlands

3DO.5.4 **Towards Inexpensive and Stable All-Evaporated Perovskite Solar Cells for Industrial Large-Scale Fabrication**
T. Abzieher, J.A. Schwenzer, F. Sutterlüti, M. Pfau, M. Hetterich & U. Lemmer
Karlsruhe Institute of Technology, Germany
E. Lotter & M. Powalla
ZSW, Stuttgart, Germany
U.W. Paetzold
Kalrsruhe Institute of Technology, Karlsruhe, Germany

3DO.5.5 **Enhancing the Radiative Efficiency of Perovskites Materials and Solar Cells by Improved Crystallization and Passivation Methods**
B. Wenger & H.J. Snaith
University of Oxford, United Kingdom

ORAL PRESENTATIONS 5DO.8

15:15 - 16:45 Advanced PV Module Concepts

Chairpersons:
Ana Rosa Lagunas
CENER, Spain
Ulrike Jahn
TÜV Rheinland Energy, Germany

5DO.8.1 **Special Introductory Presentation: Advanced PV Module Concepts**
S.K. Chunduri
Sunnybloke, Hyderabad, India

5DO.8.2 **Hybrid Encapsulation Film for PV Modules Operating at High Voltage**
S.C. Pop
SCP SYS, San Francisco, United States
J. Kapur
DuPont, Wilmington, United States
P. Hacke & M. Kempe
NREL, Golden, United States
R.N. Schulze
Sunrun, San Francisco, United States
X. Wang
Yingli Green Energy, Philadelphia, United States

5DO.8.3 **A Multidimensional Optimization Approach to Improve Module Efficiency, Power and Costs**
J. Shahid, M. Mittag, M. Heinrich & U. Eitner
Fraunhofer ISE, Freiburg, Germany

Thursday, 27 September 2018

5DO.8.4 **Novel Light-Weight Glass-Free PV Module Design Based on Use of Polycarbonate**
V. Rosca & L.A.G. Okel
ECN, Petten, Netherlands
M. Brounne & J.-W. Heuseveldt
Sabic, Bergen op Zoom, Netherlands

5DO.8.5 ***EU PVSEC Student Award Winner Presentation:*** **Pre-Qualification of Glass-Free Lightweight Modules for Building Integrated Photovoltaics**
A.C. Oliveira Martins, A. Virtuani & C. Ballif
EPFL, Neuchâtel, Switzerland
V. Chapuis
CSEM, Neuchâtel, Switzerland

ORAL PRESENTATIONS 6DO.11

15:15 - 16:45 Solar Forecasting

Chairpersons:
Wilfried G.J.H.M. Van Sark
Utrecht University, Netherlands
Manajit Sengupta
NREL, United States

6DO.11.1 **Comparison of Methods for Cloud Motion Vector Estimation on Satellite Images**
D.G. Anagnostos & D. Soudris
NTUA, Athens, Greece
F. Catthoor
imec, Leuven, Belgium

6DO.11.2 **Modelling and Forecasting PV Production in the Absence of Behind-the-Meeter Measurements**
T. Landelius & S. Andersson
SMHI, Norrköping, Sweden
R. Abrahamsson
Tekniska Verken, Linköping, Sweden

6DO.11.3 **Support Vector Regression for Spatio-Temporal PV Forecasting**
R. Amaro e Silva, L.C. Teixeira da Silva & M.C. Brito
University of Lisbon, Portugal

6DO.11.4 **Ensemble Detrending for Solar Nowcasting**
L. Martín-Pomares & A. Sanfilippo
QEERI, Doha, Qatar

6DO.11.5 **Short-Term Photovoltaic Power Forecasting Based on Artificial Neural Networks: A Numerical Weather Prediction-Free Approach**
S. Theocharides, G. Makrides, M. Theristis & G.E. Georghiou
University of Cyprus, Nicosia, Cyprus
F. Almonacid & E.F. Fernández
University of Jaén, Spain

6DO.11.6 **Comparison of Irradiation Data from Different Numerical Weather Models and Their Combination in Multi-Model Forecasts**
M. Bührer & K.G. Gutbrod
meteoblue, Basel, Switzerland
T. Kanefendt, D. Beinert & R. Fritz
Fraunhofer IEE, Kassel, Germany

VISUAL PRESENTATIONS 7DV.2

15:15 - 16:45 PV Economics and Markets / PV-Related Strategies and Societal Issues

Detailed information on this session is presented in the section entitled 'Visual Presentations'.

ORAL PRESENTATIONS 7DO.3

17:00 - 18:30 Drivers Behind Global PV Market Development

Chairpersons:
Maria Getsiou
European Commission DG RTD, Belgium
Stefan Nowak
NET Nowak Energy & Technology, Switzerland

7DO.3.1 A Snapshot of Global PV Markets - The Latest Survey Results on PV Markets and Policies from the IEA PVPS Programme in 2017
G. Masson
IEA PVPS, Brussels, Belgium
I. Kaizuka
RTS, Tokyo, Japan
J. Lindahl
Svensk Solenergi, Stockholm, Sweden
A. Jäger-Waldau
European Commission JRC, Brussels, Belgium
G. Neubourg
APERe, Brussels, Belgium
P. Ahm
PA Energy, Malling, Denmark
J. Donoso Alonso
UNEF, Madrid, Spain
F. Tilli
GSE, Rome, Italy

7DO.3.2 Established and Emerging Solar Markets in 2017: Overview on Global Solar Market Development
Ch. Werner
Chris Werner Energy Consulting, Dessau, Germany
A. Gerlach
Alexander Gerlach New Energy Consulting, Ellrich, Germany
Ch. Breyer
Lappeenranta University of Technology, Finland
G. Masson
Becquerel Institute, Brussels, Belgium

Thursday, 27 September 2018

7DO.3.3 Development of Innovative Self-Consumption and Aggregation Concepts for PV Prosumers to Improve Grid Load and Increase Market Value of PV: The PV-Prosumers4Grid Project
L.A. Aguilar, M. Roos & M. Battaglia
BSW - Solar, Berlin, Germany
C. Grundner & M. Jimeno
eclareon, Berlin, Germany
D. Hendricks
ESHA, Brussels, Belgium
P. Bancourt
EREF, Brussels, Belgium
G. Lettner
Vienna University of Technology, Austria
R. Battisti
Ambiente Italia, Rome, Italy
K. Moosdorf
APESF, Aljezur, Portugal
D. Velte & E. Román Medina
Tecnalia, San Sebastián, Spain
A. Joyce
INETI, Lisbon, Portugal
G. Masson & C. Cambiè
Becquerel Institute, Brussels, Belgium
J. Donoso Alonso
UNEF, Madrid, Spain
C. Winter, N. Diewald & U. Winter
Fronius, Wels, Austria
W. Schram & W.G.J.H.M. van Sark
Utrecht University, Netherlands

7DO.3.4 Impact of Batteries and Electric Vehicles on the Competitiveness of Solar PV
E. Vartiainen
Fortum Growth, Finland
G. Masson
Becquerel Institute, Brussels, Belgium
C. Breyer
Lappeenranta University of Technology, Finland
D. Moser
EURAC, Bolzano, Italy

7DO.3.5 Price-Bifaciality Relationship of Bifacial Modules in Vertical East-West Oriented PV Systems
H. Hernandez, J. Bierbaum, J. Kang, S. Nold & R. Preu
Fraunhofer ISE, Freiburg, Germany
L. Bodlak
RENA, Freiburg, Germany

7DO.3.6 Quantifying the Impact of R&D Achievements on PV Project Financing Costs
D. Feldman & R. Margolis
NREL, Washington, United States
R. Jones-Albertus
U.S. Department of Energy, Washington, United States

ORAL PRESENTATIONS 3DO.6

17:00 - 18:30 Upscaling of Perovskite Photovoltaics

Chairpersons:
Giorgio Bardizza
European Commission JRC, Italy
Ulrich Wilhelm Paetzold
Karlsruhe Institute of Technology, Germany

3DO.6.1 **Perovskite Solar Modules: A Path to Record-Breaking Devices**
A.L. Palma, F. Matteocci, L. Vesce, L.A. Castriotta, N. Yaghoobi Nia, E. Calabrò & A. Di Carlo
University of Rome II, Italy

3DO.6.2 **Large Area Perovskite Deposition Enabled by Nanoparticle Adhesion Promoters**
M. Schultes & E. Ahlswede
ZSW, Stuttgart, Germany
N. Giesbrecht
Ludwig-Maximilians-University, Munich, Germany
P. Docampo
Newcastle University, United Kingdom

3DO.6.3 **From Cell to Mini-Module – Blade Coating and Controlled Drying for Planar Inverted Perovskite Solar Cells**
U. Würfel, M.A. Yakoob, J. Herterich & L.E. Mundt
Fraunhofer ISE, Freiburg, Germany
M. Kohlstädt
University of Freiburg, Germany

3DO.6.4 **Picosecond Laser Scribing of Perovskite Solar Cells Eliminates PbI2 Residuals within Interconnection Scribe**
C. Schultz, A. Bartelt & B. Stegemann
HTW Berlin, Germany
A. Neubauer
Becker & Hickl, Berlin, Germany
M. Jost, L. Kegelmann, B. Rech, R. Schlatmann & S. Albrecht
HZB, Berlin, Germany

3DO.6.5 **Processing of Large Area Perovskite-Based Solar Devices: High Efficency and Stability Assessment**
M. Manceau, C. Roux, N. Lemaitre, S. Cros & S. Berson
CEA, Le Bourget du Lac, France

3DO.6.6 **Efficient, Large-Area Scalable Perovskite-Si and Perovskite-CIGS Tandem Solar Modules**
M. Jaysankar, M. Debucquoy, T. Aernouts, R. Gehlhaar & J. Poortmans
imec, Leuven, Belgium
S. Paetel & E. Ahlswede
ZSW, Stuttgart, Germany
U.W. Paetzold
Karlsruhe Institute of Technology, Germany

Thursday, 27 September 2018

ORAL PRESENTATIONS 5DO.9

17:00 - 18:30 Energy Performance, PID and LID

Chairpersons:
Christos Monokroussos
TÜV Rheinland, China
Steve Ransome
Steve Ransome Consulting, United Kingdom

5DO.9.1 **Special Introductory Presentation: The 35th Birthday of the Tiso-10-kW Solar Plant: Lessons Learnt in Safety and Performance**
A. Virtuani, E. Annigoni & C. Ballif
EPFL, Neuchâtel, Switzerland
M. Caccivio, G. Friesen & D. Chianese
SUPSI, Canobbio, Switzerland

5DO.9.2 **The Completed IEC 61853 Standard on PV Module Energy Rating, Overview, Applications and Outlook**
T. Huld, A.M. Gracia Amillo, T. Sample, E.D. Dunlop, E. Salis & R.P. Kenny
European Commission JRC, Ispra, Italy

5DO.9.3 **Module Architectures to Prevent Potential-Induced Degradation: The Interplay between Material Properties, Moisture Ingress, and PID**
E. Annigoni, A. Virtuani & C. Ballif
EPFL, Neuchâtel, Switzerland

5DO.9.4 **Temperature and Irradiance Dependency of Light Induced Degradation and Regeneration**
M. Passaro, E. Garcia Goma & S. Roest
Eternal Sun, The Hague, Netherlands
C. Chan & A. Ciesla
UNSW Australia, Sydney, Australia
T. Luka
Fraunhofer CSP, Halle (Saale), Germany

5DO.9.5 **Identifying High Uncertainties in PV Soiling Measurements When Comparing Two Devices**
A.T. Al-Asfour, F.G. Alzubi & A. Alkandary
KISR, Safat, Kuwait

ORAL PRESENTATIONS 6DO.12

17:00 - 18:30 Grid Integration

Chairpersons:
Henrik Te Heesen
Trier University of Applied Sciences, Germany
Kristian Peter
ISC Konstanz, Germany

6DO.12.1 **Myopic and Predictive Control Policies for Photovoltaic and Storage-Based Energy Ecosystems: A Technical and Economical Assessment**
F. Sossan, E. Scolari, E. Namor & M. Paolone
EPFL, Lausanne, Switzerland

6DO.12.2 **Optimization of Component Dimensioning for a Combined Heat and Power System with Special Focus on PV Generator Size**
G. Angenendt, S. Zurmühlen, H. Axelsen & D.U. Sauer
RWTH Aachen University, Germany

6DO.12.3 **Photovoltaic Energy Integration with Households' Demand: A Case Study of a Residential Smart Grids Pilot in the Netherlands**
C. Gerçek & A.H.M.E. Reinders
University of Twente, Enschede, Netherlands

6DO.12.4 **Managing PV Power Injection and Storage, Enabling a Larger Consumption of Renewable Energy: A Case Study for the Belgian Electricity System**
M. Meuris, P. Lodewijks, R. Ponnette, F. Meinke-Hubeny, P. Valkering, R. Belmans & J. Poortmans
EnergyVille, Genk, Belgium

6DO.12.5 **Techno-Economic Evaluation of Voltage Dependant Active and Reactive Power Control to Reduce Voltage Violations in Distribution Grids**
R. Knecht, F. Carigiet, A. Schwab, P. Korba & F.P. Baumgartner
ZHAW, Winterthur, Switzerland

6DO.12.6 **Spatial Representation of Low-Voltage Network Hosting Capacity for Photovoltaic Roof-Top Installations Using an Open-Source Tool**
M. Joos, N. Lebert & B. Gaiddon
Hespul, Lyon, France
E. Seguin & P.-E. Gautreau
IGN, Saint Mandé, France

VISUAL PRESENTATIONS 2DV.3

17:00 - 18:30 **Thin Film and Foil-Based Si Solar Cells / Characterisation & Simulation Methods for Si Cells / Manufacturing & Production of Si Cells**

Detailed information on this session is presented in the section entitled 'Visual Presentations'.

#

Friday, 28 September 2018

ORAL PRESENTATIONS 5EO.1

08:30 - 10:00 **Inverters and Balance of Systems Components / Sustainability and Recycling**

Chairpersons:
Giovanna Adinolfi
ENEA, Italy
Karsten Wambach
bifa Environmental Institute, Germany

5EO.1.1 **Keynote presentation**
A High Step-Up Resonant Converter with Single Switch for Photovoltaic Applications
H.-T. Yang & C. Hsu
National Cheng Kung University, Tainan, Taiwan

5EO.1.2 **DC-DC Power Optimizers for Building Integrated Photovoltaic Applications - A Simulation-Based Evaluation**
J. Eisenlohr, S. Gasparotto, H.R. Wilson & T.E. Kuhn
Fraunhofer ISE, Freiburg, Germany

5EO.1.3 **Switched-Capacitors as Local Converters for Snake PV Modules: A Cost/Efficiency Exploration**
P. Bauwens & J. Doutreloigne
Ghent University, Belgium
A. Bakovasilis
Aristotle University, Thessaloniki, Greece
P. Manganiello, E. Voroshazi, J. Poortmans & F. Catthoor
imec, Genk, Belgium

5EO.1.4 **Life Cycle Assessment of CIGS PV Modules: Update of Current Production Conditions in Germany and Investigation of a Planned Factory in China**
A.-K. Briem
University of Stuttgart, Germany
M. Held
Fraunhofer IBP, Stuttgart, Germany
B. Dimmler
NICE Solar Energy, Schwäbisch Hall, Germany

5EO.1.5 **Integration of Fluctuating Photovoltaic Power Plants into the Grid: Life Cycle Environmental Impacts of Infrastructure Adaptations for Photovoltaic Electricity**
R. Itten, V. Stahel & M. Stucki
ZHAW, Wädenswil, Switzerland

5EO.1.6 **Life Cycle Assessment of PV-Battery Systems for a Cloakroom and Club Building in Zurich**
P. Stolz & R. Frischknecht
Treeze, Uster, Switzerland
T. Kessler & Y. Züger
City of Zurich, Switzerland

#

#

ORAL PRESENTATIONS 6EO.2

08:30 - 10:00 Energy System and Grid Integration

Chairpersons:
Ingrid Weiss
WIP - Renewable Energies, Germany
Bert Herteleer
Ekistica, Australia

6EO.2.1 **Energy Cluster Model for the Hunsrück-Hochwald National Park Region**
D. Jung & H. te Heesen
Trier University of Applied Sciences, Neubrücke (Nahe), Germany

6EO.2.2 **Performance of In-House Li-Ion Battery Storage System Based on Various Strategies**
N. Munzke & B. Verma
Karlsruhe Institute of Technology, Eggenstein-Leopoldshafen, Germany
J. Barry
Heidelberg University, Germany

6EO.2.3 **Residential Battery Storage Sizing Based on Daily PV Production and Load Consumption Profile Characterization**
S. Afxentis, M. Florides, S. Theocharides, V. Venizelou & G.E. Georghiou
University of Cyprus, Nicosia, Cyprus

6EO.2.4 **TH-E Box: THermodynamic and Electric Energy Box**
K. Peter, F. Reichenbach, A. Minde, E. Gnann, J. Glatz-Reichenbach & R. Roescu
ISC Konstanz, Germany

6EO.2.5 **A Modular Stand-Alone Photocatalytic Reactor for Waste Water Purification: The HPSolar Project**
P. Bernardoni, M. Boschetti, D. Vincenzi, V. Cristino, S. Caramori, C.A. Bignozzi, S. Fugattini & A. Andreoli
University of Ferrara, Italy

6EO.2.6 **Analysing the Voltage Stability of Photovoltaic Inverters Reactive Power Control in the Laboratory Including the Distribution GRID Transformer**
F.P. Baumgartner & F. Carigiet
ZHAW, Winterthur, Switzerland
T. Strasser, R. Bründlinger, C. Messner, C. Seitl & G. Lauss
AIT, Vienna, Austria

#

Friday, 28 September 2018

#

ORAL PRESENTATIONS 7EO.3

08:30 - 10:00 PV Related Policies, Strategies and Societal Issues

Chairpersons:
Christian Breyer
Lappeenranta University of Technology, Finland
Gaetan Masson
Becquerel Institute, Belgium

7EO.3.1 **Diversifying Land-Use Options for the Future Large Scale European PV Deployment**
T. Huld, A. Jäger-Waldau, S. Szabó & N. Taylor
European Commission JRC, Ispra, Italy

7EO.3.2 **The Roadmap for PV Systems and Applications in the Netherlands**
W. Folkerts, C. de Keizer & M.N. van den Donker
SEAC, Eindhoven, Netherlands
W.G.J.H.M. van Sark
Utrecht University, Netherlands
W. van Hooff
TKI Urban Energy, Utrecht, Netherlands

7EO.3.3 **"PV150" : Toward 150 GW PV in Japan by 2030**
K. Sugibuchi, I. Kaizuka, H. Yamaya, T. Ohigashi & O. Ikki
RTS, Tokyo, Japan

7EO.3.4 **Solar Electricity in Africa: Overcoming Barriers and Lessons Which May Be Learnt from Previous Experiences in Europe**
A. Virtuani
O'Sole, Milan, Italy
G. Agostinelli
IFC, Washington, United States

7EO.3.5 **Cost-Benefit Analysis of BIPV Specific Policies in Key European Countries**
P. Macé & G. Masson
Becquerel Institute, Brussels, Belgium
F. Tilli
GSE, Rome, Italy
F. Frontini
SUPSI, Canobbio, Switzerland
S. Boddaert
CSTB, Sophia Antipolis, France

7EO.3.6 **EPBD Recast: A Real or a Missed Opportunity for the Market Uptake of Integrated Photovoltaic and Efficiency Solutions?**
Y. Saheb
OpenExp, Paris, France

#

#

PLENARY SESSION 7EP.1

10:30 - 11:30 A Vision for PV in the Energy Sector

Chairpersons:
Thomas Nordmann
TNC Consulting, Switzerland
Heinz Ossenbrink
Band Gap, Germany

7EP.1.1 **Solar Photovoltaic Capacity Demand for a Sustainable Transportation Sector to Fulfil the Paris Agreement by 2050**
C. Breyer, S. Khalili, E. Rantanen, M. Fasihi & D. Bogdanov
Lappeenranta University of Technology, Finland

7EP.1.2 **Sector Coupling in Europe to Reach the Climate Change Mitigation Goals by 2050**
M.-C. Leonhard, M. Kamberaj, L. Richert & H. te Heesen
Trier University of Applied Sciences, Neubrücke (Nahe), Germany

7EP.1.3 **Photovoltaics, You Should Think Big!**
A.H.M. Smets
Delft University of Technology, Netherlands

CLOSING

Key note, Highlights of the Conference, Poster Awards, Student Awards, Farewell

#

#

Visual Presentations

Monday, 24 September 2018

VISUAL PRESENTATIONS 2AV.1

13:30 - 15:00 Feedstock, Crystallisation, Wafering, Defect Engineering

2AV.1.1 **Extraction and Characterization of Silicon Extracted from the Padma River Sand Using a Modified-Aluminothermic Process**
A.B.M. Ismail & M.A. Kuddus
University of Rajshahi, Bangladesh
S.M. Mahabubuzzaman
Walton HIL, Dhaka, Bangladesh

2AV.1.2 **Study of Metal Impurity Extraction from Silicon**
S.M. Karabanov, D.V. Suvorov, E.V. Slivkin & D.Y. Tarabrin
RSREU, Ryazan, Russia
A.S. Karabanov & O.A. Belyakov
Helios-Resource, Saransk, Russia

2AV.1.3 **Effects of Mg-Doping on Silicon Leaching for Solar Grade Feedstock Production**
M. Zhu & J. Safarian
NTNU, Trondheim, Norway
A. Murgau
Elkem Solar, Kristiansand, Norway

2AV.1.4 **Phosphorus Removal from Al-Doped Silicon by Vacuum Refining**
A. Hoseinpur & J. Safarian
NTNU, Trondheim, Norway

2AV.1.5 **Performance of Modules and Solar Cells Made of 100% Solar Silicon Purified by Direct Route**
E. Forniés & M. Tojeiro
Aurinka PV, Madrid, Spain
A. Souto, A. Pérez Vázquez & G. Varela
FerroGlobe, Arteixo, Spain
T. Vlasenko
Pillar, Kiev, Ukraine

2AV.1.6 **Effect of Commercially Available SiO2 Diffusion Barriers on the Material Quality of Directionally Solidified High Performance Multi-Crystalline Silicon Ingots**
F. Sturm, C. Reimann, M. Trempa, S. Schwanke & J. Friedrich
Fraunhofer IISB, Erlangen, Germany
I. Kupka
Fraunhofer THM, Freiberg, Germany
C. Schenk
Heraeus Quarzglas, Kleinostheim, Germany
L. Weizhi
Heraeus Materials Technology, Shanghai, China

2AV.1.7 **Influencing the Incorporation of Oxygen during the Directional Solidification of Multi-Crystalline Silicon by Adjusting the Silicon Nitride Coating**
S. Schwanke, C. Reimann & J. Friedrich
Fraunhofer IISB, Erlangen, Germany
M. Kuczynski, C. Hoislbauer & J. Sans
AlzChem, Trostberg, Germany

#

#

2AV.1.8 **Cost Effective Growth of Silicon Mono Ingots by the Application of the Multipulling Technique Combined with Active Crystal Cooling**
F. Mosel, A.V. Denisov & B. Klipp
PVA Crystal Growing Systems, Wettenberg, Germany
R. Kunert & P. Dold
Fraunhofer CSP, Halle, Germany

2AV.1.9 **Mathematical Modeling of Electromagnetic Stirring of Silicon Melt**
S.M. Karabanov, D.V. Suvorov, D.Y. Tarabrin & E.V. Slivkin
RSREU, Ryazan, Russia
A.S. Karabanov & O.A. Belyakov
Helios-Resource, Saransk, Russia

2AV.1.10 **Analysis of the Impact of Czochralski Growth Parameters on Silicon Grown-in Defects Formation**
M. Jomâa, J.A. Bones, M. M'Hamdi, M. Juel & E.J. Øvrelid
SINTEF, Oslo, Norway
O. Jensen
Institute for Energy Technology, Kjeller, Norway

2AV.1.11 **Development of Methods for Reducing the Red Zone in the Top Region of mc-Silicon Ingots**
T. Bähr & M. Ghosh
Access, Aachen, Germany
C. Kranert
Fraunhofer THM, Freiberg, Germany
C. Reimann
Fraunhofer IISB, Erlangen, Germany
C. Morche
ALD-VT, Hanau, Germany

2AV.1.12 **Evaluation of a New Hybrid Crucible Concept for Crystallization of mc-Silicon Ingots**
T. Bähr & M. Ghosh
Access, Aachen, Germany
C. Kranert
Fraunhofer THM, Freiberg, Germany
C. Morche, A. Zimmermann & H. Franz
ALD-VT, Hanau, Germany

2AV.1.13 **Influence of Process Parameter on the Bubble Formation in Fused Silica Crucibles during Czochralski Growth of Mono-Crystalline Silicon for Solar Cell Application**
I. Kupka & L. Schmidtner
Fraunhofer THM, Freiberg, Germany
M. Trempa, C. Reimann & J. Friedrich
Fraunhofer IISB, Erlangen, Germany

2AV.1.14 **A Study on the Continuous Casting of High Purity Silicon Ingot Using Numerical Simulation Method**
J.-K. Lee, J.S. Lee, Y.S. Ahn & G.-H. Kang
KIER, Daejeon, Korea South

2AV.1.15 **Computer Modeling of a DS Furnace for Multicrystalline Silicon Ingot Growth**
A. Mokrani & D. Ouadjaout
CRTSE, Algiers, Algeria
E.H. Amara
CDTA, Algiers, Algeria

2AV.1.16 **The Crucible- Si3N4 Coating-Silicon Feedstock Quality Effect on the Electrical Properties of the Directional Solidified Multicrystalline Silicon Ingot**
A. Lami, Y. Chettat, N. Drouiche & B. Palahouane
CRTSE, Algiers, Algeria

#

Monday, 24 September 2018

#

2AV.1.18 **Thermal Stress Minimization in Silicon Ribbon Growth Processes by Thermal Gradients Modulation with 808 nm Laser Scanning**
D.M. Pera, M.C. Brito, A.M. Vallêra, J.M. Serra & J.M. Alves
University of Lisbon, Portugal

2AV.1.19 **Eco-Solar Factory: Utilisation of Kerf-Loss from Silicon Wafer Sawing for the Manufacturing of Silicon Nitride Crucibles**
M.P. Bellmann
SINTEF, Trondheim, Norway
A. Ciftja
Steuler Solar Technology, Porsgrunn, Norway
G. Noja
Garbo, Cerano, Italy

2AV.1.20 **The Impact of Wafer Thickness (210 and 140 µm) for Photovoltaic Use on the Fracture Strength**
H. Sekhar, T. Fukuda & H. Takato
AIST, Koriyama, Japan
K. Tanahashi & K. Shirasawa
AIST, Tsukuba, Japan
K. Ohkubo
Noritake, Fukuoka, Japan
H. Ono, Y. Sampei & T. Kobayashi
Fukushima Technical Centre, Koriyama, Japan

2AV.1.21 **Epitaxial Growth of Silicon by Electron Beam Evaporation Deposition**
M. Stange, R. Dahl-Hansen, A.S. Azar & A. Ulyashin
SINTEF, Oslo, Norway

2AV.1.22 **Slurry Sawing of Multicrystalline Silicon with Low-Viscosity Carrier Liquid**
T. Kaden & C. Look
Fraunhofer THM, Freiberg, Germany
V. Ischenko & M. Gröschel
SiC Processing, Bautzen, Germany
O. Anspach
PV Crystalox Solar, Erfurt, Germany

2AV.1.23 **Study of the Failure Mechanism of Crystalline Silicon: Relation between Crack Orientation and Failure Stress**
S. Rodríguez-Conde, A. Moretón & O. Martínez
UVa, Valladolid, Spain
J. Barredo Egusquiza
UPM, Madrid, Spain
J. Ferrer
Newgentechs, Valladolid, Spain

2AV.1.24 **Cutting Performance of Structured Wire in Correlation to the Wire Geometry**
R. Koepge, F. Kaule, K. Buehler & S. Schoenfelder
Fraunhofer CSP, Halle (Saale), Germany
O. Anspach
PV Crystalox Solar, Erfurt, Germany

2AV.1.29 **Lifetime Evolution during Regeneration in Boron-Doped Czochralski-Silicon**
D.C. Walter, L. Helmich, D. Bredemeier & J. Schmidt
ISFH, Emmerthal, Germany
R. Falster & V.V. Voronkov
SunEdison, Merano, Italy

2AV.1.30 **Defect Analysis of APCVD Gettered Multicrystalline Silicon**
M. Fleck, J. Lindroos, A. Zuschlag & G. Hahn
University of Konstanz, Germany

#

#

2AV.1.31 **Gettering and Passivation of Advanced High Performance Multicrystalline Silicon Material**
C. Fischer, J. Lindroos, A. Zuschlag & G. Hahn
University of Konstanz, Germany

2AV.1.32 **Thermally Induced Oxygen Related Donor States in Cz-Silicon Studied by Spectral Photoluminescence**
E. Olsen, M. Helander, T. Mehl & I. Burud
NMBU, Ås, Norway
R. Søndenå
Institute for Energy Technology, Kjeller, Norway

2AV.1.33 **Quantifying the Impact of Grain Boundaries on Standard and High Performance mC-Silicon Solar Cells**
A.P.J. Pacho, B. Petrelius & M. Rinio
Karlstad University, Sweden

2AV.1.34 **An Efficient Optimized RTP Process to Minimize Light Induced Degradation Phenomenon and their Effect on Surface Roughness in p-Type Cz-Si Wafers**
Y. Kouhlane, D. Bouhafs, N. Khelifati, S. Mezghiche & A. Guenda
CRTSE, Algiers, Algeria
W. Hetatache
University of Sétif, Algeria
F. Derkaoui
University of Blida, Algeria
O. Vivian Nwadiaru
University of Tlemcen, Algeria

2AV.1.35 **The Performance of Cast Mono Wafer, Cell and Module**
X.-S. Wang & G. Xing
Canadian Solar, Suzhou, China
T. Galvez
Photowatt International, Bourgoin Jallieu, France

VISUAL PRESENTATIONS 2AV.2

15:15 - 16:45 Homojunction Solar Cells

2AV.2.1 **Passivation of Black Silicon Solar Cells**
D.V. Aghabekyan, L.M. Lakhoyan & A. Barseghyan
National Polytechnic University of Armenia, Yerevan, Armenia

2AV.2.2 **Dry-Etched Black Silicon: A Cost-Effective Production Route for PERC Solar Cells**
C. Modanese, H.S. Laine, T.P. Pasanen, O. Aydin & H. Savin
Aalto University, Espoo, Finland
E. Salmi & S. Sneck
Beneq, Espoo, Finland
V. Weeda & E. Vartiainen
Fortum, Espoo, Finland
M.A. Juntunen
Naps Solar Systems, Helsinki, Finland
M. Tilli
Okmetic, Vantaa, Finland
R. Alcubilla González & P.R. Ortega
UPC, Barcelona, Spain
T. Savisalo
Valoe, Mikkeli, Finland
J.M. Pearce
Michigan Technological University, Houghton, United States

#

Monday, 24 September 2018

#

2AV.2.3 **Optimization of Surface Passivation for Black Silicon Based on Thermal Oxidation**
S. Zhang, H. Qian, J. Peng, Q. Wei & Z. Ni
Talesun Solar, Suzhou, China
J. Jie & X. Zhang
Soochow University, Suzhou, China

2AV.2.4 **Industrially MCCE Texutured Cells on Monolike Substrates**
Z. Xu, H. Wang, Y. Wang, J. Liu, F. Lang, F. Li, J. Shi & D. Song
Yingli Green Energy, Baoding, China

2AV.2.5 **Industrial Applicability of AR-Coating-Free Black Silicon**
T.P. Pasanen, V. Vähänissi, I.T.S. Heikkinen, H. Vahlman & H. Savin
Aalto University, Espoo, Finland
F. Wolny, A. Oehlke & M. Wagner
SolarWorld Innovations, Freiberg, Germany
M.A. Juntunen
Naps Solar Systems, Helsinki, Finland
E. Salmi & S. Sneck
Beneq, Espoo, Finland
A. Tolvanen & J. Hyvärinen
Endeas, Espoo, Finland

2AV.2.6 **The Black-SiN Method - A Novel Approach to Reduce the Reflection of Solar Cells**
J. Hirsch, S. Großer & D. Lausch
Fraunhofer CSP, Halle (Saale), Germany
A.V. Okhorzina & N. Bernhard
Anhalt University of Applied Sciences, Köthen, Germany

2AV.2.7 **Wet Chemical Surface Finishing for Lithography-Free Inverted Pyramids**
E. Donercark, T. Colakoglu, M. Terlemezoglu, M.K. Abak, A. Bek & R. Turan
METU, Ankara, Turkey

2AV.2.8 **Green Black Silicon Texturing for Multi-Crystalline Silicon Wafer**
P.-Y. Sun, P.-C. Tsai, H.-P. Hsu, A. Sutejo & C.-W. Lan
NTU, Taipei, Taiwan
A. Yang
Solartech Energy, Hsinchu, Taiwan

2AV.2.9 **Silicon Wafer Reflection Reduction with Maskless Plasma Etching by CHF3 and H2**
A.V. Okhorzina, J. Hirsch & N. Bernhard
Anhalt University of Applied Sciences, Köthen, Germany
D. Lausch
Fraunhofer CSP, Halle (Saale), Germany

2AV.2.10 **Electroless-Plated Metallization for Mono- and Bi-Facial n-PERT Solar Cells**
Y.-L. Lee, M.-S. Lin, K.-C. Lai, C.C. Chuang & C.-C. Li
Motech Industries, Tainan, Taiwan

2AV.2.11 **Influence of Plating Solution via Wet Process on High Efficiency Silicon Solar Cells**
M.-S. Lin, Y.-L. Lee, K.-C. Lai, C.C. Chuang & C.-C. Li
Motech Industries, Tainan, Taiwan

2AV.2.12 **Optimization of Boron Doping by BCl3 for n-Type Bifacial c-Si Solar Cell**
E. Orhan, F. Es & R. Turan
METU, Ankara, Turkey

2AV.2.13 **Metallization Fraction of Bifacial pSPEER Shingle Solar Cells**
M. Al-Akash, P. Baliozian, E. Lohmüller, T. Fellmeth, N. Wöhrle & R. Preu
Fraunhofer ISE, Freiburg, Germany

#

2AV.2.14 **Novel PERC Solar Cells with Advanced Passivated Multi-Layers**
S.-Y. Chen, Y.-H. Lin & C.-H. Du
ITRI, Hsinchu, Taiwan
S.-H. Yang & Y.-C. Chen
Tainergy Tech, Taoyuan, Taiwan

2AV.2.15 **Aluminum/Porous Silicon Combination on Multicrystalline Silicon Nanostructure Passivation for Solar Cells Applications**
M. Ben Rabha
CRTEn, Hammam-Lif, Tunisia
A. Bessadok Jemaic
Riyadh College of Technology, Saudi Arabia

2AV.2.16 **Modifying the Ratio between Highly- and Lightly-Doped Emitters for PERC with a Selective Emitter Structure by Wet Chemical Etch-Back Process**
S. Joonwichien, Y. Kida, M. Moriya, S. Utsunomiya, K. Shirasawa & H. Takato
AIST, Koriyama, Japan

2AV.2.18 **Boron Autodoped LPCVD Polysilicon as a Surface Passivation and Contact Passivation Layer on the Front-Side of n-PERT Solar Cells**
R.C.G. Naber & J.R.M. Luchies
Tempress, Vaassen, Netherlands
M. Jahn, R. Keding, M. Zimmer & A. Wolf
Fraunhofer ISE, Freiburg, Germany

2AV.2.19 **Improvement of Pull Strength for Plated Ni/Cu Electrodes on Silicon Solar Cells**
K.-C. Lai, W.-T. Chung, M.-S. Lin, Y.-L. Lee, C.C. Chuang & C.-C. Li
Motech Industries, Tainan City, Taiwan

2AV.2.21 **Analysis of Doped Poly Si with Tunnel Silicon Oxide for Carrier Selective Solar Cell Application**
H. Oh, J. Kang, J. Lee, Y.S. Choi & M.-I. Hwang
Hyundai Heavy Industries, Gyeonggi, Korea South

2AV.2.22 **Influence of Oxygen on Formation of Poly-Si Films by Al-Induced Crystallization of SiOx Films**
J.-H. Yoon
Kangwon National University, Chuncheon, Korea South

2AV.2.23 **Effect of Light Absorption from Rear Side in Bifacial Interdigitated-Back-Contact (IBC) Crystalline Silicon Solar Cell**
T. Tachibana, K. Tanahashi, T. Mochizuki, K. Shirasawa & H. Takato
AIST, Koriyama, Japan

2AV.2.24 **X-Ray Photoelectron Spectroscopy (XPS) Study of the Printed-SiOx DL CAP in PERC-Type Solar Cell Application**
Y.-S. Lin, C.-H. Ku, C.-F. Yu, S.-L. Lee, T.-C. Chen, T.-W. Guo & C.-C. Wen
E-TON Solar Tech, Tainan, Taiwan
J.-Y. Hung
New E Materials, Kaohsiung, Taiwan
J.-C. Wang
Eternal Materials, Kaohsiung, Taiwan
Y.-C. Lee & I.-S. Yu
National Dong Hwa University, Hualien, Taiwan

2AV.2.26 **Application of Boron Doping Paste for Simplified Fabrication of Interdigitated Back Contact Solar Cells**
A. Aliefendioglu, E.H. Çiftpinar & R. Turan
METU, Ankara, Turkey

Monday, 24 September 2018

2AV.2.27 **Laser Doping from PSG for Selective FSF of Screen Printed Rear-Junction n-PERT Cells**
S. Singh, L. Tous, P. Choulat, J. Chen, F. Duerinckx, I. Gordon, J. Szlufcik & J. Poortmans
imec, Leuven, Belgium
R. Liu, L. Ma, X. Wu, J. Wang & Z. Liu
Jolywood, Taizhou, China

2AV.2.28 **Screen-Printed Interdigitated Back Contact Silicon Solar Cell: Design, Fabrication, and Analytical Characterization**
Y.-W. Peng & J.-Y. Gan
NTHU, Hsinchu, Taiwan

2AV.2.29 **Bath-Life Time Analysis and Simulation of HF-HCl-Cl2 Batch Processes for Texturing Monocrystalline Silicon Wafers**
K. Halbfaß, A. Stapf, P. Nattrodt, B. Neubert & E. Kroke
Freiberg University of Technology, Germany

2AV.2.30 **The Impact of Advanced Texturing on Saturation Current Density in n-Type PERT Silicon Solar Cell Processing**
J. John, S. Jambaldinni, M. Haslinger, M. Gocyla, I. Kuzma-Filipek, L. Tous, R. Russell, F. Duerinckx, J. Szlufcik & J. Poortmans
imec, Leuven, Belgium
A.T. Hajjiah
Kuwait University, Safat, Kuwait

2AV.2.31 **Avoiding Parasitic Plating on Ni/Cu Plated Monocrystalline Silicon Solar Cells by Optimization of Silicon Oxide Etching in Fluoride Media**
C. Molto, P.P. Grand, J. Rousset & A. Duchatelet
EDF, Palaiseau, France
K. Kholostov & E. Drahi
TOTAL, Paris la Defense, France
A. Etcheberry & A.M. Goncalves
UVSQ, Versailles, France

2AV.2.32 **Characterization of Metal Oxide Barrier Layer in Screen-Printed Cu Paste Electrode / Mono c-Si Solar Cell**
T. Saito, M. Tanabe, H.T. Hai, D. Ando, Y. Sutou, K. Shirasawa & J. Koike
Tohoku University, Sendai, Japan
T. Fukuda & Y. Kurimoto
Material Concept, Sendai, Japan

2AV.2.33 **Impact of Surface Morphology and Interfacial Oxide Thickness on Passivation Quality of p+ Polysilicon Passivating Contacts**
S. Mack, F. Feldmann, A. Moldovan & A. Wolf
Fraunhofer ISE, Freiburg, Germany
M. Lenes
Tempress, Vaassen, Netherlands
J.M. Luchies
Amtech, Vaassen, Netherlands

2AV.2.34 **WetAlOx: A Novel Negative Charge and Cost Effective Passivation Method for Crystalline Silicon Solar Cells**
E. Schmid, S. Schmitt, T. Boescke, E. Wefringhaus, F. Buchholz, C. Peter & R. Marczak
ISC Konstanz, Germany
A. Ramakrishnan, M. Mateescu & P. Kunze
GP Solar, Konstanz, Germany

#

2AV.2.35 **Industrial biPERC Solar Cells with Varied Rear Side Characteristics under Bifacial Illumination**
N. Wöhrle, A. Krieg, J.M. Greulich & S. Rein
Fraunhofer ISE, Freiburg, Germany
P. Palinginis, T. Weber & S. Steckemetz
SolarWorld, Freiberg, Germany
K. Ramspeck
h.a.l.m. elektronik, Frankfurt am Main, Germany

2AV.2.36 **In-Situ Photoluminescence Study of the Influence of Plasma Processes on Passivation Quality of c-Si Wafers Coated with Al2O3**
M. Sreng
IPVF, Palaiseau, France
F. Silva & P. Roca i Cabarrocas
CNRS, Palaiseau, France

2AV.2.37 **Emitter Formation and Passivation Dependence on Crystal Grain Orientations after Atmospheric Pressure Dry Nanotexturing**
A.I. Ridoy, B. Kafle, P. Saint-Cast, S. Lohmüller, M.H. Norouzi, M. Hofmann, J. Rentsch & R. Preu
Fraunhofer ISE, Freiburg, Germany
L. Clochard & E. Duffy
Nines Photovoltaics, Dublin, Ireland

2AV.2.38 **Optimizing TCO Layers for Novel Bifacial Crystalline Silicon Homojunction Solar Cells Integrating Passivated Contacts**
E. Bruhat, T. Desrues, B. Grange & S. Dubois
CEA, Le Bourget du Lac, France
D. Blanc-Pélissier
INSA Lyon, France

2AV.2.39 **Rear Side Design Optimization and Loss Analysis for n-Type IBC Solar Cells Using Simulation**
C. Sasidharan & S. Mondal
TERI, New Delhi, India

2AV.2.40 **Effect of Laser Parameters on Rear Contact Formation and Passivation of PERC Type Silicon Solar Cells**
E. Genç, D. Türkay, G. Kökbudak, E. Semiz, F. Es, S. Yerci & R. Turan
METU, Ankara, Turkey

2AV.2.41 **Investigation on Post Cleanings on Modified Surface Using Laser Texturing**
B. Radfar, F. Es & R. Turan
METU, Ankara, Turkey

2AV.2.42 **Evolution of Contact Formation on p-Type Crystalline Silicon Solar Cells**
R.W. Mayberry & V. Chandrasekaran
Heraeus, West Conshohocken, United States

2AV.2.43 **Passivation of Crystalline Silicon Surfaces with Ultra-Thin Silicon Nitride Films Formed by Catalytic Chemical Vapor Deposition**
H. Song & K. Ohdaira
JAIST, Ishikawa, Japan

2AV.2.44 **Fully Ion-Implanted IBC Silicon Solar Cell with Gap Structure between Emitter and BSF by Self-Aligned Process**
K. Tanahashi, T. Tachibana, M. Moriya, Y. Kida, K. Shirasawa & H. Takato
AIST, Koriyama, Japan

#

Monday, 24 September 2018

#

2AV.2.45 **Potential of Chemical Rounding for the Performance Enhancement of a Pyramid-Textured Bifacial Si Bottom Cell**
H. Lee & Y. Ohshita
Toyota Technological Institute, Nagoya, Japan
I. Song, S.W. Lee, S.H. Bae, J.Y. Hyun, Y. Kang, H. Lee & D. Kim
Korea University, Seoul, Korea South
A. Ogura
Meiji University, Kawasaki, Japan

2AV.2.46 **Novel Texturisation Approach for Improving the Performance of Diamond Wire Cut Sawn Multi-Crystalline Silicon Wafer**
B. Pal & P.P. Ray
Jadavpur University, Kolkata, India
S. Ray & U. Gangopadhyay
MSIT, Kolkata, India
S. Jana, S. Ghosh, D. Sarangi & H. Saha
IIEST Shibpur, Howrah, India

2AV.2.47 **Development of Large Area n-Type Crystalline Silicon Solar Cell by Black Silicon Emitter Surface Having Passivation and Back Surface Field with a-Si:H Layers**
S. Ray, S. Ghosh, N.C. Mondal, S. Mitra, H. Ghosh, A. Mondal & H. Saha
IIEST Shibpur, Howrah, India
B. Pal
Jadavpur University, Kolkata, India
U. Gangopadhyay
MSIT, Kolkata, India

2AV.2.48 **Investigation of c-Si Surface Passivation with ALD Deposited HfO2 Films Annealed in Air**
B. Rajab, A.B. Afif & A. Gougam
Masdar Institute, Abu Dhabi, United Arab Emirates

2AV.2.49 **Passivation Studies for p-Type and n-Type TOPCon Solar Cells**
S. Biswas, S. Mitra, H. Ghosh, N.C. Mondal, S.M. Hossain, S. Mukhopadhyay, P. Chaudhuri, H. Saha & S. Guha
IIEST Shibpur, Howrah, India

2AV.2.50 **Potential-Induced Degradation Leads to the Destruction of the Si/SiNx Interface**
X. Jia, C. Zhou & W. Wang
CAS, Beijing, China

VISUAL PRESENTATIONS 2AV.3

17:00 - 18:30 Heterojunction Solar Cells

2AV.3.1 **Efficiency Improvement of CuI-Si Solar Cells through Progress in Hole Selective Layer Quality**
J. Lin, S. Hwang, V.M. Han Cao & J. Lee
Sungkyunkwan University, Suwon, Korea South

2AV.3.2 **Nano-Rod Antireflection Film Hf-Doped In2O3 Thin Films and Its Application to Silicon Heterojunction Solar Cells**
G.H. Wang, L. Zhao, H.W. Diao & W.J. Wang
CAS, Beijing, China

2AV.3.3 **Stacks of a-SiOx:H/a-Si:H Passivation Layer for Low Parasitic Absorption and High Passivation in Silicon Heterojunction Solar Cells**
K. Gotoh, M. Cui, R. Akaishi, Y. Kurokawa & N. Usami
Nagoya University, Japan

#

#

2AV.3.5 **Development of Silicon-Oxide Layer (SiOx:H) for High-Performance Silicon Heterojunction Solar Cells under Hot and Sunny Environment**
A.A. Abdallah, B. Aissa, M.M. Kivambe, A. Belaidi & N. Tabet
QEERI, Doha, Qatar
J. Haschke, J. Cattin, M. Boccard & C. Ballif
EPFL, Neuchâtel, Switzerland

2AV.3.7 **Different p-Type Silicon Front Emitters for Si Heterojunction Solar Cells**
E. Bobeico, M. Della Noce, L. Lancellotti, L.V. Mercaldo, I. Usatii & P. Delli Veneri
ENEA, Portici, Italy

2AV.3.8 **Transparent MoOx and SiOx Window Layers for Heterojunction Silicon Solar Cells**
F. Menchini, L. Serenelli, L. Martini, M. Izzi, G. Stracci, P. Mangiapane, E. Salza & M. Tucci
ENEA, Rome, Italy

2AV.3.9 **Effects of Deposition and Annealing Temperature on Sputtered ITO**
F. Menchini, L. Serenelli, G. Stracci, M. Izzi, E. Salza, L. Martini & M. Tucci
ENEA, Rome, Italy
D. Caputo & G. de Cesare
University of Rome "La Sapienza", Italy

2AV.3.10 **Crystallinity and Profilometry of Thin Silicon Films on Rough Substrates by Raman Spectroscopy**
M. Ledinsky, Z. Hájková, A. Vetushka & A. Fejfar
ASCR, Prague, Czech Republic
A. Tomasi, J.P. Seif & C. Ballif
EPFL, Neuchâtel, Switzerland
B. Paviet-Salomon
CSEM, Neuchâtel, Switzerland
D. Lachenal
Meyer Burger, Hauterive, Switzerland
S. De Wolf
KAUST, Thuwal, Saudi Arabia

2AV.3.12 **Rear Device Architectures for Evaluating Passivated Organic/Silicon Hybrid Cells**
J. Hack, A. Iyer, M. Chen & R.L. Opila
University of Delaware, Newark, United States

2AV.3.13 **Recent Progress in Front/Back Contacted c-Si Heterojunction Solar Cells Using nc-SiOx:H Layers**
E. Özkol, Y. Zhao, G.R. van Kuler, P. Procel Moya, G. Yang, G. Limodio, A.W. Weeber, O. Isabella & M. Zeman
Delft University of Technology, Netherlands

2AV.3.14 **Electron Selective Contacts Based on Al2O3/TiO2/ZnO Stacks for Crystalline Silicon Solar Cells**
L.A. Zafoschnig, P. Ortega, I. Martín, G. Masmitja, G. López & R. Alcubilla González
UPC, Barcelona, Spain

2AV.3.15 **Amorphous Silicon-Free Metal Oxides Based Carrier Selective Contacts to Crystalline Silicon Solar Cells**
S. Patwardhan, S. Maurya, A. Kumar & K.R. Balasubramaniam
IIT Bombay, Mumbai, India

2AV.3.16 **Enhanced Pasivation Quality of Crystallized Doped Amorphous Silicon Layer with Wet Chemical Oxide**
A.E. Aytaç, G. Kökbudak, E. Donercark & R. Turan
METU, Ankara, Turkey

Monday, 24 September 2018

#

2AV.3.17 **Contactless Investigation of the p-Type Doping Concentration Level of Single GaAs Micro-Crystals Grown on Silicon for Multijunction Solar Cells**
A. Jaffré, J. Alvarez, J.P. Connolly, J.-P. Kleider & D. Mencaraglia
CNRS, Gif-sur-Yvette, France
H.-L. Chen, H. Makhloufi, C. Renard & S. Collin
University of Paris Saclay, Orsay, France

2AV.3.18 **Comparison between Amorphous Silicon Layers Deposited for Heterojunction Solar Cells at 13.56 Mhz and 140 Mhz Excitation Frequency**
B. Leszczynska, C. Strobel, S. Leszczynski, M. Albert & J.W. Bartha
Dresden University of Technology, Germany
F. Stahr & J. Kuske
FAP, Dresden, Germany

2AV.3.19 **Black Silicon with Tunnel Oxide Passivated Contacts**
M.E. Kloster, M.-L. Witthøft, R.S. Davidsen, D.H. Petersen, O. Hansen & B. Iandolo
Technical University of Denmark, Kongens Lyngby, Denmark

2AV.3.20 **Approach for Developing Amorphous Silicon Passivation Layers and p-Type Microcrystalline Layers for Highly Efficient HIT Solar Cells Using a Dynamic VHF-PECVD Process with High Deposition Rates**
S. Leszczynski, C. Strobel, B. Leszczynska, M. Albert & J.W. Bartha
Technical University of Dresden, Germany
F. Stahr & J. Kuske
FAP, Dresden, Germany

2AV.3.21 **Deposition of Intrinsic Amorphous Silicon Layers for Heterojunction Solar Cells by Hot-Wire CVD**
M. Justianto, M. Höfer, T. Harig & V. Sittinger
Fraunhofer IST, Braunschweig, Germany

2AV.3.22 **From Wafers, to Modules, to Mass Production: Solving All Bottlenecks in Silicon Heterojunction Technology**
C. Ballif & M. Boccard
EPFL, Neuchâtel, Switzerland
M. Despeisse
CSEM, Neuchâtel, Switzerland

2AV.3.23 **PERC and nPERT Industrial Low-Cost Cells Provided with Front Polysilicon Passivated Contact for Tandem Application**
L.J. Geerligs, Y. Wu, P. Manshanden, M.K. Stodolny, J. Anker, E. Bende & S.L. Luxembourg
ECN, Petten, Netherlands
D. Zhang
ECN, Eindhoven, Netherlands

2AV.3.24 **Silicon Heterojunction IBC Process Simplification: Implementation of Novel "Nano-Envelope" in Situ Dry Clean with Efficiencies above 22.5%**
H. Sivaramakrishnan Radhakrishnan, M.D. Gius Uddin, M. Xu, I. Gordon, J. Szlufcik & J. Poortmans
imec, Leuven, Belgium

2AV.3.25 **Optimization of Silicon Heterojunction Cells: A Recipe for More Than 26% Efficient Cells**
M.Y. Ghannam
Kuwait University, Safat, Kuwait

2AV.3.26 **Ultra-Thin Tunneling SiOx and AlOx Passivating Layers for MoOx Based Selective Hole Contacts**
M. Ah Sen, P. Spinelli, E. Hoek, B.W.J. Kikkert, A.W. Weeber & P.C.P. Bronsveld
ECN, Petten, Netherlands

#

Monday, 24 September 2018

2AV.3.27 **Impact of the Film Stoichiometry of a-SiNx:H Layers on Hydrogen Diffusion and the Surface Passivation Quality**
S. Jafari, V. Naumann, J. Hirsch & D. Lausch
Fraunhofer CSP, Halle (Saale), Germany
N. Bernhard
Anhalt University of Applied Sciences, Köthen, Germany

2AV.3.28 **A Transition to Thinner Si Wafers at HJT Mass Production: Ahead of ITRPV Schedule**
D. Andronikov, A. Abramov, S. Abolmasov, K. Emtsev, G. Ivanov, I. Nyapshaev, D. Orekhov, A.V. Semenov, G. Shelopin, E. Terukova & E.I. Terukov
R&D Center TFTE, St. Petersburg, Russia
N. Belkova, A. Dubrovskiy, P. Ishmuratov, A. Ivanov, D. Saykin, A. Smirnov, E. Sokolov, N. Saymurzanoiv & V. Tarasov
Hevel Solar, Novocheboksarsk, Russia

2AV.3.29 **Study of Changes in Intrinsic a-Si:H Passivation Layer Induced by the Growth of n-Doped Microcrystalline Layer**
H. Meddeb, O. Sergeev, M. Vehse & C. Agert
DLR, Oldenburg, Germany

2AV.3.30 **Improvement of Microcrystalline Doped Layer Properties with Argon and Hydrogen Plasma Treatments**
H. Meddeb, O. Sergeev, M. Vehse & C. Agert
DLR, Oldenburg, Germany

2AV.3.31 **Fabrication and Analysis of Silicon Surface Texturing at Various Coverage Ratios for Improved Solar Cell Performance**
N. Avishan & A. Bek
METU, Ankara, Turkey

2AV.3.32 **Front/Back PolySi/SiO2 Passivated Contact Device with Voc > 710 mV**
D.L. Young, V. LaSalvia, B. Nemeth, S. Theingi, A. Kale, D. Findley, M. Page & P. Stradins
NREL, Golden, United States

2AV.3.33 **Ultimate Behavior of an Al2O3 Interlayer in a Directly Grown Multilayer Graphene-Silicon Schottky Junction Solar Cell**
M.A. Rehman, I. Akhtar, N.D. Cong & Y. Seo
Sejong University, Seoul, Korea South

2AV.3.34 **Investigating Different Polymeric Systems for Heterojunction Screen Printing Technology**
S. LaPlante & S. Sylla
Heraeus, West Conshohocken, United States

2AV.3.35 **Poly-Si and SiO2 Passivation Contact on Front and Rear Sides of Si Solar Cell with 22% Efficiency**
C.-H. Chen, C.-C. Lin, C.-M. Yeh, C.-H. Du & C.-J. Huang
ITRI, Hsinchu, Taiwan
P. Yu
National Chiao Tung University, Hsinchu, Taiwan

2AV.3.36 **Effects of Flow Ratio and Annealing Temperature on Passivation Contacts**
C.-H. Chen, C.-M. Yeh, C.-C. Lin, C.-H. Chen, C.-H. Du & C.-J. Huang
ITRI, Hsinchu, Taiwan
P. Yu
National Chiao Tung University, Hsinchu, Taiwan

2AV.3.37 **Newly Developed Ag Coated Cu Paste for Si Hetero-Junction Solar Cell**
K. Nakamura & Y. Ohshita
Toyota Technological Institute, Nagoya, Japan
K. Muramatsu & A. Tanaka
Namics, Niigita City, Japan

Tuesday, 25 September 2018

VISUAL PRESENTATIONS 6BV.1

08:30 - 10:00 Solar Resource and Forecasting / Building, Infrastructure, Landscape and other Applications of PV / Grid and Energy System Integration

6BV.1.1 Improvement of Accuracy and Precision of Spectral Irradiance Measurements in Annual Spectroradiometer Intercomparison
M. Halwachs & M. Rennhofer
AIT, Vienna, Austria
R. Galleano & W. Zaaiman
European Commission JRC, Ispra, Italy
M. Pravettoni
SERIS, Singapore, Singapore
M. Theristis & A. Phinikarides
University of Cyprus, Nicosia, Cyprus
N. Riedel & A. Thorseth
Technical University of Denmark, Roskilde, Denmark
M. Po & K. Hoogendijk
EKO Instruments Europe, Den Haag, Netherlands
E.J. Haverkamp
Radboud University Nijmegen, Netherlands
A. Minuto & M. Marzoli
RSE, Milan, Italy
V. Tatsiankou
Spectrafy, Ottawa, Canada
R. Roldán
SUPSI, Canobbio, Switzerland
I.R. Cole
Loughborough University, United Kingdom
D. Alonso-Álvarez
Imperial College, London, United Kingdom
N. Ferretti & A. Drobisch
PI Berlin, Germany
G. Belluardo
EURAC, Bolzano, Italy
R. Fucci
ENEA, Naples, Italy
M. Friederichs
PV Lab Germany, Potsdam, Germany
F. Plag & D. Friedrich
PTB, Braunschweig, Germany

6BV.1.2 Studying the Impact of Spectral Irradiance Variation on the Outdoor Performance of PV Modules in the UAE
A. Alnuaimi, J. Quadir, J.J. John, A. Elnosh & M. Stefancich
DEWA, Dubai, United Arab Emirates

6BV.1.3 Development and Industrialization of an Handy and Wireless Irradiation Sensor Enabling Distributed Global, Diffuse, and Direct Irradiation Monitoring with No Need of Tracking Systems Nor Moving Parts
A. Rossi, L. Botti & R. Zaza
Alitec, Cascina, Italy

6BV.1.4 Validation of the Meteonorm Satellite Irradiation Dataset
S.C. Müller & J. Remund
Meteotest, Bern, Switzerland

Tuesday, 25 September 2018#

6BV.1.5 Radiation Data from Satellites and Numerical Weather Models - A Comparison with Surface Measurements
P. Lütolf & E. Parlow
University of Basel, Switzerland
M. Bührer & K.G. Gutbrod
meteoblue, Basel, Switzerland

6BV.1.6 Assessment of Error Sources in FARMS-NIT under Clear-Sky Conditions
Y. Xie & M. Sengupta
NREL, Golden, United States

6BV.1.7 IEA PVPS Task 16 and IEA SolarPACES V: State of the Project and Results of the First Workshops
J. Remund
Meteotest, Bern, Switzerland
P. Blanc
MINES ParisTech, France
R. Perez
SUNY, Albany, United States

6BV.1.9 Short-Term Solar Irradiance Forecasting Based on Sunshine Number
M. Paulescu & E. Paulescu
West University of Timisoara, Romania
O. Mares & D. Calinoiu
Politehnica University of Timisoara, Romania

6BV.1.11 Impact of Rapid Changes in Solar Irradiance on PV Installations
F. Kuonen & U. Muntwyler
BUAS, Burgdorf, Switzerland

6BV.1.13 Machine Learning Techniques for Forecasting Single-Site PV Production
M. Boegli & P.-J. Alet
CSEM, Neuchâtel, Switzerland
M. Pierro & D. Moser
EURAC, Bolzano, Italy

6BV.1.14 A Hybrid Solar Radiation Forecasting Based on Data Mining and Wavelet Analysis
R. Kumar & V. Vijay
IIT Jodhpur, India

6BV.1.16 Simplified Model for Solar Energy Potential Estimation in Urban Environments
A. Calcabrini, H. Ziar, O. Isabella & M. Zeman
Delft University of Technology, Netherlands

6BV.1.17 Optimisation of Physical Based Ray-Tracing Model for PV Plants Simulation
G. Tourasse
KiloWattsol, Lyon, France

6BV.1.18 Analysis of Albedo Irradiance in the Context of Bifacial Photovoltaics Potential Utilising Multiband (Spectrally Resolved) Satellite Imagery
I.R. Cole & T.R. Betts
Loughborough University, United Kingdom

6BV.1.19 Study of Electric Energy Complementarity in the Generation of Electric Power in Colombia
D.J. Rodriguez Patarroyo, J. Hernández & J. Camargo
District University of Bogotá, Colombia

6BV.1.20 Experimental Comparison of Maximum Power Estimators for a Single Unit Photovoltaic Plant
E. Scolari, F. Sossan & M. Paolone
EPFL, Lausanne, Switzerland

6BV.1.21 **Comparison of Four Numerical Weather Prediction Models Solar Radiation Forecasts in French Guiana**
M. Diallo, F. Seyler & L. Linguet
University of French Guiana, Cayenne, France

6BV.1.22 **Comparison of Irradiance Forecasting Methods Applied for Building Solar Energy Estimation**
V. Martinek, P. Wolf & L. Dupond
CTU, Bustehrad, Czech Republic

6BV.1.25 **Really Building with BIPV**
A. De Vries
Stichting Monitoring Zonnestroom, Utrecht, Netherlands
A. Kahn
4WWWWIE, Ouderkerk aan de Amstel, Netherlands
R. Comuth
Adviesbureau Comuth, Maastricht, Netherlands
A. van Deursen
HD Solar, Someren, Netherlands
M. Arninkhof
Holland Solar, Utrecht, Netherlands
G. Verpaalen
Kameleon Solar Specials, Roosendaal, Netherlands
C. Maas
Chatim, Heerlen, Netherlands
S. Kin
SolarSwing Energy, Delft, Netherlands
P. de Jong
Solinso, Kessel, Netherlands
W. van de Wall
Wallvision, Heeze, Netherlands
Z. Vroon
Zuyd Hogeschool, Heerlen, Netherlands
A. Kuypers
TNO, Eindhoven, Netherlands
J.C.P. Kester
ECN, Petten, Netherlands
R.M.E. Valckenborg
SEAC, Eindhoven, Netherlands
W.G.J.H.M. van Sark
Utrecht University, Netherlands
R. Loonen
Eindhoven University of Technology, Netherlands
Y. Aartsma, I. van Straten & E. Teunissen
Berenschot, Utrecht, Netherlands

6BV.1.26 **Energy Performance Evaluation of a Photovoltaic Window**
F. Serrano-Casares & V. Navas
UMA, Malaga, Spain

6BV.1.27 **Beyond Watt per Module and Costs Per Watt - Lightweight Indicators for Photovoltaic Modules**
S. Schindler, D. Götz & J. Schneider
Fraunhofer CSP, Halle (Saale), Germany

6BV.1.28 **Building Integrated Photovoltaic Facade Design: An Analysis of Decision Criteria**
D. Efurosibina Attoye, K.A. Tabet Aoul & A. Hassan
UAEU, Al Ain, United Arab Emirates

Tuesday, 25 September 2018#

6BV.1.29 **In-Situ Performance Evaluation and Prediction of BIPV Systems Using Normalized Efficiency**
C.-S. Lee, H.-M. Lee, M.-J. Choi, K.-Y. Lee & J.-H. Yoon
Hanbat National University, Yuseong-gu, Korea South

6BV.1.31 **Evaluation of Thermal Properties for BIPV in Glass Façade**
H. Ishii
LIXIL, Tokyo, Japan

6BV.1.32 **Comparative Performance Measurements of Identical BIPV-Elements in Different Climatic Environments - A Round Robin Action of IEA PVPS Task 15**
P. Illich
UAS Technikum Vienna, Austria
G.C. Eder
OFI, Vienna, Austria
K.A. Berger & G. Újvári
AIT, Vienna, Austria
P. Rechberger
FH-OOE, Wels, Austria
D. Moor
Ertex Solar, Amstetten, Austria
S. Boddaert
CSTB, Sophia Antipolis, France
M. Ritzen
ZUYD, Heerlen, Netherlands

6BV.1.33 **Light Attenuation Model to Predict Nominal Power of Modules with Light Scattering Ceramic Printed Front Glasses**
C. Kutter, M. Heinrich, H.R. Wilson, A. Pfreundt, U. Eitner & H. Wirth
Fraunhofer ISE, Freiburg, Germany

6BV.1.34 **Analysis of Power Generation Performance for Design Elements of BIPV System through Mock-Up Demonstration**
S. Lee, E. Ryu, K.-J. Kim & J.-J. Choi
KCL, Jincheon-gun, Korea South

6BV.1.36 **Research Project CIGS-Façade: PV Façades - Chances and Limits**
D. Geyer & P. Lechner
ZSW, Stuttgart, Germany
D. Gürlich
University of Applied Science Stuttgart, Germany
C. Conejo Gangkofner
NICE Solar Energy, Schwäbisch Hall, Germany

6BV.1.37 **A Feasibility Study of Snow Load Reduction on Roofs Using a Photovoltaic System in Heating Mode**
I. Frimannslund
Multiconsult, Oslo, Norway
T. Thiis
NMBU, Ås, Norway

6BV.1.38 **Optimized Orientation and Proportion of Transparent Components Based on the Least Annual Heat Demand**
A. Rahmani & R. Wagner
Karlsruhe Institute of Technology, Germany

6BV.1.39 **Comparison of the Electrical and Thermal Performance of Double Skin Façade and Insulating Glazing Unit Integrating Semi-Transparent Photovoltaics**
Z. Ioannidis, E.D. Rounis, A.K. Athienitis & T. Stathopoulos
Concordia University, Montreal, Canada
A. Buonomano
University of Naples, Italy

6BV.1.40 **Using the Hot Air under a Building Integrated PV Roof in Combination with a Ventilation Heat Pump to Realise Energy Efficient Dwellings**
C. de Keizer, R.M.E. Valckenborg & W. Folkerts
SEAC, Eindhoven, Netherlands
D. Hoogvliet & W. de Vries
Inventum Technologies, Houten, Netherlands
R. Borro
Rebor, Amsterdam, Netherlands
M. Laureijssen
Unilin Insulation, Oisterwijk, Netherlands

6BV.1.41 **Finding the Most Suitable PV Technology for a ZigZag-Structured PV Façade in NW-Europe**
R.M.E. Valckenborg, C. Tzikas & W. Folkerts
SEAC, Eindhoven, Netherlands
S. Sasidharan & R. Santbergen
TU Delft, Netherlands
W. van de Wall
Wallvision, Heeze, Netherlands

6BV.1.42 **High Quality Solutions of Building-Integrated Photovoltaics (BIPV) – Results of the World Wide Competition in 2017**
G. Becker, F. Flade, R. Krippner, B. Schiebelsberger & W. Weber
SeV Bavaria, Munich, Germany

6BV.1.43 **Performance of Facade-Integrated Photovoltaics at High Latitudes**
A.G. Imenes & B. Paudyal
University of Agder, Grimstad, Norway

6BV.1.44 **Experimental Study on Fire Property Regarding BIPV Module Applied to Facade**
H. Ishii
LIXIL, Tokyo, Japan

6BV.1.45 **The Use of Photovoltaic Technologies in the Built Environment: Open Issues and Research Perspectives**
A. Scognamiglio
ENEA, Portici, Italy
F. Frontini
SUPSI, Canobbio, Switzerland
A. Krstic-Furundzic, M. Devetakovicc & B. Sudimac
University of Belgrade, Serbia

6BV.1.46 **Results of PVOPTI-Ray Project: Optimisation of Reflecting Materials and Photovoltaic Yield in an Urban Context**
S. Zamini, M. Revesz & A. Schneider
AIT, Vienna, Austria
P. Weihs, S. Oswald & H. Trimmel
BOKU, Vienna, Austria
S. Krispel & M. Peyerl
Smart Minerals, Vienna, Austria

6BV.1.47 **Performance Assessment of Floating PV Systems in Central Europe**
K. Sinapis, M.M. de Jong & W. Folkerts
SEAC, Eindhoven, Netherlands

6BV.1.48 **Experimental Performance of a Curtain Wall BIPV Element under Realistic Boundary Conditions**
J. Goncalves, J. Lehmann, W. Parys & D. Saelens
KU Leuven, Belgium
G.H. Yordanov & K. Baert
KU Leuven, Genk, Belgium

Tuesday, 25 September 2018#

6BV.1.49 **Method for the Analysis of Technical and Economic Feasibility of Grid-Connected Photovoltaic Systems Integrated in Buildings' Facades**
I. Custódio & R. Rüther
UFSC, Florianópolis, Brazil

6BV.1.50 **Feedback on the Performance Monitoring of a Rooftop BIPV Installation**
Y.B. Assoa & P. Schneuwly
CEA, Le Bourget du Lac, France

6BV.1.51 **Higher Energy Efficient Facades with Solar Energy**
S. Naderi
Islamic Azad University, Tehran, Iran

6BV.1.53 **The Integration of Photovoltaics System and an Electric Battery in a Tertiary Building at RABAT to Slash the Annual Electricity Bill by 46%**
S. Idrissi Kaitouni, A. Benlarabi & B. Ikken
IRESEN, Rabat, Morocco

6BV.1.54 **Solar Decathlon AFRICA: An In-Depth Outlook on the Participating Prototype Net-Zero-Energy Houses**
S. Idrissi Kaitouni & B. Ikken
IRESEN, Rabat, Morocco

6BV.1.57 **Power Generation of Rooftop PV System Considering Partial Shading and Sand Dust Effect in a Kuwaiti Houses**
J. Park, C. Lee & B. Cho
Korea Conformity Laboratories, Cheongju, Korea South
H. Hamwi & A. Al-Qattan
KISR, Safat, Kuwait

6BV.1.58 **Investigation of Laminated Textiles Enabling an Optical Enhancement of the Appearance of Building Integrated Photovoltaic Modules**
T. Gewohn, S. Blankemeyer, M.R. Vogt, H. Schulte-Huxel, B. Lim & R. Brendel
ISFH, Emmerthal, Germany
C. Schinke
Leibniz University of Hannover, Germany

6BV.1.59 **Transmissivity and Aesthetics of Optically Uncoupled Glasses for the Application in a PVT Roof Tile**
N. Reiners & U. Blieske
Cologne University of Applied Sciences, Germany
P. Hakenberg & J. Münzberg
paXos Consulting & Engineering, Cologne, Germany

6BV.1.62 **PV Beyond Electricity, Heat Pumps Hybridization for a Multiplicative Effect towards NZEB**
A. Sanz Martinez & A. Pereda
TECNALIA, Derio, Spain
R. Fuente Dacal
UPV/EHU, Bilbao, Spain
A.J. Martin
Energy Panel, Lucena, Spain
J.M. Vega de Seoane
TECNALIA, San Sebastián, Spain

6BV.1.63 **Storage Management of Shared PV-Battery-Systems in Multi-Apartment Buildings**
L. Gaisberger & P. Rechberger
University of Applied Sciences Upper Austria, Wels, Austria

6BV.1.64 **Use and Benefits of the Combination of PV and Meteorological Networks**
P. Rechberger & R. Höller
FH-OOE, Wels, Austria
W. Traunmüller
Blue Sky, Attnang, Austria
K. Erk
Fronius, Thalheim, Austria
T. Grubinger
SCCH, Hagenberg, Austria
M. Schmidthaler
Energie AG Trading, Linz, Austria
M. Schwarz
Energieinstitut an der JKU, Linz, Austria

6BV.1.65 **The Possible Role of PV in the Future Power Supply of the Faroe Islands**
H.G. Beyer
University of the Faroe Islands, Torshavn, Faroe Islands
I. Custódio
UFSC, Florianópolis, Brazil

6BV.1.66 **Modelling Different PV-Based Communal Grids Architectures for Rural Developing Communities**
N. Opiyo
University of Southampton, United Kingdom

6BV.1.67 **SimZukunft: Studies about Integrating a Large Amount of PV into the Grid of a Small Swiss Town**
N. Pflugradt & U. Muntwyler
BUAS, Burgdorf, Switzerland

6BV.1.68 **Modelling Control Methods for PV-Based Communal Grids with Different Line Resistances and Impedances**
N. Opiyo
University of Southampton, United Kingdom

6BV.1.69 **Study of Approaches to the Creation of a Stand-Alone Microgrid on the Basis of Renewable Energy Sources for Guaranteed Power Supply of Small Settlements**
P.P. Bezrukikh
JSC ENIN, Moscow, Russia
S.M. Karabanov
Solar Consult, Ryazan, Russia

6BV.1.70 **Performance of a 40 kWp PV Irrigation Demonstrator Combining Variable and Constant Pressure Pumping**
I.A. Barata Carrêlo, R.H. Almeida & L. Narvarte Fernández
UPM, Madrid, Spain

6BV.1.71 **Main Final Results of MASLOWATEN – the H2020 Project for the Market Uptake of Large Power PV Irrigation Systems**
R.H. Almeida, I.A. Barata Carrêlo, L. Narvarte Fernández, F. Martinez-Moreno & L.M. Carrasco
UPM, Madrid, Spain
J. Fernandez-Ramos
UMA, Malaga, Spain

6BV.1.72 **Energy Management of Combined PV, Storage and HP-Systems Using Forecasts and Variable Tariffs**
P. Rechberger & H. Kirchsteiger
University of Applied Sciences Upper Austria, Wels, Austria

Tuesday, 25 September 2018#

6BV.1.74 **Experimental Evaluation of the Integration of Microgrids Supplied by Hybrid Energy Sources**
J.P. Alves Veríssimo, C.F. de Oliveira Barbosa, M.A. Barros Galhardo, W. Negrao-Macedo, V.P. de Oliveira Alves, T.V. Pinheiro da Silva & J. Tavares Pinho
UFPA, Belém, Brazil
L. Oliveira de Albuquerque
UFPA, Belem, Brazil

6BV.1.75 **The Development and Test of the PV Concentrator System with Electrical and Thermal Output**
A.V. Yurchenko & A.V. Okhorzina
Tomsk Politechnical University, Russia
N. Bernhard
Anhalt University of Applied Sciences, Köthen, Germany

6BV.1.76 **Innovative Solar Spectral Beam Splitting Concepts: Alternative Fuels Production**
G. Mittelman
Agricultural Research Organization, Rishon Iezion, Israel
A. Kribus
Tel Aviv University, Israel

6BV.1.77 **Optimal Energy Management in Microgrid Using a Particle Swarm Optimization Algorithm**
M. Ait Benali & A. Outzourhit
Cadi Ayyad University, Marrakech, Morocco

6BV.1.78 **Automatic Topology Identification for Energy Load Management in Electro Mobility Charging Applications to Increase Share of Local Renewables**
P. Klement, B. Ravanbach, B. Hanke & K. von Maydell
DLR, Oldenburg, Germany

6BV.1.80 **Computational Diagnostics of Regional Photovoltaic Smoothing Potential for Composite Orientations and Configurations**
N. Riaz & S. Repo
Tampere University of Technology, Finland

6BV.1.81 **High Gain Bi-Directional DC-DC Converter for Battery Charging Applications Interligated to a DC Nanogrid for Residencial Prosumer**
F. Queiroz & F.L.M. Antunes
UFC, Fortaleza, Brazil

6BV.1.83 **Implementation of a Grid-Friendly Control Strategy in a Solar Net-Zero Energy Residential Building**
R. Dumoulin, A. Rey, A.K. Athienitis & B. Lee
Concordia University, Montreal, Canada
K. Lavigne, A. Daoud & M. Fournier
IREQ, Shawinigan, Canada

6BV.1.84 **Smart Control of a Grid Connected PV Power Plant - Tunisian Electrical Grid Case Study**
K. Mansouri, K. Jemai & L. Sbita
University of Gabes, Tunisia

6BV.1.85 **Analysis of the Sustainability of the Energy Cost of Blockchain Technologies in a Fully Distributed PV-Based Energy System. An European Case**
P. Macé, C. Cambiè & G. Masson
Becquerel Institute, Brussels, Belgium
P.-J. Alet
CSEM, Neuchâtel, Switzerland
B. Azzopardi & R. Mikalauskiene
MCAST, Paola, Malta
J. Kervyn de Meerendré
GreenWatch, Wavre, Belgium
D. Mugnier
Tecsol, Perpignan, France
B. Wilkin
APERE, Brussels, Belgium

VISUAL PRESENTATIONS 3BV.2

13:30 - 15:00 CI(G)S, CdTe and Related Thin Film Solar Cells and Modules

3BV.2.2 **Elucidation of Mechanism behind the Performance Improvement in Nanoparticle Based CISe Solar Cells upon Na Addition**
S.J. Ahn, S. Rehan, J. Moon, Y.-J. Eo, A. Cho, J. Gwak & S.K. Ahn
KIER, Daejeon, Korea South

3BV.2.3 **High-Speed Shunt-Free Laser Scribing and Back-End Interconnection Technology for CIGS Module Production**
V.S. Gevaerts, A.F.K.V. Biezemans, H. Het Mannetje, H. Linden & J. Bosman
Solliance Solar Research, Eindhoven, Netherlands

3BV.2.4 **CuInSe2 Formation from Electroplated Metallic Layers Using Continuous-Wave Laser Annealing**
P. Arnou, D. Siopa, M.H. Wolter & P.J. Dale
University of Luxembourg, Belvaux, Luxembourg
M.A. Scarpulla
University of Utah, Salt Lake City, United States

3BV.2.6 **Investigation on Sb-Doped Induced Cu(InGa)Se2 Films Grain Growth by Sputtering Process with Se-Free Annealing**
L. Zhang, D.-M. Zhuang, M. Zhao, Y. Wei, X. Lyu, X. Peng, G. Ren, Y. Wu & C. Wang
Tsinghua University, Beijing, China

3BV.2.7 **Effect of Selenization Ramping Temperature Profile on the Structural and Morphological Properties of Cu(In,Ga)Se2 Thin Films Absorber Layers Using Two Step Growth Process**
F.B. Dejene
University of the Free State, Phuthaditjhaba, South Africa

3BV.2.8 **Investigation of High-Quality CBD-Zn(S,O,OH) Buffer Layer on CIGS-Absorbers**
M. Ostrysz, S. Song, J. Gwak & A. Cho
KIER, Daejeon, Korea South

3BV.2.9 **Molybdenum Bilayer Thin Film on Large Area by Cylindrical Rotating DC Magnetron Sputtering for CIGS Solar Cell Application**
S.R. Dhage, A.C. Badgujar & B.S. Yadav
ARCI, Hyderabad, India

Tuesday, 25 September 2018#

3BV.2.10 **Laser Patterning of CIGSe Absorber Layers: Revealing Enhanced Charge Carrier Recombination within Laser-Affected Zones by Means of Time-Resolved Photoluminescence Spectroscopy**
C. Schultz, A. Bartelt & B. Stegemann
HTW Berlin, Germany
C. Junghans
Becker & Hickl, Berlin, Germany
S.S. Schmidt & R. Schlatmann
HZB, Berlin, Germany

3BV.2.12 **Engineering of Band Alignment at the CuInSe2/In2S3 Interface of the CIGS-Based Thin Film Solar Cells**
E. Ghorbani & K. Albe
Technical University of Darmstadt, Germany

3BV.2.13 **Co-Optimized CdS Buffer and Gallium Profile toward High-Efficiency Penternary Cu(In,Ga)(Se,S)2 Solar Cell**
C.-Y. Huang, H.-M. Chou, P. Parashar, Y.-S. Lin & A. Lin
NCTU, Hsinchu, Taiwan

3BV.2.14 **Photovoltaic Glazing from Bottom-Up Electrodeposition of CIGS on Patterned Mo/Glass Substrates**
T. Sidali, A. Bou, S. Leyder & P.-Y. Thoulon
Crosslux, Rousset, France
D. Coutancier, E. Chassaing, B. Theys & D. Lincot
CNRS, Palaiseau, France
R. Garuz & D. Barakel
IM2NP, Marseille, France

3BV.2.15 **Alkali Reactivity on Aged CIGS Absorber Deposited on Flexible Substrates Studied by XPS**
S. Béchu, V. Achard, A. Loubat, M. Balestrieri, T. Hildebrandt, M. Jubault & F. Donsanti
IPVF, Palaiseau, France
M. Frégnaux, J. Vigneron, M. Bouttemy & A. Etcheberry
UVSQ, Versailles, France
D. Lincot
CNRS, Palaiseau, France

3BV.2.16 **A Study of the Long-Term Effects of Alkali Atom Inclusion on CIGS Solar Cells**
T. Kohl, J. de Wild, D.G. Buldu, N.A. Rivas & F. Renner
Hasselt University, Diepenbeek, Belgium
G. Brammertz, M. Meuris & B. Vermang
imec, Diepenbeek, Belgium
J. Poortmans
imec, Leuven, Belgium

3BV.2.17 **Stability of CIGS Solar Cells under Illumination with Damp Heat and Dry Heat: A Comparison**
M. Theelen, K. Beyeler & H. Steijvers
TNO, Eindhoven, Netherlands
N. Barreau
IMN-UMR, Nantes, France

3BV.2.18 **Assessment of CIGS Device Processing on Innovative Insulating Non-Glass Substrates**
F. Kessler & R. Würz
ZSW, Stuttgart, Germany
L. Fourdrinier, A. Lafort & S. Le Craz
CRM Group, Liège, Belgium

3BV.2.19 **3D-Imaging of Cu(In,Ga)Se2 Grain Boundaries by Time-of-Flight-Secondary Ion Mass Spectrometry**
W. Hempel, J. Hanisch, T. Magorian-Friedlmeier & M. Powalla
ZSW, Stuttgart, Germany

3BV.2.20 **Systematic Studies on Characteristics of CIGS Absorbers Grown on Flexible PI/Mo Substrate under Different Processing Temperature**
K. Kim, I. Jeong, Y.-J. Eo, D.H. Shin, S.K. Ahn, A. Cho, S. Song, Y. Cho, J.S. Yu, J.-S. Cho, S. Ahn, J.H. Park, J. Gwak & J.H. Yun
KIER, Daejeon, Korea South

3BV.2.21 **Molybdenum Back Interface Engineering Using Ultrathin Intermediate Layers for Solution Processed Cu2(Cd,Zn)SnS4 Solar Cells**
S. Zhuk, T.K.S. Wong, V. Tunuguntla & L.H. Wong
NTU, Singapore, Singapore
S. Tripathy, T.I. Wong & G.K. Dalapati
A*Star, Singapore, Singapore
A. Stsiapanau & A. Smirnov
BSUIR, Minsk, Belarus

3BV.2.22 **Characterization of Sputtered CdSexTe1-X Films and Its Application in CdTe Solar Cells**
C.X. Li, L.L. Wu, F.G. Wang, Y.L. Chen & L.H. Feng
Sichuan University, Chengdu, China

3BV.2.25 **Efficiency Improvement of CdTe Solar Cells with Ultra-Thin CdS Layer**
M. Leoncini, E. Artegiani, M. Cavallini & A. Romeo
University of Verona, Italy

3BV.2.26 **In Situ Gel Formation of High-Quality Kesterite Thin Films**
V. Trifiletti, S. Mostoni, R. Scotti & S. Binetti
University of Milan, Italy

3BV.2.27 **Effect of Annealing Condition on Formation of Cu2ZnSnS4 Thin Films Using CS2**
K. Yoshikawa, T. Shimizu, T. Ito & S. Shingubara
Kansai University, Osaka, Japan
S. Tanaka
NICT, Kobe, Japan
K. Takase
Nihon University, Tokyo, Japan

3BV.2.28 **Phases Control of CZTSSe during Selenization**
R. Sun, D.-M. Zhuang, M. Zhao, Y. Wei, G. Ren, Y. Wu, L. Zhang, X. Lyu & X. Peng
Tsinghua University, Beijing, China

3BV.2.29 **Partial and Total Substitution of Zn by Mg in the Cu2ZnSnS4 Structure**
D.M. Mena Romero, D. Victoria Valenzuela & C.L. Azanza Ricardo
UNAM, Querétaro, Mexico
L.M. Rivera González
UTEQ, Querétaro, Mexico

3BV.2.30 **Surface Passivation by Alkali Metal Containing Solution for Cu2ZnSnSe4 Solar Cells**
H. Tampo, S. Kim, H. Shibata & S. Niki
AIST, Tsukuba, Japan

3BV.2.31 **Impedance Spectroscopy of CdTe PV Modules – Comparative Study**
T. Finsterle, L. Cerná, P. Hrzina & V. Benda
Czech Technical University of Prague, Czech Republic
S. Kichou
Czech Technical University of Prague, Bustehrad, Czech Republic

Tuesday, 25 September 2018#

3BV.2.32 **Effect of Temperature Profile on the Formation of CZTSe Absorber Layer**
V. Kumar & U.P. Singh
KIIT University, Bhubaneswar, India

3BV.2.34 **Effect of Temperature on CZTS Based Thin Film Solar Cell Performance**
A. Chowdhury, M. Rahaman, M. Islam & M. Rahman
BRAC University, Dhaka, Bangladesh

3BV.2.35 **Stoichiometry Evaluation in the Partial and Total Substitution of Zn by Mg in the Cu2ZnSnS4 Structure by XRD**
C.L. Azanza Ricardo, D.M. Mena Romero & D. Victoria Valenzuela
UNAM, Querétaro, Mexico

3BV.2.36 **Fabrication of p-Type Na Doped SrCuSeF and n-Type ITO Bilayer Ohmic Tunnel Junction and Its Application to the Back Contact of CdS/CdTe Solar Cells**
T. Wada, K. Miki & D. Tamai
Ryukoku University, Otsu, Japan
Y. Shiina, S. Okamoto & T. Okamoto
Kisarazu College, Chiba, Japan

3BV.2.37 **Effect of the Chemical Composition Ratio Cu/(Zn+Sn) and Cu/Zn onto the Structural, Morphological, and Optical Properties of Cu2ZnSnS4 (CZTS) Thin Films for PV Applications**
K. Abouabassi, H. Kirou, L. Atourki, A. Elfanaoui, K. Bouabid, M. Nya & A. Ihlal
University of IBN ZOHR, Agadir, Morocco
M.Y. Messous
CNESTEN, Rabat, Morocco
A. Almaggoussi
Cadi Ayyad University, Marrakech, Morocco

3BV.2.39 **Visually Attractive and Flexible Cigs Solar Cell by Lift-Off Process with Automotive Painting**
T. Masuda & Y. Kudo
Toyota, Susono, Japan
S. Hirai, M. Inoue, J. Chantana & T. Minemoto
Ritsumeikan University, Shiga, Japan

3BV.2.40 **Cu(In,Ga)Se2 Mini-Modules with High-Mobility In2O3:W,H Transparent Conducting Oxide Layers**
T. Koida, J. Nishinaga, Y. Ueno, H. Higuchi, H. Takahashi, M. Iioka, Y. Kamikawa-Shimizu, H. Shibata & S. Niki
AIST, Tsukuba, Japan

3BV.2.41 **CIGS Solar Cell with above 19% Cell Efficiency with Na Only PDT Process**
S.T. Kim & B.T. Ahn
KAIST, Daejeon, Korea South

VISUAL PRESENTATIONS 3BV.3

15:15 - 16:45 Perovskite, Organic and Dye-Sensitised Devices

3BV.3.1 **Evaluation Emerging PV Performance under Energy Harvesting for IOT (Internet of Things) Applications**
Y.-S. Long, E.-Y. Wang & T.-C. Wu
ITRI, Hsinchu, Taiwan

3BV.3.3 **Quantitative Assessment of Humidity in Encapsulation Materials for Moisture-Sensitive Devices**
J. Hepp, S. Langner, M. Woiton, G. Jovicic, K. Burlafinger & C.J. Brabec
FAU, Erlangen, Germany
A. Vetter, C. Camus, H.-J. Egelhaaf & J. Hauch
ZAE Bayern, Erlangen, Germany

3BV.3.4 **Indoor Calibration of Large Area Organic PV Modules**
G. Bardizza, E. Salis, D. Pavanello, T. Sample, H. Müllejans & E.D. Dunlop
European Commission JRC, Ispra, Italy

3BV.3.5 **Toward High Performance Organic Solar Cells: Development of Materials**
H.J. Son
KIST, Seoul, Korea South

3BV.3.6 **Investigations of Antireflective Coatings for Organic Solar Cells**
S.X. Suleymanov, V.G. Dyskin, M.U. Djanklich, N.A. Kulagina & O.A. Dudko
Academy of Sciences of Uzbekistan, Tashkent, Uzbekistan

3BV.3.8 **Bifacial Dye Sensitized Solar Cell Prototyped Using Carbon Fibre Mesh as Counter Electrode**
M. Gheorghe & S. Gheorghe
NANOM MEMS, Rasnov, Romania
N. Olariu & G. Mantescu
Valahia University of Targoviste, Romania

3BV.3.9 **Improvement of Light Harvesting with a Multi-Resonance Tandem Geometry in Thin-Film Solar Cells**
B. Godefroid & G. Kozyreff
Free University of Brussels, Belgium

3BV.3.11 **Lead Sulfide Nanocrystal Co-Sensitized Dye-Sensitized Solar Cell: Scalable Deposition Process and Significant Improvement in Power Conversion Efficacy**
U. Mehmood, A. Al-Ahmed, A.S. Hakeem & F.A. Al-Sulaiman
KFUPM, Dhahran, Saudi Arabia
M. Afzaal
University of Salford, United Kingdom
S. Abdullahi Haladu
University of Dammam, Saudi Arabia

3BV.3.12 **3-Dimensional Dye Sensitized Solar Cell Sub-Module with Oblique Angled Cell Array for Enhanced Power and Energy Density Output Utilizing Non-Linear Relation in Cosine Law of Light Incident Angle**
M.J. Yun, Y.H. Sim, S.I. Cha & D.Y. Lee
KERI, Changwon, Korea South

3BV.3.13 **Solution Grown (100)pc Oriented BiFeO3 Thin Films: Photoconductivity and Ferroelectric Studies**
S. Nandy & S. Chandran
IIT Madras, Chennai, India

Tuesday, 25 September 2018#

3BV.3.14 **Simple and Dopant-Free Hole-Transporting Material Based on Carbazole for Efficient Planar Perovskite Solar Cells: N, N-di-p-methoxyphenylamine-substituted (2-Ethylhexyl)-9H-Carbazole and N, N-di-p-methylthiophenylamine-substituted (2-Ethylhexyl)-9H-Carba**
J. Zhang, X. Jia, S. Wang, Y. Zhu, Z. Chen, S. Zhang, B. Lin, N. Yuan & J. Ding
Changzhou University, China

3BV.3.15 **Enhancement of Hole-Extraction at the In2O3:H / CH3NH3PbI3 Interface by Graphene: Investigated by Modulated Surface Photovoltage Spectroscopy**
S.H.B. Vinoth Kumar, R. Muydinov & B. Szyszka
Berlin University of Technology, Germany
T. Koltsova & O. Tolochko
SPbPU, St. Petersburg, Russia
D. Erfurt & A. Steigert
HZB, Berlin, Germany

3BV.3.16 **Fully Inorganic Charge Transport Layers for High Efficiency Perovskite Solar Cells and Modules**
A. Walter, S.-J. Moon, B. Niesen, B.A. Kamino, J.J. Diaz Leon, G. Cattaneo, S. Nicolay & C. Ballif
CSEM, Neuchâtel, Switzerland

3BV.3.17 **Low-Temperature Electron Transport Layers for Perovskite Solar Cells**
V. La Ferrara, A. De Maria, G. Rametta, M. Della Noce, L.V. Mercaldo, C. Borriello, A. Bruno & P. Delli Veneri
ENEA, Portici, Italy

3BV.3.18 **The Effect of Potassium Doping on Perovskite Solar Cells Performance and Stability**
M.F. Vildanova, A.B. Nikolskaia, S.S. Kozlov, O.I. Shevaleevskiy & L.L. Larina
RAS, Moscow, Russia

3BV.3.19 **Growth of Compact CH3NH3PbI3 Thin Films Controlled by Ligand Chemistry**
J. Jiang, S. Wang, X. Jia, X. Fang, W. Liu, J. Ding & N. Yuan
Changzhou University, China

3BV.3.21 **Fabrication and Characterization of CH3NH3(Cs)Pb(Sn)I3(Cl) Perovskite Solar Cells with TiO2 Nanoparticle Layers**
N. Ueoka, T. Oku & A. Suzuki
University of Shiga Prefecture, Hikone, Japan
H. Sakamoto & M. Yamada
Osaka Gas, Japan
S. Minami, S. Miyauchi & S. Tsukada
Osaka Gas Chemicals, Japan

3BV.3.22 **Effects of Excess PbI2 Addition to CH3NH3PbI3-xClx Perovskite Solar Cells**
N. Ueoka, T. Oku, Y. Ohishi, H. Tanaka & A. Suzuki
University of Shiga Prefecture, Hikone, Japan

3BV.3.23 **Enhancing the High Efficiency of Perovskite Solar Cell Using TiO2 Nanorod as Effective Electron Transfer Layer**
M. Kim, Y. Jo & D.S. Kim
KIER, Ulsan, Korea South
D. Huh & H. Lee
Korea University, Seoul, Korea South

3BV.3.25 **The Impact of Time on Efficiency Variation of CH3NH3PbI3 Perovskite Solar Cells via Sandwich Deposition Technique**
C.-H. Kuan, W.-C. Hsieh, P.-T. Kuo, H.-J. Syu & C.-F. Lin
NTU, Taipei, Taiwan

3BV.3.26 **Perovskite Solar Cells Prepared by 3-Step Method Using Additional CH3NH3I or HC(NH2)2I Spin-Coating: Multiple Bandgap Structure for Efficiency Improvement**
Y. Okamoto
University of Tsukuba, Japan
T. Yasuda & M. Sumiya
NIMS, Tsukuba, Japan
Y. Suzuki
University of Tsukuba, Ibaraki, Japan

3BV.3.27 **Fabrication of High Efficiency Single Halide Lead Perovskite Solar Cells by Sandwich Deposition Technique**
T. Avula & C.-F. Lin
NTU, Taipei, Taiwan

3BV.3.28 **Improving Carrier Transport Ability to Enhance Sandwich Deposition Technique Synthesized CH3NH3PbI3-xClx Perovskite Solar Cells**
P.-T. Kuo, H.-J. Syu & C.-F. Lin
NTU, Taipei, Taiwan

3BV.3.29 **Coevaporation of Methylammonium Lead Iodide Perovskites Absorbers and Their Optical and Structural Properties**
T. Gallet & A. Redinger
University of Luxembourg, Luxembourg

3BV.3.30 **Perovskite Solar Cells with Sulfide-Based Interlayer**
A.B. Nikolskaia, L.L. Larina, M.F. Vildanova, S.S. Kozlov & O.I. Shevaleevskiy
RAS, Moscow, Russia

3BV.3.31 **Design of High-Performance Perovskite Solar Cells Adapted to the Tandem Concept and Suitable to Harsh Climates**
S. Laalioui, K. Belrhiti Alaoui & B. Ikken
IRESEN, Rabat, Morocco
K. El Assali & A. Outzourhit
Cadi Ayyad University, Marrakech, Morocco

3BV.3.32 **Simulation Study of Tandems of Perovskite and IBC c-Si Solar Cells**
S. Silvestre, J. Puigdollers González, P. Ortega & D. Serra
UPC, Barcelona, Spain
E. Mas-Marzá & F. Fabregat-Santiago
UJI, Castellón, Spain

3BV.3.34 **Exploring the Use of Collodion as a Binder in Screen Printing Vehicles for Perovskite Solar Cells Metallization**
C. Montes, L. Ocaña, L. De Sousa-Vieira, J.S. Moreno-Ramírez, M. Friend & M. Cendagorta
ITER, Granadilla de Abona, Spain
S. González-Pérez & B. González-Diaz
ULL, La Laguna, Spain

3BV.3.35 **Innovative Intermitent Coating Techniques in the R2R Manufacturing of Perovskite Solar Cells and Nano-Imprint Structuring for Efficiency Optimization**
T. Exlager, K. Crone & N. Meyer
Coatema, Dormagen, Germany
H. Hauser
Fraunhofer ISE, Freiburg, Germany
I. de Vries & P. Groen
TNO, Eindhoven, Netherlands

Tuesday, 25 September 2018#

3BV.3.36 **Producing Uniform and Smooth Thin Layers of Perovskite under Ambient Conditions by Adjusting to the Existing Levels of Moisture**
C. Montes, L. Ocaña, L. De Sousa-Vieira, J.S. Moreno-Ramírez, M. Friend & M. Cendagorta
ITER, Granadilla de Abona, Spain
S. González-Pérez, B. González-Diaz & C. Hernandez-Rodriguez
ULL, La Laguna, Spain

3BV.3.37 **Optimization of Three-Terminal Perovskite / c-Si Tandem Solar Cells**
R. Santbergen & M. Zeman
Delft University of Technology, Netherlands
H. Uzu & K. Yamamoto
Kaneka, Osaka, Japan

3BV.3.38 **Preparation of Large Area Perovskite Solar Cells Modules by Industrial Methods**
S. Wang, J. Zhang, Y. Zhu, X. Jia, Z. Chen, K. Zhang, B. Lin, N. Yuan & J. Ding
Changzhou University, China

3BV.3.40 **Improved Performance and Stability of Organo-Halide MAPbI3-xClx Perovskite Solar Cell by Grain Boundary Modification with CsPb(BrI)3 Quantum Dots**
D. Ghosh, D.K. Chaudhary, Y. Ali & S. Bhattacharyya
IISER, Kolkata, India

3BV.3.41 **Designation of a Novel and Highly Stable Lead-Free Cs2NaBiI6 Double Perovskite for Photovoltaic Application**
C. Zhang, S. Teo, Z. Guo, Z. Xu & T. Ma
Institute of Technology, Kitakyushu, Japan

3BV.3.42 **Highly Efficient and ITO-Free Flexible Counter Electrodes Employing Novel Copper Based Redox Shuttles in Dye-Sensitized Solar Cells**
H. Iftikhar, S.G. Hashmi & P. Lund
Aalto University, Espoo, Finland
G. Gava Sonai & A. Flávia Nogueira
University Of Campinas, Brazil

3BV.3.43 **First Long-Term Stability Test for Carbon Based Printed Perovskite Solar Cells in Harsh Nordic Conditions**
S.G. Hashmi & S. Lepikko
Aalto University, Espoo, Finland
D. Martineau
Solaronix, Aubonne, Switzerland

3BV.3.44 **Fabrication of Metal Organic Framework Based Composites as Electron Transport Layer for Perovskites Solar Cells**
R. Kaur & S.K. Tripathi
Panjab University, Chandigarh, India
V.A. Chhabra
C-DAC, Mohali, India
A. Deep
CSIR-CSIO, Chandigarh, India

3BV.3.45 **Investigating the Optimum Optical Spacer in a 4-Terminal Semitransparent Perovskite/Silicon Tandem Solar Cell**
A.T. Hajjiah & F.A. Parmouneh
Kuwait University, Khaldiya, Kuwait
A. Hadipour, M. Jaysankar, W. Song, T. Aernouts, I. Gordon & J. Poortmans
imec, Leuven, Belgium

3BV.3.46 **Semitransparent Organic Solar Cells from a Transparent Conductive Polymer Electrode**
M.H. Kang, D.H. Kim, D.J. Lee & D.G. Hur
KMU, Daegu, Korea South

3BV.3.47 Improving Efficiency of CH3NH3PbI3 Perovskite Solar Cells by Co-Doping H2O and Potassium Halide in PbI2 Buffer Layer
Y.-W. Hsiao, K.-T. Huang, H.-T. Wu, K.-T. Hung, Y.-T. Cheng & C.-F. Shih
National Cheng Kung University, Tainan, Taiwan

VISUAL PRESENTATIONS 4BV.4

17:00 - 18:30 III-V-Based Devices for Terrestrial and Space Applications

4BV.4.2 **Dichroic Pentaprism for the Spectral Splitting of Concentrated Solar Radiation**
A. Parretta
University of Ferrara, Italy
M. Izzi & M. Tucci
ENEA, Rome, Italy

4BV.4.3 **Machine Learning for Realistic Yearly Averaged Photovoltaic Efficiency Calculations**
J.M. Ripalda
IMM - CSIC, Madrid, Spain
J. Buencuerpo
NREL, Golden, United States
I. Garcia
UPM, Madrid, Spain

4BV.4.4 **Coupling Effects in InGaP/InGaAs/Ge Triple Junction PV Cells of Different Structures**
V. Paraskeva & G.E. Georghiou
University of Cyprus, Nicosia, Cyprus
N. Armani, A. Malchiodi, F. Trespidi & G. Timò
RSE, Piacenza, Italy

4BV.4.5 **Isotype Heterointerfaces in Triple-Junction Solar Cells: Influence on IV-Curve Shape and Optimization**
M.A. Mintairov, V.V. Evstropov, S.A. Mintairov, M.Z. Shvarts & N.A. Kalyuzhnyy
RAS / Ioffe, St. Petersburg, Russia

4BV.4.6 **CPVIndia - Evaluation of a 53 kW CPV System in India**
M. Steiner, A. Wekkeli & G. Siefer
Fraunhofer ISE, Freiburg, Germany
S. Ojha, S. Sardar, J. Singh, V. Singh & J. Singh Chandok
NETRA NTPC, Gr. Noida, India

4BV.4.7 **Internal Sun Tracking CPV4ALL Module: Improvement and Novel Characterization of the 4-Lobed Parabolic Mirror with Tolerance Manufacturing**
S. Bernardis & P. Voarino
CEA, Le Bourget du Lac, France
G. Ickes, H. Hagedorn, H. Reus & T. Schmauder
Buhler Leybold Optics, Alzenau, Germany
M. Schottner, H. Rooms & P.-J. Bolt
TNO, Eindhoven, Netherlands
J. Bos-Coenraad, S.G.D. van Es & J.J. Schermer
Radboud University, Nijmegen, Netherlands

4BV.4.9 **Open and Close Loop Control of Solar Tracker Applied to Small Size HCPV System**
L.E. Peñaranda Chenche, M. Barros de Almeida, R. Mendes Finzi Neto, O.S. Hernandez Mendoza & E. Pedone Bandarra Filho
Federal University of Uberlândia, Brazil

4BV.4.10 **Optimization of MBE Grown III-V Phosphide for Multijunction Solar Cells**
A. Michaud & J. Fernandez Martin
Total New Energies, Palaiseau, France
T. Bideau, L. Largeau, J.-C. Harmand & S. Collin
C2N, Marcoussis, France

Tuesday, 25 September 2018#

4BV.4.11 **On the Development of a Novel Triple-Stacked Solar Cell**
S. Michael
Naval Postgraduate School, Monterey, United States

4BV.4.12 **Concentrator Solar Cells (up to 100 Suns) for Space Applications**
M.B. Kagan, S.V. Pushko, N.T. Vagapova, E.V. Slystchenko, A.A. Naumova, M.A. Genali, B.V. Zhalnin, E.V. Obrucheva, S.K. Sharov & A.A. Lebedev
OJSC RPE "KVANT", Moscow, Russia

4BV.4.13 **GaAs Solar Cell with Quantum Objects: Temperature Photovoltaic Characteristics**
M.A. Mintairov, V.V. Evstropov, S.A. Mintairov, M.Z. Shvarts & N.A. Kalyuzhnyy
RAS / Ioffe, St. Petersburg, Russia

#

Wednesday, 26 September 2018

VISUAL PRESENTATIONS 5CV.1

08:30 - 10:00 PV Module Design, Manufacture, Performance and Reliability

5CV.1.1 **Influence of the Module Temperature on the Performance and EL-Image of Precracked PV-Modules**
C. Buerhop-Lutz, M. Krause, T. Winkler, J. Hauch & C. Camus
ZAE Bayern, Erlangen, Germany
C.J. Brabec
FAU, Erlangen, Germany

5CV.1.2 **Sequential Stress Test Methods to Predict Outdoor Performance of Monofacial and Bifacial Module Designs**
W.J. Gambogi, T. Felder, S. MacMaster, K. Roy-Choudhury, B.-L. Yu & T.-J. Trout
DuPont, Wilmington, United States
A. Borne
DuPont, Geneva, Switzerland
H. Hu
DuPont, Shanghai, China

5CV.1.3 **The Influence of Module Structure on Degradation Modes of Multi-Crystalline Silicon Photovoltaic Modules by Dynamic Mechanical Loading Test**
Y. Ino, S. Asao, K. Shirasawa & H. Takato
AIST, Koriyama, Japan

5CV.1.4 **Temperature and Power Yield Difference of N-Mono Si Halved Cell Modules in Outdoor Shading Testing**
J. Jiang, J. Ni, D. Rong, Y. Zhang, T. Feng, Y. Li, C. Ma, J. Shi & D. Song
Yingli Green Energy, Baoding, China

5CV.1.5 **Evaluation of Reliability and Field Performance of a Novel Shading-Free PV Module**
T. Feng, J. Jiang, J. Ni, D. Rong, Y. Li, Y. He, C. Ma, J. Shi & D. Song
Yingli Green Energy, Baoding, China

5CV.1.6 **Early Potential Induced Degradation (PID) Detection in the Field: Cell Shunt Resistance Characterisation at Different Degradation Rates**
M. Florides, G. Makrides & G.E. Georghiou
University of Cyprus, Nicosia, Cyprus

5CV.1.8 **Importance of Power Stabilization of Crystalline PV Modules**
R. Ebner & G. Újvári
AIT, Vienna, Austria
W. Mühleisen & Ch. Hirschl
CTR, Villach, Austria
G.C. Eder & Y. Voronko
OFI, Vienna, Austria
F. Vollmaier
PVP Photovoltaik, Wies, Austria

5CV.1.9 **Architecture, Design and Simulation for a Shade Resilient Smart Module**
S.Z. Mirbagheri Golroodbari, A.C. de Waal & W.G.J.H.M. van Sark
Utrecht University, Netherlands

5CV.1.10 **Resistance of PID Sensitive PV Modules to Alternating High Voltage Stress (A-HVS)**
J. Arp
PV Lab Germany, Potsdam, Germany
B. Jaeckel
UL International, Neu-Isenburg, Germany

#

Wednesday, 26 September 2018

#

5CV.1.11 **Outdoor Performance Characterization of a Novel Shadow Tolerant Module**
K. Sinapis & W. Folkerts
SEAC, Eindhoven, Netherlands
L.H. Slooff, L.A.G. Okel & M.J. Jansen
ECN, Petten, Netherlands

5CV.1.12 **Comparative Assessment of Anti-Soiling Nanocoated Photovoltaic Modules in an Arid Desert Environment**
A. Alkandary, A.T. Al-Asfour & F.G. Alzubi
KISR, Shuwaikh, Kuwait

5CV.1.13 **Assessment of Technology- and Weather-Specific Temperature Losses of Various Photovoltaic Technologies**
C. Camus, J. Bogenrieder & J. Hauch
ZAE Bayern, Erlangen, Germany
A. Adrian
ISC Konstanz, Germany
C.J. Brabec
University of Erlangen-Nuremberg, Germany

5CV.1.14 **Evaluation of PV and PV/T Systems under Various Cooling Conditions**
M. Al-Damook, D.W. Dixon-Hardy, P.J. Heggs, S.W.O. Luhaib, J. Cottom & P. Mason
University of Leeds, United Kingdom
Z. Hussein Obaid
University of Anbar, Iraq
M. Al Qubeissi
Coventry University, United Kingdom

5CV.1.15 **Novel Computational Fluid Dynamics Modeling of Spatial Convective Heat Transfer over PV-Modules Mounted on an Inclined Surface with an Underlying Air Gap**
M.G. Chowdhury, L. Somma, H. Goverde, I.T. Horvath, E. Voroshazi, J. Poortmans & F. Catthoor
imec, Heverlee, Belgium
D. Goossens
KU Leuven, Belgium

5CV.1.16 **The Study on the Anti-PID Performance of High Efficiency Bifacial Cell Module**
X. Cai, Z. Ni, C. Chen, P. Ke, H. Chen, Q. Zhang & H. Cao
Talesun Solar, Suzhou, China

5CV.1.17 **Crystalline Silicon Photovoltaic Modules Degradation Mode in Different Climatic Zones in China**
H. Song, P. Xu, Z. Wu, Y. Xia & M. Yun
CPVT, Wuxi, China

5CV.1.18 **Effect of Temperature in Potential Induced Degradation Recovery Process of PV Modules with the Application of Reverse Bias Pulse Voltage**
H. Win, T. Kiroshiro, Y. Kawaguchi, G.S. Huai, A. Rahayu, F. Ohashi, H. Yoshida & S. Nonomura
Gifu University, Japan
Y. Hara & A. Masuda
AIST, Tsukuba, Japan

5CV.1.19 **Potential-Induced Degradation (PID) of n-Type and p-Type Silicon Solar Cells**
M. Schwark & J. Slamberger
AIT, Vienna, Austria

#

5CV.1.20 **Field Performance Analysis of Bi-Facial Modules in South Africa**
M. Basappa Ayanna, S. Miene, L. Pratt, K.T. Roro & S. Koopman
CSIR, Pretoria, South Africa
M. Diale
University of Pretoria, South Africa

5CV.1.21 **New Developments in Modeling and Numerical Simulations of Temperature and Yield of Commercial Photovoltaic Panels under Desert Environment**
S. Ahzi, S.P. Aly, N. Barth, B.W. Figgis & A.A. Abdallah
QEERI, Doha, Qatar

5CV.1.23 **Reducing Uncertainty in Outdoors PV Module Characterisation**
F. Martinez-Moreno, C.H. Rossa & E. Lorenzo
UPM, Madrid, Spain

5CV.1.24 **Towards Efficient and Accurate Energy Yield Modelling of Bifacial PV Systems**
I.T. Horvath, P. Manganiello, H. Goverde, E. Voroshazi, F. Catthoor & J. Poortmans
imec, Leuven, Belgium
D.G. Anagnostos
NTUA, Athens, Greece
B. Aldalali
Kuwait University, Khaldiya, Kuwait

5CV.1.25 **BIPV Modules with Plated Bifacial n-PERT Cells and Smart Wire Interconnection: Manufacturing, Monitoring and Energy Yield Analysis**
A.S.H. van der Heide, H. Goverde, L. Tous, R. Russell, E. Voroshazi & J. Poortmans
imec, Leuven, Belgium
K. Spiliotis, J. Lehmann, D. Saelens & J. Driesen
KU Leuven, Heverlee, Belgium

5CV.1.27 **Quantification of the Infra-Red Response of Various Cell Technologies on the Energy Yield**
H. Goverde, J. Govaerts & I.T. Horvath
imec, Genk, Belgium
B. Aldalali
Kuwait University, Khaldiya, Kuwait
E. Voroshazi, J. Szlufcik, F. Catthoor & J. Poortmans
imec, Leuven, Belgium

5CV.1.28 **Adaptable PV Performance Modelling**
S. Ransome
Steve Ransome Consulting, Kingston upon Thames, United Kingdom
J. Sutterlueti
Gantner Instruments, Schruns, Austria

5CV.1.29 **Investigation on the Quality of Adhesive Joints of Shingled Solar Cells by Accelerated Lifetime Testing**
I. Ullmann, D. Rudolph, J. Rabanal-Arabach, A. Schneider & A. Halm
ISC, Konstanz, Germany

5CV.1.30 **IV Measurement of Bifacial PV Module Using Monofacial Illumination by Applying Dynamic Bifacialities**
A.N.N. Alquennah & A.T. Al-Asfour
KISR, Shuwaikh, Kuwait

5CV.1.31 **Performance Simulations of a 72-Cell, a-Si HET Module with Different Tab-Interconnection Geometries**
J. Eymard, B. Commault & F. Gérenton
CEA, Le Bourget du Lac, France
R. Clerc & M. Hebert
University of Lyon, Saint-Etienne, France

Wednesday, 26 September 2018

5CV.1.32 **Current-Voltage Characteristic Driven Yield Investigation of Bifacial Modules**
D. Daßler, S. Malik, H. Hanifi, J. Fröbel & M. Ebert
Fraunhofer CSP, Halle, Germany

5CV.1.33 **Novel Power-Enhancing Ribbon for Solar Cell Interconnection**
T. Zhou, M. König & A. Henning
Heraeus, Hanau, Germany
S. Hoffmann, L. Pitta Bauermann, E. Fokuhl, D. Eberlein, A. Kraft & U. Eitner
Fraunhofer ISE, Freiburg, Germany
W. Pranger & A. Schütz
Ulbrich of Austria, Müllendorf, Austria

5CV.1.34 **Super Lightweight Flexible HJT Solar Panels**
A. Abramov, D. Andronikov, K. Emtsev, D. Orekhov, E.I. Terukov, E. Terukova & S. Yakovlev
R&D Center TFTE, St. Petersburg, Russia
S. Shakhray
Hevel Solar, Moscow, Russia

5CV.1.35 **Influence of Near Field Shadowing on the Performance Ratio at Thin Film Modules**
S. Wendlandt & L. Podlowski
PI Berlin, Germany

5CV.1.36 **Energy Yield Comparison Between Bifacial and Monofacial PV Modules - Real World Measurements and Validation with Bifacial Simulations**
J.N. Bonilla Castro, M. Herz, C. Monokroussos & M. Schweiger
TÜV Rheinland Energy, Cologne, Germany

5CV.1.37 **Techno-Commercial Performance Evaluation of 5 Different PV Technologies in Same Weather Conditions - A One Year Practical Case Study**
R. Bohra, R.R. Gowda & M.R. Krishnan
Infosys, Bangalore, India

5CV.1.38 **The Performance of Different Module under Composite Test Conditions**
M.-A. Tsai, K.-W. Lu, W.-L. Yang, S.-H. Chen, H.-S. Wu & T.-C. Wu
ITRI, Hsinchu, Taiwan

5CV.1.40 **Multiscale Analysis of Silicon-Based Photovoltaic Module Performance in a 19 Years-Old Power Plant**
M. Li & K. Le Dinh
Girasol Energy, Tokyo, Japan
H. Ochiai
The University of Tokyo, Japan
I. Kurimoto
Kisarazu College, Chiba, Japan
A. Fujita & Y. Toda
ITES, Shiga, Japan

5CV.1.41 **Comprehensive Study of Reliability of Photovoltaic Modules of Various Configurations under Static and Dynamic Mechanical Loading Conditions Using Finite Element Analysis**
B. Masetty
IIT Kharagpur, India
N. Shiradkar & S. Patwardhan
IIT Bombay, Mumbai, India

5CV.1.42 **From Bifaciality to Yield: How Different Bifacial Cell Technologies May Differ Even More in Annual Outdoor Performance**
C. Reise, G. Baarah, E. Schnabel, U. Kräling & B. Müller
Fraunhofer ISE, Freiburg, Germany
S. Chang, Y. Choe & H. Cho
LG Electronics, Gumi-City, Korea South

#

5CV.1.43 **A 3D Stress Analysis of Silicon Wafer Cells during Lamination**
W.M. Song, S.K. Tippabhottla, A. Tay & A.S. Budiman
SUTD, Singapore, Singapore

5CV.1.44 Water Diffusion Simulation of the Photovoltaic Module Based on Gravimetric Measurement of Packaging Materials
A. Dadaniya & N.V. Datla
IIT Dehli, New Dehli, India

5CV.1.45 **Investigation and Analysis of Bifacial Photovoltaics Modules with Reflective Layer**
E. Sng
REC Solar, Singapore, Singapore
C.X. Ang & I. Lim
University of Glasgow, United Kingdom

VISUAL PRESENTATIONS 6CV.2

13:30 - 15:00 Design and Installation of PV Systems

6CV.2.1 **Modeling of Lead Acid and Lithium Ion Batteries Used in PV System**
N. Achaibou & B. Saoudi
USTHB, Algiers, Algeria

6CV.2.3 **Quality Control of PV Modules at Origin: Essential Risk Mitigation Strategy for PV Developers**
R.J. Gómez, F. Prieto, C. Acinas, L. Pérez & V. Parra
Enertis Solar, Alcobendas, Spain

6CV.2.4 **Nonlinear Controller Design for Maximum Power Point Tracking in Photovoltaic Systems**
H. Yatimi & E. Aroudam
Abdelmalek Essaadi University, Tetouan, Morocco

6CV.2.5 **Impact of Dynamic-Mechanical Load on PV Modules Mounted on Single-Axis Tracker**
D. Stellbogen, P. Lechner, O. Schanz, S. Hummel & J. Schnepf
ZSW, Stuttgart, Germany
M. Kaiser
Canadian Solar, Munich, Germany

6CV.2.7 **Technical Evaluation of a Stand-Alone PV Heat Pump System for Space Heating/ Cooling Applications without Batteries**
C. Lorenzo Navaro, L. Narvarte Fernández & F. Martinez-Moreno
UPM, Madrid, Spain

6CV.2.8 **1.2 GW PV Installation in Chernobyl Exclusion Zone – Revitalizing Radioactive-Contaminated Zone with Renewable Solar Energy Generation**
C. Tjengdrawira, L. Botet, V. Lebrun, J. Dantinne & T. Dewez
Tractebel Engineering, Gennevilliers, France
R. Cariou
CEA, Grenoble, France

6CV.2.9 **PV Systems Based on Bifacial Modules: The Factors That Influence the Bifacial Gain**
S. Liu, Z. Wang, S. Zhang, Y. Tang & J. Lv
LONGi Solar, Xi'an, China

#

Wednesday, 26 September 2018

#

6CV.2.10 **Evaluation and Comparison of the Operational Aspects of Two Topologies for the Integration of Several Hybrid Renewable Energy Systems for Grid-Connected and Stand-Alone Applications**
K. Novaes, A.R. Arrifano Manito, M. Pinho Almeida, G. Figueiredo, A.R. Mocelin, T.A. Flores Melendez & R. Zilles
University of São Paulo, Brazil
J. Tavares Pinho
Federal University of Para, Belém, Brazil

6CV.2.11 **Maximizing the Energy Output for Local Climate Conditions: Advanced Technology Selection and PV System Design Toolbox**
E. Garcia Goma, R. Santbergen, H. Ziar, O. Isabella & M. Zeman
Delft University of Technology, Netherlands
B. Prudon
Waterschap Rivierenland, Tiel, Netherlands
B. Roeffen
Blue21, Delft, Netherlands
H. van Laar
Hakkers, Werkendam, Netherlands

6CV.2.12 **Non-Uniformity on the Backside of a Bifacial Panel for Different Configurations Including Spectral Reflectivity**
M. Vuylsteke, H. Goverde, I. Horvath, A.S.H. van der Heide, E. Voroshazi, J. Szlufcik & J. Poortmans
imec, Genk, Belgium

6CV.2.13 **Concept and Design of PV System for Harvesting Salt and Electricity at the Salt Farm Floor**
C. Lim, C. Kim & S. Lee
Green Energy Institute, Jeollanamdo, Korea South
S.-M. Lee & B.-S. Kim
KEPRI, Jeollanam-do, Korea South

6CV.2.14 **Comparative Analysis of a Novel Low Concentration Dual Photovoltaic/Phase Change Material System with a Conventional Photovoltaic System**
J. Sarwar, A.E. Abbas & K. Kakosimos
UET, Lahore, Pakistan

6CV.2.15 **An Empirical Techno-Commercial Assessment of Inverter DC Loading of Photovoltaic Assets in Asian Locations**
A.M. Nobre, J. Tan, S. Karthik, R.S. Baker, R. Malhotra & A. Khor
Cleantech Energy, Singapore, Singapore

6CV.2.18 **Photovoltaic System Equipped with Flat Reflectors: New MPPT Model in Case of Non-Uniform Illumination on PV Modules**
C. Abdel Nour, A. Migan Dubois & C. Marchand
GeePs, Gif-sur-Yvette, France
J. Badosa
CNRS, Palaiseau, France
V. Bourdin
LIMSI, Orsay, France
T. Akiki
Holy Spirit University of Kaslik, Jounieh, Lebanon

6CV.2.19 **Yield Simulations for Horizontal Axis Trackers with Bifacial PV Modules in PVsyst**
B. Wittmer & A. Mermoud
PVsyst, Satigny, Switzerland

#

#

6CV.2.20 **Reduction of the Carbon Footprint Using Photovoltaic Energy on Irrigation Systems. Case Study on a Semiarid Zone in the Southeast of Spain**
J.P. Chazarra Zapata
University Miguel Hernandez, Alicante, Spain
R. Egea Pérez
EMUASA, Murcia, Spain
F.J. López Peñalver
University of Alicante, Spain

6CV.2.21 **Comparison between Central and String Inverters Performance for the Utility-Scale PV Plant in Nova Olinda Brazil**
G. Nobile, M. Cacciato, G. Scarcella & G. Scelba
University of Catania, Italy
A.G.F. Di Stefano, F. Bizzarri, G. Leotta & P.M. Pugliatti
ENEL Green Power, Catania, Italy

6CV.2.22 **Sizing of Photovoltaic Systems for Self-Consumption in Commercial and Industrial Applications**
T. Roessler
Yingli Namene, Munich, Germany

6CV.2.23 **PV Battery Systems Sizing to Account for the Provision of Ancillary Services under Different Scenarios for Energy Policies and Tariffs**
A.R. Arrifano Manito, K. Novaes, M. Pinho Almeida, G. Figueiredo & R. Zilles
USP, São Paulo, Brazil
J. Tavares Pinho
UFPA, Belém, Brazil

6CV.2.24 **The Dutch Photovoltaic Portal 2.0**
V. Schepel, A. Tozzi, P. Nepal, J.H. Castro Barreto, H. Ziar, O. Isabella & M. Zeman
Delft University of Technology, Netherlands

6CV.2.25 **New Photovoltaic System Based on Solar Radiation Splitting Technology**
M. Tonezzer, P. Bernardoni & D. Vincenzi
University of Ferrara, Italy
P. Decarli
Trentino Rainbow Energy, Altopiano della Vigolana, Italy

6CV.2.26 **Inflatable System for Ubiquitous Deployment of Organic Photovoltaics**
A. Bernardi, G. Corso, R. Po, G. Giannotta & A. Cominetti
eni, Novara, Italy

6CV.2.28 **PHOTOPUR-PV-Powered Water Decontamination for Wine Growers**
J. da Costa Fernandes, F. Ziebold, S. Lapp, M. Schmidt & E. Bollin
University of Applied Sciences, Offenburg, Germany

6CV.2.29 **Custom PV System Integration into High Performance Autonomous Heliostats for Optimal Thermo Solar Plants**
J. Ulbikas, D. Horbacauskas & V. Ulbikaite
Modern E-Technologies, Vilnius, Lithuania
J. Doneliene & M. Rudzikas
PROTECH, Vilnius, Lithuania
M.A.C. Pérez
Thermal Power Engineering, Madrid, Spain
S. Bundgaard & J. Pelle
Aalborg CSP, Denmark
R.J. Serrano & I. Palomino
Acciona Industrial, Alcobendas, Spain

6CV.2.30 **Cloud Enhancement Phenomenon and Its Effect on PV Generators**
M. Järvelä, K. Lappalainen & S. Valkealahti
Tampere University of Technology, Finland

#

Wednesday, 26 September 2018

#

6CV.2.31 **Dual-Axis Sun Tracking System Development Using Microcontroller ATmega 328 for Maximum Solar Energy Generation**
H.S. Akbar, M.W. Aziz & O.O. Raoof
University of Kirkuk, Iraq
A.I. Siddiq & M.N. Fathulla
Kirkuk Technical College, Iraq

6CV.2.32 **New Approach for the Design of Large Scale Photovoltaic Plants Which Takes into Account the Integration of Project Data, Tools and Cost Analysis Trough the Digitalization of the Processes**
D. Guida, A. Sabene, W. Ferrara & M. Carbone
ENEL Green Power, Rome, Italy

6CV.2.33 **Parameter Identification of a Photovoltaic System**
A. Hajizadeh & J.W.A. Kumar
Aalborg University, Esbjerg, Denmark

6CV.2.35 **Effect of Bypass Diodes on a Photovoltaic System under Partial Shading**
A. Hajizadeh & J.W.A. Kumar
Aalborg University, Esbjerg, Denmark

6CV.2.36 **Detailed Calculation of Electrical Mismatch Losses for Central and String-Inverter Configurations on Uility-Scale PV Arrays**
M. Herrerías Azcué & H. Capdevila
capdevila ite, Stuttgart, Germany

VISUAL PRESENTATIONS 5CV.3

15:15 - 16:45 **PV Module Design, Manufacture, Performance and Reliability / Inverters and Balance of System Components / Sustainability and Recycling**

5CV.3.1 **Reliability Investigation on Bifacial c-Si Photovoltaic Modules Using Multiple Sequential Tests**
C. Lien, S.-Y. Ting, S.-H. Chen, K.-W. Lu, W.-L. Yang, C.F. Hsieh, H.-S. Wu & T.-C. Wu
ITRI, Hsinchu, Taiwan

5CV.3.2 **Study on Reliability of p-PERC and n-PERT Bifacial Modules**
Y. Li, J. Ni, Y. Geng, Y. He, T. Feng, C. Ma, J. Shi & D. Song
Yingli Green Energy, Baoding, China

5CV.3.3 **PET- Versus Polyolefin-Based Backsheet: Comparison of Degradation Behavior**
A. Omazic & G. Oreski
PCCL, Leoben, Austria
G.C. Eder
OFI, Vienna, Austria
C. Hirschl
CTR, Villach, Austria
M. Edler
ISOVOLTAIC, Lebring, Austria
G. Pinter
University of Leoben, Austria
M. Erceg
University of Split, Croatia

5CV.3.4 **Multi-Imaging of PV Module Inhomogeneities in 17 kW PV Power Plant and Mutual Correlations**
M. Bokalic, K. Brecl & M. Topic
University of Ljubljana, Slovenia

#

5CV.3.5 **Enhancement of Reliability for Photovoltaic Modules by More Severe Test in Accordance with Particular Environment of Taiwan**
C.-Y. Gao, C.-H. Lin & B.-C. Kuo
TERTEC, Taoyuan, Taiwan
C.-W. Huang, C.-H. Chen & Q.-R. Li
BSMI, Taipei, Taiwan

5CV.3.6 **Durasol - A French Multisite Platform for Assessing the Durability of Solar Material and Systems**
J. Merten, B. Braisaz, O. Doucet & O. Raccurt
CEA, Le Bourget du Lac, France
D. Barakel
IM2NP - CNRS, Marseille, France
J.-L. Canaletti
SPE University of Corsica, Ajaccio, France
M. David
University of la Réunion, St. Pierre, France
F. Mezzasalma
CEA, St-Paul-lez-Durance, France
D. Nelias
INSA Lyon, Villeurbanne, France

5CV.3.7 **The Influence of the EVA Film Quality on the Degradation of PV Modules under Harsh Test Conditions**
K. Brecl, M. Bokalic & M. Topic
University of Ljubljana, Slovenia
C. Barretta & G. Oreski
PCCL, Leoben, Austria
B. Malic
Jozef Stefan Institute, Ljubljana, Slovenia

5CV.3.8 **PV Module Glass Stress Testing**
G. Mathiak, D. Grimm, L. Falk, L. Rimmelspacher, W. Herrmann & F. Reil
TÜV Rheinland Energy, Cologne, Germany

5CV.3.9 **Temperature Mapping of PV Modules**
A.C. Besen, E. Arikan & M. Aldemir
GTC, Adiyaman, Turkey

5CV.3.10 **Development of Packaging Materials for Hot Spot Resistance PV Modules with High Efficiency**
Y. Sun, J. Qi, Q. Zhu & C. Zhu
LONGi Solar Technology, Taizhou, China

5CV.3.11 **Determination of Moisture Ingress and Diffusion Path in Encapsulation Layers of Standard PV Modules**
L. Neumaier, D. Holzmann, W. Mühleisen, J. Zikulnig & C. Hirschl
CTR, Villach, Austria

5CV.3.12 **Statement of Certified PV Module Registration and Policy in Taiwan**
C.-C. Chou
ITRI, Hsinchu, Taiwan

5CV.3.13 **Characterization of Degraded Site in Crystalline Silicon Photovoltaic Cells Exposed to Acetic Acid Vapor**
T. Tanahashi, N. Sakamoto, H. Shibata & A. Masuda
AIST, Tsukuba, Japan

Wednesday, 26 September 2018

5CV.3.14 **Review of Statistical and Analytical Degradation Models for PV Modules and Systems and Improvements**
I. Kaaya & K.-A. Weiß
Fraunhofer ISE, Freiburg, Germany
S. Lindig & D. Moser
EURAC, Bolzano, Italy

5CV.3.15 **A Benchmark for Visual Identification of Defective Solar Cells in Electroluminescence Imagery**
C. Buerhop-Lutz, J. Hauch & C. Camus
ZAE Bayern, Erlangen, Germany
S. Deitsch & F. Gallwitz
Nuremberg Institute of Technology, Germany
A. Maier & C.J. Brabec
FAU, Erlangen, Germany

5CV.3.16 **Single Diode Model Applied to PV Module Aging**
N. Hrelja, M. Van Iseghem & E. Lajoie-Mazenc
EDF R&D, Moret sur Loing, France
E. Moulines
Ecole Polytecchnique, Palaiseau, France

5CV.3.17 **Electroluminescence System for In Situ Characterization of PV Modules**
M. Ezquer Mayo, A. Barrenetxea, J. Moracho, J. Díaz & A.R. Lagunas
CENER, Sarriguren, Spain

5CV.3.18 **Evaluation of Industrial Frameless Double Glass Silicon Cells Modules Using a Novel Accelerated Aging Test Procedure**
J. Dupuis, E. Lajoie-Mazenc, F. Sicard & D. Binesti
EDF R&D, Moret-sur-Loing, France
S. Mousel & K. Radouane
EDF EN, Paris La Defense, France

5CV.3.19 **Anti-Reflective Properties of Reactive Ion Etched Glasses**
E. Zugasti, J. Bengoechea, A. Turumbay, M. Murillo, M.J. Rodriguez & A.R. Lagunas
CENER, Sarriguren, Spain

5CV.3.20 **Digitalization in PV – Virtual Application of Real Weather Data on PV Modules for Lifetime Prediction**
U. Zeller & M. Pander
Fraunhofer CSP, Halle (Saale), Germany
D. Daßler
Anhalt University of Applied Sciences, Koethen, Germany

5CV.3.21 **Development of Non-Destructive Methods for Acetic Acid Detection in Photovoltaic Modules**
C. Barretta & G. Oreski
PCCL, Leoben, Austria
N. Kyranaki
CREST, Loughborough, United Kingdom
K. Resch-Fauster & G. Pinter
University of Leoben, Austria

5CV.3.22 **Wireless System for In-Situ Monitoring of Moisture Ingress in PV Modules**
M. Jankovec, J. Slapšak & M. Topic
University of Ljubljana, Slovenia

5CV.3.23 **Scanning Acoustic Microscopy as a Non-Destructive Method for the Investigation of PV Module Components**
L. Verissimo Mesquita, D.E. Mansour, L. Pitta Bauermann & D. Philipp
Fraunhofer ISE, Freiburg, Germany

5CV.3.24 **Using UV LEDs for PV Module Aging and Degradation Study**
S. Mitterhofer, M. Jankovec & M. Topic
University of Ljubljana, Slovenia

5CV.3.25 **Degradation Analysis from Long-Term PV Module IV Curve Field Monitoring**
D. Stellbogen, P. Lechner & O. Schanz
ZSW, Stuttgart, Germany

5CV.3.26 **Multi-Wire Interconnection: The Impact of the Lamination Process and Encapsulant Properties on Solder Joint Formation**
R. Van Dyck & S. De Jonge
KU Leuven, Belgium
T. Borgers, J. Govaerts, A. van der Heide, E. Voroshazi, J. Szlufcik & J. Poortmans
imec, Genk, Belgium
P. Nivelle
imomec, Diepenbeek, Belgium

5CV.3.27 **Analysis and Development of Transport Phenomena Models for PV Modules**
L. Castillon & G. Oreski
PCCL, Leoben, Austria
G. Pinter
University of Leoben, Austria

5CV.3.28 **Nanoindentation Analysis of the Encapsulant in a PV Module after Accelerated Aging**
D.E. Mansour, I. Kaaya, D. Philipp & L. Pitta Bauermann
Fraunhofer ISE, Freiburg, Germany
F. Swientek & P. Pavlov
Anton Paar Germany, Ostfildern-Scharnhausen, Germany

5CV.3.29 **DaySy Photoluminescence Measures the Shunt Resistance in Installed PV Modules**
L. Stoicescu & M. Reuter
Solarzentrum Stuttgart, Germany

5CV.3.30 **Investigating the Effect of Soiling on the Power Production of PV Panels Exposed to Wind: Wind Tunnel Approach**
R. Lundholm, H. Goverde, J. Poortmans, G. Chowdhury & J. Govaerts
imec, Leuven, Belgium
D. Goossens
KU Leuven, Heverlee, Belgium

5CV.3.31 **Automatic Quantitative Analysis of Silicon Solar Panels Based on Statistical Parameters from Electro- and Photoluminescence Images**
M. Guada, S. Pena, O. Martínez, M.A. González & J. Jiménez
UVa, Valladolid, Spain
L. Pérez
Enertis Solar, Madrid, Spain

5CV.3.32 **Long Term Performance Evaluation of PV Module Backsheets: Module Accelerated Sequential Testing (MAST)**
A. Sinha, S. Tatapudi & G. TamizhMani
Arizona State University, Mesa, United States
W.J. Gambogi, T.J. Trout & K. Roy-Choudhury
DuPont, Wilmington, United States

5CV.3.33 **Degradation Analysis of m-Si Photovoltaic Modules for Early Life Defects Observed in Harsh Climate of Morocco**
A. Bouaichi, A. Alami Merrouni, B. Ikken, A. Ghennioui, H. Zitouni, C. Hajjaj & A. Benlarabi
IRESEN, Rabat, Morocco
C. Messaoudi & A. El Amranil
OATE, Errachidia, Morocco

Wednesday, 26 September 2018

5CV.3.35 **Proposing an Electro-Thermal SPICE Model to Investigate the Effect of Partial Shading on CIGS PV Modules**
J. Carolus, Z. Purohit, T. Vandenbergh, M. Meuris & M. Daenen
Hasselt University, Belgium
B. Tripathi
PDPU, Gujarat, India

5CV.3.36 **Overview of the "Darkbus" Defect: Causes, Consequences and Solutions**
B. Braisaz, L. Sicot, V. Barth, H. Robin, M. Vite, W. Favre & P.-J. Ribeyron
CEA, Le Bourget du Lac, France
F. Rametta, L. Todaro, A. Canino, A. Ragonesi, M. Sciuto & A. Battaglia
3SUN, Catania, Italy
C. Gerardi
ENEL Green Power, Rome, Italy

5CV.3.37 **Selection Map for PV Module Installation Based on Shading Tolerability and Temperature Coefficient**
H. Ziar, S. Mishra, O. Isabella & M. Zeman
Delft University of Technology, Netherlands

5CV.3.38 **Avanced Testing of PV Module Encapsulants**
S. Pingel, S. Fechner, S. Janke & L. Podlowski
PI Berlin, Germany
B. Stannowski
HZB, Berlin, Germany

5CV.3.39 **Current Collection Efficiency Mapping of Solar Modules in Daylight**
A. Gerber, V. Huhn, B.E. Pieters & U. Rau
Forschungszentrum Jülich, Germany

5CV.3.40 **Multi-Scale Mechanical Model for Photovoltaic Module Reliability**
P. Nivelle, J. D´Haen, W. De Ceuninck & M. Daenen
Hasselt University, Belgium
T. Borgers, J. Govaerts, E. Voroshazi & J. Poortmans
imec, Genk, Belgium

5CV.3.41 **Scaling up Laser Line Photoluminescence Imaging for Outdoor Inspections**
G.A. dos Reis Benatto, M. Chi, N. Riedel, A.A. Santamaria Lancia, O. Bjarlin Jensen, S. Thorsteinsson & P.B. Poulsen
Technical University of Denmark, Roskilde, Denmark

5CV.3.42 **Key Performance Indicators and PV Module Reliabiity**
G. Kleiss
Kleiss Consulting, Bonn, Germany

5CV.3.43 **Assessments for Distance through Insulation (DTI) of PV Encapsulant/ Backsheet Materials**
H.-H. Hsieh, W.-H. Wang, M.-T. Kuan & C.-C. Wang
ITRI, Hsinchu, Taiwan

5CV.3.44 **Transient Effects and Internal Series Resistance Calculation on Bifacial Silicon PV Modules**
J. Lopez-Garcia, D. Pavanello & T. Sample
European Commission JRC, Ispra, Italy

5CV.3.45 **Development of Conductive Back-Sheet for Manufacture of PV Modules with Back-Contact Cells**
I.J. Bennett
DSM Innovation, Geleen, Netherlands

#

5CV.3.46 **Performance of Various Polymeric PV Backsheet Designs in Different UV Tests**
J. Jung
Agfa Gevaert, Mortsel, Belgium
S. Suga
Suga Test Instruments, Tokyo, Japan

5CV.3.47 **Investigating the Degradations of Front and Back Sides of c-Si PV Cells that Exposed in Acetic Acid**
N. Kyranaki
CREST, Loughborough, United Kingdom
J. Zhu & T.R. Betts
Loughborough University, United Kingdom
R. Gottschalg
Fraunhofer CSP, Halle, Germany

5CV.3.48 **PV Modules Inspection through Photoluminescence in Daylight Conditions**
L.J. Herrero, R. Herrero Martín & I. Antón Hernández
UPM, Madrid, Spain

5CV.3.54 **Accreditation for the PV Inverter Test Bench of the PV Laboratory**
U. Muntwyler, A. Werder, L. Borgna, D. Gfeller & E. Schuepbach
BUAS, Burgdorf, Switzerland

5CV.3.55 **Development of a Multichannel Data Logger for the Measurement of Microclimatic Parameters within Enclosures of (Externally Mounted) PV-Inverters**
J. Zikulnig, L. Neumaier, W. Mühleisen, C. Hirschl & D. Holzmann
CTR, Villach, Austria
H. Heigl
Fronius, Thalheim, Austria

5CV.3.56 **Reliable-Thermal Design Smart Converters for NZEB Application**
G. Graditi, G. Adinolfi, R. Ciavarella & V. Palladino
ENEA, Portici, Italy

5CV.3.57 **Substring-MPPT for 4 Terminal 3-Substring Modules**
R. Brace, A. Neumann, T. Czarnecki & R. Merz
University of Applied Sciences, Karlsruhe, Germany

5CV.3.59 **Modelling the Probability to Fail for PV Systems at Specific Locations due to the Impact of Cosmic Rays**
M. Halwachs, M. Schwark, K.A. Berger & R. Ebner
AIT, Vienna, Austria

5CV.3.60 **New PV System Concept – Inductive Power Transfer for PV Modules**
F. Carigiet, R. Knecht & F.P. Baumgartner
ZHAW, Winterthur, Switzerland
C.J. Brabec
FAU, Erlangen, Germany

5CV.3.61 **A Comparative Study on the Durability of Metallic Coated Profiles as Structural Elements Used in PV Solar Energy Fields**
P. Verpoort, B. Corlu & J. De Strycker
ArcelorMittal, Zelzate, Belgium
C. Dieu
ArcelorMittal, Flémalle, Belgium

5CV.3.62 **Technical and Economic Comparative Study of DC Cables Operated in Solar PV Farms in Iran**
I. Kazemi
Islamic Azad University, Damavand, Iran
M. Zandi, N. Aboufazeli & A. Tadjik
Shahid Beheshti University, Tehran, Iran

#

Wednesday, 26 September 2018

#

5CV.3.68 **Life Cycle Assessment of Perovskite Solar Cells in Single and Tandem Configuration**
J.C. Gomez Trillos, U. Brand, S. Peterhammer & T. Vogt
DLR, Oldenburg, Germany

5CV.3.69 **An Assessment of a Photovoltaic Plant in Tehran (Iran): Life-Cycle Approach**
A. Bakhtiari, S. Eslami, H. Akhbari & Y. Gholami
Shahid Beheshti University, Tehran, Iran

5CV.3.70 **A Strategy for 2nd Life c-Si-PV-Panels Based on Failure Assessment of Scrap PV-Modules**
U. Ricklefs, H. Weigand, E.A. Stadlbauer, J. Glatthaar, E. Kamdje, J. Barnikel, R. Gissel & J. Henkel
THM, Giessen, Germany
M. Dax
Ruehl Solar, Lohra Kirchvers, Germany
V. Schaub
AWLD, Asslar, Germany
H.G. Stevens
SM-innotech, Bocholt, Germany
B. Jehle
ZME, Heuchelheim, Germany

5CV.3.71 **Study about Silicon Material - Received from EOL-PV Waste and Intended as Secondary Raw Material**
W. Palitzsch & S. Rudolph
Loser Chemie, Zwickau, Germany
I. Röver
FRESITEC, Freiberg, Germany

5CV.3.72 **Earth First! Greening the PV Industry with an Universal PV-Module Recycling Concept!**
W. Palitzsch
Loser Chemie, Zwickau, Germany
U. Loser
GERAU, Grunau, Germany

5CV.3.73 **Indium, Silicon and Silver from PV Waste for New Photovoltaics and Other Applications - Latest News from CABRISS (EU Collaborative Project)**
W. Palitzsch, P. Schönherr & A. Killenberg
Loser Chemie, Zwickau, Germany

5CV.3.74 **Planning and Optimizing the PV Material Life Cycle - Case Study Switzerland**
U. Muntwyler & E. Schuepbach
BUAS, Burgdorf, Switzerland
R. Eppenberger
SENS, Zurich, Switzerland

#

#

5CV.3.75 **Eco-Solar Factory: 40% Plus Eco-Efficiency Gains in the Photovoltaic Value Chain with Minimised Resource and Energy Consumption by Closed Loop Systems**
M.P. Bellmann
SINTEF, Trondheim, Norway
K. Wambach, M. Seitz & R. Peche
bifa Environmental Institute, Augsburg, Germany
G.S. Park
NorSun, Oslo, Norway
J. Denafas
Soli "Tek R&D", Vilnius, Lithuania
F. Buchholz
ISC Konstanz, Germany
R. Einhaus
Apollon Solar, Lyon, France
G. Noja
Garbo, Cerano, Italy
B. Ehlen
Boukje.com Consulting BV, Bleiswijk, Netherlands
R. Roligheten
Steuler Solar Technology, Porsgrunn, Norway
P. Romero
AIMEN, Porrino (Pontevedra), Spain
A. Bollar
INGESEA, Elgoibar, Spain

5CV.3.76 **PV Module Recycling Solution and Module Defects in the Field**
M. Ito & T. Doi
NPC Incorporated, Tokyo, Japan

VISUAL PRESENTATIONS 1CV.4

17:00 - 18:30 **Fundamental Studies / New Materials and Concepts for Photovoltaic Devices**

1CV.4.1 **Modeling of the Outdoor Operating Temperature of Polycrystalline Photovoltaic Module. Case Study: Harsh Climatic Conditions of Benguerir City, Morocco**
C. Hajjaj, A. Alami Merrouni, A. Ghennioui, H. Zitouni, A. Bouaichi, B. Ikken & A. Benlarabi
IRESEN, Rabat, Morocco
M. Benhmida & S. Sahnoun
University of Chouaib Doukkali, El Jadida, Morocco

1CV.4.2 **Approach for Simulating Outputs of PV Module/Array of Different Technologies with High Accuracy**
S. Kichou & P. Wolf
CTU, Bustehrad, Czech Republic

1CV.4.3 **Comprehensive Approach to Accurate Albedo Modelling and Simulation for Solar Engineering Applications**
H. Ziar, F.F. Sönmez, O. Isabella & M. Zeman
Delft University of Technology, Netherlands

1CV.4.5 **SLALOM: Open-Source, Portable and Easy-to-Use Solar Cell Optimizer. Application to the Design of InGaN and CZTS Solar Cells**
S. Ould Saad Hamady & N. Fressengeas
Université de Lorraine, Metz, France

#

Wednesday, 26 September 2018

#

1CV.4.6 **A Planar Indium-Tin-Oxide Thermophotovoltaic Emitter with High-Temperature Verification**
D.-H. Wu & Y.-B. Chen
NTHU, Hsinchu, Taiwan
P. Parashar, H.-M. Chou, Y.-S. Lin, Y.-C. Lai, P. Yu & A. Lin
NCTU, Hsinchu, Taiwan

1CV.4.7 **Rapid Calculation of the Backsheet Coupling Gain Using Ray Groups**
A. Pfreundt, M. Mittag, M. Heinrich & U. Eitner
Fraunhofer ISE, Freiburg, Germany

1CV.4.8 ***EU PVSEC Student Award Winner Presentation:*** **Generalized Reciprocity Relation in p-i-n Junction Solar Cells**
K. Toprasertpong, A. Delamarre, K. Watanabe, Y. Nakano & M. Sugiyama
University of Tokyo, Japan
J.F. Guillemoles
CNRS, Chatou, France

1CV.4.9 **Simulation of Some Effects of Grain Boundaries in Solar Cells**
T.O. Saetre
University of Agder, Grimstad, Norway

1CV.4.13 **Evaluating the Potential of Optical Materials as Solar Cell Absorbers**
B. Dzurnak
CTU, Prague, Czech Republic
L. Danos
Lancaster University, United Kingdom
T. Markvart
University of Southampton, United Kingdom

1CV.4.14 **Surface Defect Spectroscopy of Transparent Conductive Oxides**
E. Horynova & R. Nevyhosteny
CTU, Prague, Czech Republic
N. Neykova, Y.Y. Chang & J. Holovsky
ASCR, Prague, Czech Republic

1CV.4.15 **Multiphysics Modeling and Optimization of the Induction Heating Process for Germanium Crystal Growth**
D. Ouadjaout
CRTSE, Algiers, Algeria
N. Derguini
CDTA, Algiers, Algeria

1CV.4.16 **Quantifying Radiative and Non-Radiative Carrier Lifetime of Solar Cells by Combined Optical and Electrical Characterisation**
V. Tsai, M. Bliss, T.R. Betts & R. Gottschalg
Loughborough University, United Kingdom

1CV.4.18 **Enhanced Electrical and Optical Properties of Zinc Oxide Ultrathin Film Using Graphene Sheet for Solar Cell Application**
A.F. Abdelaal, M.K. Hossain, A. Ibrahim, B. Salhi & T. Laoui
KFUPM, Dhahran, Saudi Arabia

1CV.4.19 **Enhanced Performance of a Graphene/n-GaAs Schottky Barrier Solar Cell by Means of a AlGaAs/GaAs Thin Multi-Quantum Well Layer**
A.C. Varonides
University of Scranton, United States

1CV.4.26 **Optimal Band Gap Energies for Two-Step Photon Up-Conversion Solar Cells with Partial Absorptivity**
Y. Harada, T. Matsuo, S. Asahi & T. Kita
Kobe University, Japan

#

#

1CV.4.27 **Interfacial Buffer Layer for the Integration in CNT/a-Si Hybrid Thin Films Solar Cells**
H. Meddeb, O.V. Sergeev, M. Vehse & C. Agert
DLR, Oldenburg, Germany
P.M. Rajanna & A.G. Nasibulin
Skoltech, Moscow, Russia

1CV.4.29 **Advanced Silver Paste Formulation for High Efficiency Silicon Solar Cells**
C. Yüce, C. Xu & N. Willenbacher
Karlsruhe Institute of Technology, Germany
M. König
Heraeus, Hanau, Germany

1CV.4.30 **Rare Earth Doped Compounds for Enhancing the Efficiency of Silicon BICPV via Spectral Conversion**
J. Day, T.K. Mallick & S. Sundaram
University of Exeter, Penryn, United Kingdom

1CV.4.31 **Thick Films of CY:PMMA as a Luminescent Solar Concentrator for Photovoltaic Windows**
M. Jobin & C. Ruiz Diaz
HES-SO, Geneva, Switzerland

1CV.4.32 **Efficient Light Collection via Dielectric Nanoparticles in Ultrathin Cu(In,Ga)Se2 Solar Cells and Modules**
M. Schmid
University of Duisburg-Essen, Germany
P. Manley & G. Yin
HZB, Berlin, Germany

1CV.4.33 **Application of Reduced Graphene Oxide (rGO) on a-Si: H Solar Cell for Performance Enhancement**
A. Nandi, S. Ghosh, S. Majumdar, S.M. Hossain & H. Saha
IIEST Shibpur, Howrah, India
S. Mandal
IIT Delhi, New Delhi, India

1CV.4.34 **Optical and Structural Properties of RF-Sputtered ZnS:Cr Thin Films**
C.M. Samba Vall, M. Chaik, H. El Aakib, M. Elyaagoubi & A. Outzourhit
Cadi Ayyad University, Marrakech, Morocco
M. Aggour
Ibn Tofail University, Kenitra, Morocco

1CV.4.36 **Synthesis, Structural and Photo Physical Properties of Perovskite Oxide (KNbO3)1-x+(La2NiMnO6)x for Photovoltaic Application**
M.S. Sheikh, A. Dutta, T.K. Bhowmik & T.P. Sinha
Bose Institute, Kolkata, India
S.K. Ghosh & S.K. Rout
Birla Institute of Technology, Ranchi, India

1CV.4.37 **Silicon Nanowire for Solar Energy Application**
B. Salhi, M.K. Hossain & F. Al-Sulaiman
KFUPM, Dhahran, Saudi Arabia

1CV.4.38 **Optimization of Technology for Creation of Composite Antireflection Coatings for Silicon Solar Cells**
S.X. Suleymanov, V.G. Dyskin, M.U. Djanklich, N.A. Kulagina & O.A. Dudko
Academy of Sciences of Uzbekistan, Tashkent, Uzbekistan

1CV.4.40 **Improved Durability and Efficiency of Solar Modules by Reduced Operating Temperature**
M.A. Green, Z. Zhou, M.J. Keevers, J. Jiang & N.J. Ekins-Daukes
UNSW Australia, Sydney, Australia

#

Wednesday, 26 September 2018

#

1CV.4.41 **Effect of Annealing Process on Crystalline Silicon Solar Cells with Down-Conversion SiNx::Tb3+ - Yb3+ Films**
Y.-C. Lee, S.-C. Wu & I.-S. Yu
NDHU, Hualien, Taiwan
L. Dumont, J. Cardin, C. Labbe & F. Gourbilleau
CIMAP, Caen, France

1CV.4.42 **Characterization of a Novel Photovoltaic Backsheet Based on Polyamide-Ionomer Alloy Technology**
C. Thellen, A. Rothacker, R. Davis & D. Santoleri
Tomark-Worthen, Nashua, United States

1CV.4.43 **Novel (ZnSe)0.1(SnSe)0.9 Absorber for Use in Thin-Film Solar Cells**
T.M. Razykov, B. Ergashev, K.M. Kouchkarov, A.A. Mavlonov & R. Yuldoshov
Academy of Sciences of Uzbekistan, Tashkent, Uzbekistan
A. Bosio & N. Romeo
University of Parma, Italy
E. Artegiani & A. Romeo
University of Verona, Italy

1CV.4.45 **Effect of Co and Cr Doping on the Optical Band Gap of ZnTe**
M. Chaik, H. El Aakib, C. Sambeval, M. Elyaagoubi & A. Outzourhit
Cadi Ayyad University, Marrakech, Morocco

1CV.4.48 **Precursor Compositions Effect on the Photovoltaic Performance of Non-Vacuum Proceed CuSbS2 Solar Cells and Its Defect Properties**
S. Banu, Y. Cho & A. Cho
KIER, Daejeon, Korea South

1CV.4.50 **The Research of the Al2O3 Passivation Layer in Sb2Se3 Thin Film Solar Cells**
C. Ma, H. Guo, X. Guo, K. Zhang, N. Yuan & J. Ding
Changzhou University, China

1CV.4.51 **Nanosphere Colloidal Coating for Improvement of Solar Cell Efficiency**
N. Seyedpour Esmaeilzad, I.M. Öztürk, M. Zolfaghariborra & A. Bek
METU, Ankara, Turkey

1CV.4.52 **Spectrally Selective Solar Cells for Simultaneous Use of Photosynthesis and Photovoltaics**
N. Osterthun, V. Steenhoff, N. Neugebohrn, K. Gehrke, M. Vehse & C. Agert
DLR, Oldenburg, Germany

1CV.4.53 **Electron Selective La:BaSnO3 Thin Films via Pulsed Laser Deposition – Effect of Deposition Pressure**
A. Kumar, A.K. Singh & K.R. Balasubramaniam
IIT Bombay, Mumbai, India

1CV.4.54 **Studying Transition Metal Doped In2S3 by Means of Hybrid Density-Functional Theory**
K. Albe & E. Ghorbani
Technical University, Darmstadt, Germany

1CV.4.55 **Optical and Compositional Properties of ALD Grown TiOx**
O. Akdemir, H. Nasser, M. Zolfaghariborra, E. Aygün, R. Turan & A. Bek
METU, Ankara, Turkey

1CV.4.56 **Design Limitations and Opportunities for Using CIGS Flexible Solar Cell Technology to Create Integrated Plastic and Composite Photovoltaic Products**
S. Kristensen, M.H.B. Driesser, H. de Moor & E. Geldof
Avans University Applied Sience, 's-Hertogenbosch, Netherlands

#

#

1CV.4.57 **Reliability of Electrically Conductive Adhesives**
G. Oreski, S. Pötz & A. Omazic
PCCL, Leoben, Austria
G.C. Eder
OFI, Vienna, Austria
L. Neumaier & C. Hirschl
CTR, Villach, Austria
R. Ebner
AIT, Vienna, Austria
J. Scheurer
Polytec PT, Karlsbad, Germany
W. Pranger
Ulbrich of Austria, Müllendorf, Austria

1CV.4.58 **Hole Transport Transparent Conductive Oxide: Towards Dopant Free Si-Based Solar Cells**
O. Akdemir, H. Nasser, M. Zolfaghariborra, R. Turan & A. Bek
METU, Ankara, Turkey

1CV.4.59 **Sputter-Deposited CuGaO2 as a Hole Conductor for Transparent Recombination Junctions for Methylammonium-Pb-Halide Tandem Solar Cells**
R. Wenisch, Y. Wang & I. Lauermann
HZB, Berlin, Germany

1CV.4.60 **Evaluation of Different Module Designs and Determination of Different Physical Loss Mechanisms by Means of a Practical Multi-Physic Model**
H. Hanifi & J. Schneider
Fraunhofer CSP, Halle (Saale), Germany

1CV.4.62 **Influence of Ni Doping on the Optical and Structural Properties of CuO Thin Films Deposited by RF Sputtering**
H. El Aakib & A. Outzourhit
Cadi Ayyad University, Marrakech, Morocco
J.F. Pierson
University of Lorraine, Nancy, France

1CV.4.63 **CsSnI3-xClx Based Metal Halide for the Near IR Absorption Perovskite Solar Cells**
M.-H. Jung
Sejong University, Seoul, Korea South

1CV.4.64 **Using White Encapsulants in PV Modules**
M. Li & C. Quan
HIUV, Shanghai, China
A. Hoffmann
GLAAST, Bensheim, Germany

1CV.4.65 **Coating Paper with Paper. A Planarization Strategy towards Efficient Silicon Thin Film Solar Cells to Power Optoelectronic Devices**
M.P. Ferreira, A.T. Vicente, T. Mateus, M.J. Mendes, S. Zakir, H. Águas, E. Fortunato & R. Martins
New University of Lisbon, Caparica, Portugal

1CV.4.69 **Si with Self Organized Quasiperiodical Microrelief for Plasmonic Solar Cells**
S.V. Mamykin, A.V. Korovin, N.V. Kotova, T.R. Barlas, O.S. Kondratenko, I.B. Mamontova & V.R. Romanyuk
NAS, Kiev, Ukraine

Wednesday, 26 September 2018

#

1CV.4.70 **Application of Taguchi Approach to Optimize the Spray Pyrolysis Process of the Quaternary CuInxGa(1-x)(Se,S)2 with Good Optical Properties**
A. Bouich
University of Hassan II, Casablanca, Morocco
B. Hartiti & M. Ebn Touhami
Ibn Tofail University, Kenitra, Morocco
D.M.F. Santos
IST-ULisboa, Lisbon, Portugal

1CV.4.72 **Electronic Properties of Twist-Angle Interlayer of WSe2/MoSe2 Heterostructure**
N.D. Cong, C.W. Seok, I. Akhtar, M.A. Rehman & Y. Seo
Sejong University, Seoul, Korea South

1CV.4.74 **ZnO Based Nanostructures Fabricating by Chemical Bath Deposition for Dye-Sensitized Solar Cell Application**
C. Li & Q. Zhang
Kochi University of Technology, Kami, Japan

1CV.4.75 **Innovative Solar Spectral Beam Splitting Concepts: Cogeneration and Photochemistry**
G. Mittelman, H. Vitoshkin & B. Lew
Agricultural Research Organization, Rishon Lezion, Israel
H. Mamane & A. Kribus
Tel Aviv University, Israel

1CV.4.76 **Ultra-Fast Plasmonic Ag NPs Production for Light Trapping in Thin Si Solar Cells**
A. Araújo Cardoso, M.J. Mendes, T. Mateus, J. Costa, D. Nunes, E. Fortunato, H. Águas & R. Martins
New University of Lisbon, Caparica, Portugal

1CV.4.78 **Inorganic Cesium Carbonate Electron Transport Layer for High Efficiency Perovskite Solar Cells**
M.I. Hossain, N. Tabet & A. Belaidi
QEERI, Doha, Qatar
I. Zimmermann & M.K. Nazeeruddin
EPFL, Lausanne, Switzerland

1CV.4.80 **Solar Cell Embedded Textile Yarn**
A. Satharasinghe, T. Hughes-Riley & T. Dias
Nottingham Trent University, United Kingdom

1CV.4.81 **Development of High Efficiency Multi-PERC Bifacial Cells and Modules**
F. Jiang, J. Wu, J. Xia, E. Liu & G. Xing
Canadian Solar, Suzhou, China

1CV.4.82 **Photovolataic Driven Solar Fuel Generation Using Chalcogenide Materials**
J.S. Kim, Y.B. Kim & H. Cho
Sungkyunkwan University, Suwon-City, Korea South

1CV.4.83 **Solder Joint Analysis of Tin-Lead and Bismuth Based Lead Free PV Ribbons in High Throughput Manufacturing**
N.S. Pujari, J. Sundaramurthy & S. Sarkar
Alpha Assembly Solutions, Bangalore, India
M. Murphy & C. Bilgrien
Alpha Assembly Solution, New Jersey, United States

#

1CV.4.84 **Investigation of Phonon Dynamic in Single Crystal Lead-Halide Perovskites by Inelastic Neutron Scattering (INS)**
M. Dubajic, D. Wang, A. Mahmud, M.B. Upama, S. Shrestha, S.P. Bremner & G.J. Conibeer
UNSW Australia, Sydney, Australia
X. Jia
Changzhou University, China
K. Rule
ANSTO, Sydney, Australia

Thursday, 27 September 2018

VISUAL PRESENTATIONS 6DV.1

13:30 - 15:00 Operation, Performance and Maintenance of PV Systems

6DV.1.2 **Effect of Dust Deposition on Photovoltaic System Performance of Various Tilt Angle in Residential Area of Shiraz/Iran**
A. Khodakaram-Tafti & M. Yaghoubi
Shiraz University, Iran

6DV.1.4 **Local Variability in PV Soiling Rate**
M. Gostein & B. Stueve
Atonometrics, Austin, United States
K. Passow
First Solar, San Francisco, United States
M.G. Deceglie & L. Micheli
NREL, Golden, United States

6DV.1.5 **Modeling of the Influence of Dust Soiling on PV Panels for Desert Applications: The Example of the Solar Test Facility at Doha – Qatar**
N. Barth, B.W. Figgis, A.A. Abdallah, S.P. Aly & S. Ahzi
QEERI, Doha, Qatar

6DV.1.6 **Analysing the Effect of Snow on the PV Regulator Response in a Simple PV System**
J. Solis & S. Hamanee
Karlstad University, Sweden
M. Nilsson
Glava Energy Center, Sweden

6DV.1.8 **Unique Soiling Detection System for PV Modules**
M. Korevaar, J. Mes, T. Bergmans & X. van Mechelen
Kipp & Zonen, Delft, Netherlands
A. Alami Merrouni
IRESEN, Rabat, Morocco
P. Nepal
Delft University of Technology, Netherlands

6DV.1.9 **New Experimental Results on the Impact of Soiling on High Concentration Photovoltaic Module Performance**
A. Barhdadi, W. Anana, F. Chaouki & B. Laarabi
University Mohammed V-Agdal, Rabat, Morocco
V. Gilioli & D. Verdilio
Becar, Monteveglio, Italy

6DV.1.10 **Deep Analyses of Soiled Photovoltaic Modules under Different Moroccan Climates**
B. Laarabi, F. Safsafi, F.-E.-Z. Daoudi & A. Barhdadi
University Mohammed V-Agdal, Rabat, Morocco

6DV.1.11 **Innovative Cleaning Technique for Solar Biaxial Tracker PV Modules**
D. Dahlioui, S. El Ayane, M. Rhourri, S. Medaghri Alaoui & A. Barhdadi
University Mohammed V, Rabat, Morocco
E. Menard & J. Boardman
HeliosLite, Le Bourget du Lac, France

6DV.1.12 **The Soiling Effect on the Performance and the Cleaning Cost of Amorphous Photovoltaic System in Benguerir, Morocco**
H. Zitouni, A. Ghennioui, C. Hajjaj, A. Bouaichi, B. Ikken & A. Benlarabi
IRESEN, Rabat, Morocco
M. Regragui
University Mohammed V-Agdal, Rabat, Morocco

6DV.1.13 **Deployment of Photovoltaic Systems in Public Buildings of Saudi Arabia Including the Effects of Dust Accumulation**
J. Alshahrani & P. Boait
De Montfort University, Leicester, United Kingdom

6DV.1.14 **Long Term Evaluation of Anti-Reflection and Anti-Soiling Coating for Existing Photovoltaic Modules**
K. Nishioka & Y. Ota
University of Miyazaki, Japan

6DV.1.15 **Low-Cost Soiling Detector for Photovoltaic Applications**
L. Micheli
NREL, Golden, United States
E.F. Fernández & F. Almonacid
University of Jaén, Spain
M. Muller
Leidos, Denver, United States

6DV.1.16 **Photovoltaic (PV) Degradation Rate Trend Assessment with Time Series Change Point Analysis**
A. Livera, G. Makrides, A. Kyprianou & G.E. Georghiou
University of Cyprus, Nicosia, Cyprus

6DV.1.17 **I-V Characteristics of Broken Bypass Diode on PV Module**
S. Oke, H. Sakai & H. Tottori
NIT, Tsuyama College, Japan
I. Nanno & T. Hamada
NIT, Ube College, Japan
N. Ishikura
NIT, Yonago College, Japan
M. Fujii
NIT, Oshima College, Suo-oshima, Japan

6DV.1.18 **Influence of the Irradiance on the Detection and Performance of PID-Affected PV-Modules**
C. Buerhop-Lutz, T. Pickel, F. Wenz, J. Hauch & C. Camus
ZAE Bayern, Erlangen, Germany
C. Zetzmann
Rauschert, Pressig, Germany
C.J. Brabec
FAU, Erlangen, Germany

6DV.1.19 **Image Processing for Daylight Electroluminescence PV Imaging Acquired in Movement**
G.A. dos Reis Benatto, C. Mantel, N. Riedel, A. Alejo Santamaria Lancia, S. Thorsteinsson, P.B. Poulsen, S. Forchhammer, A. Thorseth & C. Dam-Hansen
Technical University of Denmark, Roskilde, Denmark
K.H.B. Frederiksen
Kenergy, Horsens, Denmark
J. Vedde
SiCon, Birkerod, Denmark
M. Larsen & H. Voss
Sky-Watch, Støvring, Denmark
H.R. Parikh, S.V. Spataru & D. Sera
AAU, Aalborg, Denmark

Thursday, 27 September 2018#

6DV.1.20 **Low-Cost Electroluminescence System for Infield PV Modules**
M. Abdullah Eissa
Helwan University, Giza, Egypt
J. Almeida Silva, J.M. Serra & K. Lobato
University of Lisbon, Portugal
A.M. Bassiuny
Helwan University, Cairo, Egypt

6DV.1.21 **A Health Check of the Italian Solar Photovoltaic Park Using Satellite-Based Solar Resource Data**
A. Virtuani
O'Sole, Milan, Italy
A. Skoczek & J. Betak
Solargis, Bratislava, Slovakia

6DV.1.22 **System Failure Analysis Tool for PV Plants – A Software Concept for Non-Specialists**
A. Horn, W. Mühleisen & C. Hirschl
CTR, Villach, Austria
R. Ebner
AIT, Vienna, Austria
M. Spielberger
PVSV, Guttaring, Austria
H. Sonnleitner
ENcome Energy Performance, Klagenfurt, Austria

6DV.1.24 **An Enhanced Fault Diagnosis Approach for PV Array Based on I-V Characteristics and Neural Networks**
M. Ouassaid & Y. Chouay
University Mohammed V-Agdal, Rabat, Morocco

6DV.1.25 **Evaluation of Irradiance Sensor Technologies for Plant Monitoring of PV Systems with CIGS Thin Film Modules**
S. Grünsteidl, P. Borowski & T. Dalibor
Avancis, Munich, Germany

6DV.1.27 **Delta Structure for Constant Daily Power Profile in PV Irrigation Systems**
R.H. Almeida, I.A. Barata Carrêlo, L. Narvarte Fernández & E. Lorenzo Pigueiras
UPM, Madrid, Spain

6DV.1.28 **Harmonized Data Collection from the Field**
D. Moser
EURAC, Bolzano, Italy
L. Azpilicueta
SOLARUNITED, Brussels, Belgium
L. Garreau-Iles
DuPont, Paris, France
G. Masson & G. Serra
Becquerel Institute, Brussels, Belgium

6DV.1.29 **Investigation on Response Characteristics of PV-PCS at Step Change in Solar Irradiance**
H. Konishi, J. Hashimoto & K. Otani
AIST, Koriyama, Japan

6DV.1.30 **A Decision Support System Based on Earth Observation Exploitation for Renewable Energy Plants Management**
A. Masini
Flyby, Livorno, Italy
C. Lanzetta
I-EM, Livorno, Italy
F. Bizzarri, G. Leotta, G.L. Giuliattini Burbui, P. Guerrisi & M.L. Lo Trovato
ENEL, Rome, Italy

6DV.1.32 **Review of Guidelines for PV System Performance and Degradations**
B.R. Paudyal, A.G. Imenes & T.O. Saetre
University of Agder, Grimstad, Norway

6DV.1.35 **Evaluation of 1 MW Arak Photovoltaic Power Plant According to IEC-61724 Standard**
A.A. Ghadimi, M. Pirzadi & A.A. Basiri
Arak University, Iran

6DV.1.38 **Observations in PV Module Operating Voltage Distribution Along a PV Array. An In-Deep Look on Mismatch Losses**
E. Lorenzo, C.H. Rossa & F. Martinez-Moreno
UPM, Madrid, Spain

6DV.1.39 **Web Platform of Real-Time Performance Monitoring and Smart Analysis PV Systems**
C. Ghannaj
ENSET, Rabat, Morocco
A. Benazzouz
IRESEN, Rabat, Morocco

6DV.1.41 **Estimation of the PV Output Power in the Various Setting Directions and Angles from the IV Characteristics of the Inclined PV Module**
K. Saito & M. Sato
Fukushima University, Japan
M. Kondo
AIST, Koriyama, Japan

6DV.1.42 **Performance Analysis of a Remote Hybrid PV System Based on Real and Modelled Data in Indonesia**
K. Kunaifi & A.H.M.E. Reinders
University of Twente, Enschede, Netherlands

6DV.1.43 **Yield of Small Roof-Top PV Systems in Germany 2017**
H. te Heesen & M. Rumpler
Trier University of Applied Sciences, Neubrücke (Nahe), Germany
V. Herbort
Ulm University of Applied Sciences, Germany

6DV.1.44 **Data-Filtering-Dependent Variability of Long-Term Degradation Rates of MW-Scale Photovoltaic Power Plants from "Non-Ideal" Monitoring and Weather Data**
C. Camus, M. Hüttner, J. Hauch & C.J. Brabec
ZAE Bayern, Erlangen, Germany
D. Lassahn & C. Kurz
Meteocontrol, Augsburg, Germany

6DV.1.45 **Performance of Si-Heterojunction Modules with Different Cell Interconnection and Module Technologies**
A. Titov, K. Emtsev, D. Andronikov, A. Abramov, E.I. Terukov & D. Orekhov
R&D Center TFTE, St. Petersburg, Russia
B. Bulygin & A. Dubrovskiy
Hevel Solar, Novocheboksarsk, Russia
I. Shakhray
Avelar Solar Technology, Moscow, Russia

6DV.1.46 **Cell-Level Analysis of Multi-Megawatt PV Plants**
J. Schlipf & A. Fladung
Aerial PV Inspection, Aachen, Germany

6DV.1.47 **Validation of PV System Performance Modelling in View of Köppen-Geiger-Photovoltaic Climate Classification**
J. Ascencio-Vásquez, K. Brecl & M. Topic
University of Ljubljana, Slovenia

Thursday, 27 September 2018#

6DV.1.49 **Double Diode Model of PV Panel for Power Estimation under Real Outdoor Conditions**
M. Kumar & A. Kumar
IIT Roorkee, India

6DV.1.50 **PV Power Prediction in Qatar Based on Machine Learning Approach**
K. Benhmed, F. Touati, M. Al-Hitmi, N.A. Chowdhury, A.Jr. San Pedro Gonzales, Y. Qiblawey & M. Benammar
Qatar University, Doha, Qatar

6DV.1.51 **Prioritization of Test Execution with Operational Profile Mechanism for Software Reliability of Solar Energy Monitoring System**
W.S. Jang, R.Y.C. Kim & B.K. Park
Hongik University, Sejong, Korea South

6DV.1.53 **Methods for Quality Control of Monitoring Data from Commercial PV Systems**
M.B. Øgaard, A. Skomedal, H. Haug & J.H. Krogh Selj
Institute for Energy Technology, Kjeller, Norway

6DV.1.54 **Novel Characterization of Indian Weather Zones for Study of PV Degradation**
P. Mundle & N. Shiradkar
IIT Bombay, Mumbai, India

6DV.1.55 **Impact of Environmental Factors on the Efficiency of a PV System: Case Study in Ouarzazate, Morocco**
K. Ettalbi, Z. Naimi & H. Bouzekri
Masen, Rabat, Morocco
I. Munoz Morales, M. Ezquer Mayo & A.R. Lagunas
CENER, Sarriguren-Navarra, Spain
M. Maaroufi
Mohammadia School of Engineering, Rabat, Morocco

6DV.1.56 **Performance Analysis and Evaluation of Different Grid-Connected Photovoltaic System Technologies in Bolivia, Chile and Germany**
L. Clasing & M. Raabe
Cologne University for Applied Sciences, Germany
U. Blieske & R. Gecke
Cologne University of Applied Sciences, Germany

VISUAL PRESENTATIONS 7DV.2

15:15 - 16:45 PV Economics and Markets / PV-Related Strategies and Societal Issues

7DV.2.1 **Implementation of Business Models for Renewable Energy Aggregators: Experience from the European Project BestRES**
S. Caneva, P. Alonso, S. Challet & I. Weiss
WIP - Renewable Energies, Munich, Germany

7DV.2.2 **Cooperatively-Owned Batteries as a Concept to Prevent Local Grid Congestion**
G. Leghissa, M.N. van den Donker, C. Tzikas & W. Folkerts
SEAC, Eindhoven, Netherlands
G.P.J. Verbong
Eindhoven University of Technology, Netherlands

7DV.2.3 **Solar PV Electrification in New Regions and the Globalized Energy Transition**
H.J.J. Yu
CEA, Gif-sur-Yvette, France

7DV.2.5 **Impact of PV Power Loss/Gain on PV Power Cost and PV Adoption**
N. Mohandes, A. Elrayyah, A. Sanfilippo & A. Boumaiza
QEERI, Doha, Qatar

7DV.2.7 **Status of Building Integrated Photovoltaics (BIPV) in Latin America and the Case of Suriname**
A. Raghoebarsing
Anton de Kom University of Suriname, Paramaribo, Suriname
A.H.M.E. Reinders
University of Twente, Enschede, Netherlands

7DV.2.8 **Introducing the Super PV Project - Cost Reduction and Enhanced Performance of PV Systems**
J. Ulbikas
PROTECH, Vilnius, Lithuania
J. Denafas
Soli "Tek R&D", Vilnius, Lithuania
M. Köntges
ISFH, Emmerthal, Germany
M. Topic
University of Ljubljana, Slovenia
F. Frontini
SUPSI, Canobbio, Switzerland
P. Macé
Becquerel Institute, Brussels, Belgium
P.J. Bolt
TNO, Eindhoven, Netherlands
A.G. Ulyashin
SINTEF, Oslo, Norway
T. Haarberg
BNW-Energy, Trondheim, Norway
W. Palitzsch
Loser Chemie, Zwickau, Germany
B. Terheiden
University of Konstanz, Germany
I. Weiss
WIP - Renewable Energies, Munich, Germany

7DV.2.9 **Grid Connected PV Systems in Spain: An Economic Assessment with Sensitivity Analysis**
R. Peña, A.M. Diez-Pascual, P. Garcia Díaz & J.A. Luceño Sánchez
UAH, Madrid, Spain

7DV.2.12 **DuraMAT: The Durable Module Materials Consortium**
T.M. Barnes, D.S. Ginley, P. Hacke, M. Woodhouse & M. Owen-Bellini
NREL, Golden, United States
M. Gordon, K. Leung & B.H. King
Sandia National Laboratories, Albuquerque, United States
M. Hartney & M.F. Toney
SLAC, Palo Alto, United States
A. Jain
LBNL, Berkeley, United States

7DV.2.13 **Calculating the Cost of Distribution Grid Upgrades Required to Accommodate Current and Future Levels of PV Deployment in the UK**
S. Few, P. Djapic, G. Strbac, J. Nelson & C. Candelise
Imperial College London, United Kingdom

7DV.2.16 **Building on CrowdFundRES: CrowdFunding the Energy Transition**
P. Alonso, S. Caneva & I. Weiss
WIP - Renewable Energies, Munich, Germany

7DV.2.17 **Market Potential of TIPV Applications and Opportunities for the PV Industry**
P. Macé, G. Masson & C. Cambiè
Becquerel Institute, Brussels, Belgium

Thursday, 27 September 2018#

7DV.2.23 **Addressing PV Overvoltage and Backwards Flow Problems with Policy**
G.T. Currie, I. Mareels, C. Duffield & R. Evans
University of Melbourne, Parkville, Australia

7DV.2.25 **Patterns of Sectoral Diffusion of Solar Photovoltaics: A Comparative Analysis in UK**
A.-M. Bunea
IMT Institute for Advanced Studies, Lucca, Italy
P. Della Posta & P. Manfredi
University of Pisa, Italy

7DV.2.26 **Impacts of Socio-Economic Policies on Temporal Diffusion of PV-Based Communal Grids in a Rural Developing Community**
N. Opiyo
University of Southampton, United Kingdom

7DV.2.29 **SOLAR-ERA.NET Cofund - European Network of National and Regional Research and Innovation Programmes - Recent Developments of Joint Transnational Calls**
S. Nowak, M. Gutschner & T. Biel
NET Nowak Energy & Technology, St. Ursen, Switzerland
S. Oberholzer
Swiss Federal Office of Energy, Bern, Switzerland
C. Hünnekes, H. Bastek & R. Horbelt
Forschungszentrum Jülich, Germany
S. Falcón Morales
MINECO, Madrid, Spain
L. Gómez
FECYT, Coruña, Spain
G. del Rio
CDTI, Madrid, Spain
P.-J. Rigole & T. Walla
Swedish Energy Agency, Eskilstuna, Sweden
O. Bernsen
RVO, Den Haag, Netherlands
I. Sergidou-Loizou
RPF, Lefkosia, Cyprus
T. Carrere
ADEME, Paris, France
K. Karaösz
TUBITAK, Gebze, Turkey
A. Goodbrook
InnovateUK, Swindon, United Kingdom
J. Osinski
NCBR, Warszaw, Poland
E. Lutter
Climate and Energy Fund, Vienna, Austria
A. Hipfinger
FFG, Vienna, Austria
U. Rohrmeister
BMVIT, Vienna, Austria

7DV.2.31 **Education for Stand-Alone Photovoltaic System Projects Financed by Governments in Developing Countries: The Case of the Río Ibáñez Commune in the Aysén Region, Patagonia, Chile**
J.C. Osorio-Aravena
Austral University of Chile, Coyhaique, Chile
E. Muñoz-Cerón
University of Jaén, Spain

7DV.2.32 **BIPV Courseware for Higher Education and Professionals**
M. Tabakovic & H. Fechner
UAS Technikum Wien, Vienna, Austria
J. van Leeuwen, E. Bontekoe, W.G.J.H.M. van Sark & A. Louwen
Utrecht University, Netherlands
I. Weiss & S. Arancón
WIP - Renewable Energies, Munich, Germany
G.E. Georghiou, G. Makrides & M. Hadjipanayi
University of Cyprus, Nicosia, Cyprus
E. Loucaidou & M. Ioannidou
Deloitte, Lemassol, Cyprus

7DV.2.34 **Enhancing Solar Research by Using ICT and Explorative Web-Based Methods for Communication, Education and Training**
C.S. Polo López, F. Frontini & P. Bonomo
SUPSI, Canobbio, Switzerland

7DV.2.36 **The Potential of Webinars as a Dissemination and Training Tools in Photovoltaics Among Communities of Scientists, Students, Professionals, Stakeholders**
F. Roca, D. Casaburi, F. Ammirati & F. Beone
ENEA, Portici, Italy
K. Bittkau
Forschungszentrum Jülich, Germany
C. del Cañizo
UPM, Madrid, Spain
E. Simonot
KIC InnoEnergy Iberia, Barcelona, Spain

7DV.2.37 **Trends in Employment Factors for the PV Value Chain and Implications for EU Jobs**
N. Taylor, P. Ruiz Castello, V. Czako & A. Jäger-Waldau
European Commission JRC, Petten, Netherlands

7DV.2.38 **Human Capital for the Global PV Revolution: Experiences with Online BSc and MSc Education in Solar Energy Engineering**
A.H.M. Smets
Delft University of Technology, Netherlands

7DV.2.39 **Photovoltaic Generation in the Spanish Electrical System and Its Impact on Agriculture of Irrigation. Regulations, Current Situation and Limitations**
J.P. Chazarra Zapata, A. Ruíz Canales & F.J. López Peñalver
University Miguel Hernandez, Alicante, Spain
R. Egea Pérez
Alicante University, Spain
F.J. Pérez de la Cruz
Polytechnic University of Cartagena, Murcia, Spain

7DV.2.40 **Energy and Climate Change**
M.I. Rabiou
CODDAE, Niamey, Niger

7DV.2.41 **Enterprise Europe Network Sector Group Intelligent Energy and Sustainable Constructions Helping Companies in Photovoltaics Innovate and Grow Internationally**
S. Angloher-Reichelt
Bayern Innovativ, Nuremberg, Germany
K. Tzitzinou
FING, Thessaloniki, Greece
F. Roca
ENEA, Portici, Italy

Thursday, 27 September 2018#

VISUAL PRESENTATIONS 2DV.3

17:00 - 18:30 **Thin Film and Foil-Based Si Solar Cells / Characterisation & Simulation Methods for Si Cells / Manufacturing & Production of Si Cells**

2DV.3.1 **Homogeneous Deposition of High Purity Silicon Thin Films with Highest Rates above 30 µm/min**
S. Saager & B. Scheffel
Fraunhofer FEP, Dresden, Germany

2DV.3.2 **Large Area Deposition of P, I and N Single Layer of Amorphous Silicon Thin Films Solar Cells Prepared by PECVD**
K. Belrhiti Alaoui, S. Laalioui & B. Ikken
IRESEN, Rabat, Morocco
A. Outzourhit
Cadi Ayyad University, Marrakech, Morocco

2DV.3.3 **High-Performing Photonic-Structured ARCs Enabling Pronounced Efficiency Enhancement in a-Si Thin Film Solar Cells**
O. Sanchez-Sobrado, M.J. Mendes, S. Haque, T. Mateus, H. Águas, E. Fortunato & R. Martins
New University of Lisbon, Caparica, Portugal

2DV.3.4 **Structural Study of Nickel Silicide Formation Using Ni/a-Si/c-Si and a-Si/Ni/a-Si/c-Si Multilayers Prepared by RF Sputtering for Photovoltaic Application**
A. Agdad, A.-I. El Khalfi, A. Tchenka, M. Azizan, E. Ech-Chamikh & Y. Ijdiyaou
Cadi Ayyad University, Marrakech, Morocco

2DV.3.5 **PEDOT:PSS Window Layer for a-Si:H Thin Film Solar Cells on Flexible Substrates**
Y. Lee, M. Shin & J. Lee
Korea Aerospace University, Goyang, Korea South
S.J. Yun, G. Kim & J.W. Lim
ETRI, Daejeon, Korea South

2DV.3.6 **Optimizing the Transparent Electrode Structure in a-Si:H Solar Cells for Low Angular Dependence of Incident Light for BIPV Windows**
G. Kim & J.W. Lim
ETRI, Daejeon, Korea South
Y. Lee & M. Shin
Korea Aerospace University, Goyang, Korea South

2DV.3.7 **Enhanced Efficiency of Crystalline Si Solar Cells Based on Kerfless-Thin Wafers with Nanohole Arrays**
H.-S. Lee, J. Suk, H. Kim, J. Kim, J. Song, D.S. Jeong, J.-K. Park, W.M. Kim, D.-K. Lee, T.S. Lee & I. Kim
KIST, Seoul, Korea South
K.J. Choi
UNIST, Ulsan, Korea South
B.-K. Ju
Korea University, Seoul, Korea South

2DV.3.8 **Study on Bowing Phenomenon According to Thickness of Front/Back-Side Electrode of Thin C-Si Solar Cell**
J.-R. Lim, H.-J. Song, S.H. Ko, W.G. Shin, H. Hwang, Y.C. Ju, H.S. Yun & G.H. Kang
KIER, Daejeon, Korea South

2DV.3.13 **Validity Analysis of the Textbook Lumped Series Resistance Approach for Solar Cells**
A.S.H. van der Heide
imec, Leuven, Belgium

2DV.3.15 **Cross-Sectional Workfunction Measurements on Solar Cell Structures Under Light-Controlled Conditions**
F. Yamada, T. Kamioka, Y. Ohshita & I. Kamiya
Toyota Technological Institute, Nagoya, Japan

2DV.3.16 **A Simulation Study of LID Loss in p-Type Monocrystalline Silicon Solar Cells**
C.-M. Wei, Y.-C. Lai & C.-C. Li
Motech Industries, Tainan City, Taiwan

2DV.3.18 **Theoretical Simulation of Carbon Nanotubes – Amorphous Silicon Hybrid Solar Cells**
H. Meddeb, O.V. Sergeev, M. Vehse & C. Agert
DLR, Oldenburg, Germany
P.M. Rajanna & A.G. Nasibulin
Skoltech, Moscow, Russia

2DV.3.19 **Fundamental and Technological Limits to Low-Light Efficiency of Crystalline Silicon Solar Cells**
B. Conrad & A.P. Amalathas
CTU, Prague, Czech Republic
J. Holovsky
ASCR, Prague, Czech Republic

2DV.3.20 **Silicon Failure under Complex Loadings**
M. Fourmeau, M. Wang & D. Nelias
INSA Lyon, Villeurbanne, France

2DV.3.21 **Series Resistance Breakdown of Silicon Heterojunction Solar Cells Produced on CEA-INES Pilot Line**
L. Basset, W. Favre & R. Varache
CEA, Le Bourget du Lac, France
J.-P. Vilcot
IEMN, Villeneuve d'Ascq, France

2DV.3.22 **A New Analysing Approach for Periodically Textured c-Si Solar Cells**
S.H. Altinoluk
Mugla University, Turkey
H.E. Çiftpinar, O. Demircioglu & R. Turan
METU, Ankara, Turkey

2DV.3.23 **Electrical and Optical Characterization of e-Beam Evaporated Poly-Si Films as an Alternative Emitter Layer for Solar Cell Applications**
S.H. Sedani, O.F. Erdem & R. Turan
METU, Ankara, Turkey

2DV.3.24 **Evaluation of the Lateral Homogeneity of the Light Field of Solar Simulators**
M. Turek & S. Eiternick
Fraunhofer CSP, Halle (Saale), Germany

2DV.3.25 **Simulations of Optimal Solar Cell Architecture and Material Parameters for Silicon Heterojunction Cells on Quasi-Mono Substrate: Strategies for Obtaining Efficiencies over 20%**
Y. Smirnov, V.N. Verbitskiy, I. Nyapshaev, D. Andronikov, A. Abramov & E.I. Terukov
R&D Center TFTE, St. Petersburg, Russia

2DV.3.26 **Physical Device Simulation of Dopant-Free Silicon Solar Cell Based on Hole-Selective Molybdenum Oxide and Electron-Selective Titanium Oxide**
H. Mehmood
NUST, Islamabad, Pakistan
T. Tauqeer
ITU, Lahore, Pakistan
H. Nasser & R. Turan
METU, Ankara, Turkey

#

Thursday, 27 September 2018#

2DV.3.27 **Inline Wafer Identification Using Optical Character Recognition (OCR)**
S. Al-Hajjawi, T. Hammer & J. Haunschild
Fraunhofer ISE, Freiburg, Germany

2DV.3.28 **Optical and Electrical Behaviour of Dislocations in Monolike Silicon Solar Cells**
D. Ory
EDF R&D, Palaiseau, France
O. Lafont & L. Lombez
IPVF, Palaiseau, France

2DV.3.29 **Image Recognition of Etch Pits on As-Sliced Surface of Multicrystalline Silicon Using Machine Learning**
T. Kojima, K. Onishi & A. Ogura
Meiji University, Kawasaki, Japan
K. Fukui, M. Komoda & J. Atobe
Kyocera, Higashiomi, Japan

2DV.3.30 **Spectral Optical Characteristics of Silicon Nanowire System: Simulative Prediction Followed by Experiments**
M.K. Hossain, A. Wajeeh & B. Salhi
KFUPM, Dhahran, Saudi Arabia

2DV.3.31 **Study of Inhibition Amorphous Incubation Layer in n an p Doped µc-Si:H Thin Films by Optical Methods and Electron Microscopy**
F.E. Rojas Tarazona
Pontifical Xavierian University, Bogotá, Colombia
F. Villar Lopez, J.M. Asensi & J. Bertomeu
UB, Barcelona, Spain

2DV.3.32 **Application of Genetic Algorithm Parameter Optimization on Current-Voltage Data of Multi-Crystalline Silicon Solar Cells**
R. Dix-Peek, E.E. van Dyk, F.J. Vorster & C.J. Pretorius
Nelson Mandela University, Port Elizabeth, South Africa

2DV.3.33 **Silver Nanoparticles on Substrate and Superstrate: Fabrication and Numerical Analysis for Solar Cell Applications**
M.K. Hossain & A. Wajeeh
KFUPM, Dhahran, Saudi Arabia

2DV.3.34 **Spectral Characterization of Temperature Increase in Encapsulated Crystalline Silicon Solar Cells**
J. Bengoechea, I. Urrea, E. Zugasti & A.R. Lagunas
CENER, Navarra, Spain

2DV.3.36 **Electroluminescence Imaging and Light-Beam Induced Current as Characterization Techniques of Multi-Crystalline Si Solar Cells**
L.A. Sánchez, A. Moretón, S. Rodríguez-Conde, M. Guada, O. Martínez & J. Jiménez
UVa, Valladolid, Spain

2DV.3.38 **IV-Measurements of Bifacial Solar Cells in an Inline Solar Simulator with Double-Side Illumination**
A. Krieg, N. Wöhrle, J.M. Greulich, M. Rauer & S. Rein
Fraunhofer ISE, Freiburg, Germany
K. Ramspeck & D. Dzafic
h.a.l.m. elektronik, Frankfurt am Main, Germany

2DV.3.39 **An Examination into the Optical Coupling between Light Funnel Arrays and Underlying Substrates**
A. Prajapati, Y. Nissan, T. Gabay & G. Shalev
BGU, Beer-Sheva, Israel

#

2DV.3.40 **Efficient Light Trapping with Light Funnel Arrays**
A. Prajapati, Y. Nissan, T. Gabay & G. Shalev
BGU, Beer-Sheva, Israel

2DV.3.43 **GÜNAM Photovoltaic Line (GPVL) - A Pilot Research Line for PERC/PERL/PERT Concepts**
F. Es, E. Semiz & R. Turan
METU, Ankara, Turkey

2DV.3.44 **Over 22.0% Efficiency for the p-Type Mono Silicon PERC Solar Cells by Industrial Mass Production Technology**
C.-W. Kuo, T.-M. Kuan, W.-L. Chueh, C.-J. Li, L.-G. Wu, C.-C. Huang & C.-Y. Yu
TSEC, Hsinchu, Taiwan

2DV.3.45 **Optimization of Rear Pattern for p-Type Mono Bifacial PERC Cells in Mass Production**
H. Li, Z. Zhang, T. Jia, C. Yu, Q. Ma & Q. Xu
Dongfang Huansheng Photovoltaic, Yixing, China

2DV.3.46 **70% Bifaciality Industrial p-Type mc-Si Bifacial PERC Solar Cell**
J. Dong, X. Chen, Y. Zhang, J. Lv, Z. Shen, J. Li, Q. Ye, W. Wei, W. Wang, S. Yuan, J. Sheng, X. Zhou & C. Zhang
GCL System Integration Technology, Suzhou, China

2DV.3.48 **Magnetron Sputtered TCO-Layers for Industrial Production of Heterojunction Silicon Solar Cells**
R. Korn, S. Hübner, M. Huber & P. Wohlfart
Singulus Technologies, Kahl am Main, Germany

2DV.3.49 **Atmospheric Pressure Chemical Vapor Deposition of in-Situ Doped Amorphous Silicon Layers for Passivating Contacts**
A. Merkle, B. Min, R. Brendel & R. Peibst
ISFH, Emmerthal, Germany
S. Seren, H. Knauss & R. Nissler
SCHMID Group, Freudenstadt, Germany
J. Steffens & B. Terheiden
University of Konstanz, Germany

2DV.3.50 **Printed Dopant Sources for Locally-Doped SiOx/Poly-Si Passivating Contacts**
Z. Kiaee, C. Reichel, M. Jahn, F. Feldmann, R. Keding, M. Hermle & F. Clement
Fraunhofer ISE, Freiburg, Germany

2DV.3.51 **19.2% Efficiency of Industrial Multi-Crystalline Silicon Solar Cell with MCCE Textured**
H. Wang, Z. Xu, F. Lang, Y. Wang, J. Liu, F. Li, J. Shi & D. Song
Yingli Green Energy, Baoding, China

2DV.3.52 **Metal-Free Texturing for Diamond-Wire-Sawn Multi-Crystalline Silicon (DWS-mc)**
C. Schmitt, B. Zhou, B. Straub, B. Burgenmeister, A. Pediaditakis, B.-U. Sander & H. Kühnlein
RENA, Freiburg, Germany

2DV.3.53 **MCCE Textured Multicrystalline and Monocrystalline Silicon Solar Cells**
W. Jooss, I. Melnyk, A. Teppe, J. Jung König, S. Madugula, O. Voigt, F. Binaie Masouleh & P. Fath
RCT-Solutions, Konstanz, Germany

2DV.3.54 **Anisotropic Etching of Monocrystalline Silicon Wafer without Formation of Hydrogen**
A. Stapf, K. Halbfaß, P. Nattrodt, B. Neubert & E. Kroke
Freiberg University of Technology, Germany

Thursday, 27 September 2018#

2DV.3.55 **Improvement of Emitter Characterization for Industrial PERC Solar Cell**
C.-S. Park, N.R. Oh, D.K. Kim, J.-M. Yeon, K. Hong, E.-J. Lee & D.-S. Kim
Shinsung Solar Energy, Chungcheongbuk-do, Korea South

2DV.3.56 **Phosphorus and Boron Co-Diffusion in Silicon for p-PERT Solar Cells Application**
N. Khelifati & D. Bouhafs
CRTSE, Algiers, Algeria
I. Charif
USTHB, Algiers, Algeria
S.-E.-H. Abaidia
UMBB, Boumerdes, Algeria

2DV.3.57 **Gentle and Damage Free Ablation of Dielectric Layers Using a Femtosecond Laser Source for High Efficiency Silicon Wafer Solar Cells**
J.M. Yacob Ali, V. Shanmugam, A.G. Aberle & T. Mueller
SERIS, Singapore, Singapore

2DV.3.58 **Improvement of Solar Cell Efficiencies for Ultrashort-Pulse Laser Contact Opening with Ni-Cu Plated Contacts by Optimized LCO-FFO Processing Order**
V. Arya, S. Kluska, S. Gutscher, G. Cimiotti, J.-F. Nekarda & A.A. Brand
Fraunhofer ISE, Freiburg, Germany

2DV.3.59 **Low Temperature Silver-Copper Paste Printed on Bus-Bar Electrodes of Passivated Emitter and Rear Cell**
K.-Y. Wu, C.-H. Chen, H.W. Lu, C.-H. Chen, X.-W. Wu & C.-H. Du
ITRI, Hsinchu, Taiwan

2DV.3.61 **PVD Metallization for High-Efficiency c-Si Solar Cells: Scenario for Implementation in Production**
A. Hain, M. Dörr, M. Huber & P. Wohlfart
Singulus Technologies, Kahl am Main, Germany
H. Nagel
Fraunhofer ISE, Freiburg, Germany
T. Buck & Z.-W. Peng
ISC Konstanz, Germany

2DV.3.62 **Deep Learning Approach to Inline Quality Rating and Mapping of Multi-Crystalline Si-Wafers**
M. Demant, A.S. Kovvali & S. Rein
Fraunhofer ISE, Freiburg, Germany
P. Virtue & S.X. Yu
University of California, Berkeley, United States

2DV.3.63 **Ultrafast In-Line Regeneration for Cz-Si PERC Solar Cells and Stability Testing**
K. Krauß, S. Roder, J.-F. Nekarda & S. Rein
Fraunhofer ISE, Freiburg, Germany
P. Wild & S. Schörner
Rehm Thermal Systems, Blaubeuren, Germany

2DV.3.64 **Temperature Dependence and Low Light Performance of Various Types of Silicon Solar Cells**
Y.Y. Hu, Y. Yang, G.C. Xu, L.J. Chen, L.X. Liu, P.P. Altermatt & Z. Feng
Trina Solar Energy, Changzhou, China

2DV.3.65 **Screen Printed Thick Film Metallization of Silicon Solar Cells - Recent Developments and Future Perspectives**
A. Lorenz, M. Linse, D. Erath & F. Clement
Fraunhofer ISE, Freiburg, Germany
H. Frintrup
Hans Frintrup, Bonn, Germany
M. Lehner
Lehner Engineering, Engelburg, Switzerland
M. König
Heraeus Deutschland, Hanau, Germany
R. Greutmann & H. Brocker
Gallus Ferd. Rüesch, St. Gallen, Switzerland

2DV.3.66 **Results of the Project "AdmMo" – Cell and Module Development towards a 318 W Module**
J.-F. Nekarda, A. Brand, M. Linse, F. Meyer, F. Clement & R. Preu
Fraunhofer ISE, Freiburg, Germany
J. Schneider & C. Hagendorf
Fraunhofer CSP, Halle, Germany
T. Urban, M. Müller & J. Heitmann
Freiberg University of Technology, Germany
M. Ehrl
Freiberg University of Technology, Freiebrg, Germany
C. Yüce & N. Willenbacher
Karlsruhe Institute of Technology, Germany
T. Große
Meyer Burger, Hohenstein-Ernstthal, Germany
R. Böhme
InnoLas Solutions, Krailling, Germany
M. König
Heraeus, Hanau, Germany
H. Frintrup
Hans Frintrup, Bonn, Germany
P. Fuss-Kailuweit
WAVELABS, Münster, Germany
A. Mette & J.W. Müller
Hanwha Q CELLS, Bitterfeld-Wolfen, Germany

2DV.3.68 **335W Heterojunction Record Module with Smart Wire Cell Technology**
M. König, A. Waltinger & H. Mehlich
Meyer Burger, Hohenstein-Ernstthal, Germany
B. Bonnet-Eymard & G. Marti
Meyer Burger, Gwatt (Thun), Switzerland

2DV.3.69 **Mass Production of Ga-Doped p-Type Cz-Silicon PERC Solar Cells Approaching 21.6% Efficiency**
H. Wang, C. Chen, J. Yang, W. He & H. Yang
Xi'an Jiaotong University, China
J. Lv
LONGi Solar, Xi'an, China

2DV.3.70 **Towards the Mass Production of High Efficiency Passivated Contacts n-Type PERT Solar Cells**
B. Martel, T. Blevin & C. Bouet
CEA, Le Bourget du Lac, France
J. Yang, J.C. Loretz & S. Tran
SEMCO, Montpellier, France

2DV.3.71 **Industrial Solutions to Mitigate Light-Induced Degradation in mc-PERC Cells and Modules**
J. Wu, Z. Yao, D. Zhang, G. Xiong, F. Jiang, J. Sun, J.-N. Jaubert & G. Xing
Canadian Solar, Suzhou, China

Thursday, 27 September 2018#

2DV.3.72 **High-Efficiency Diamond Wire-Sawn mc-Si-based PERC Solar Cells Textured by Atmospheric Pressure Dry Etching**
B. Kafle, A.I. Ridoy, P. Saint-Cast & M. Hofmann
Fraunhofer ISE, Freiburg, Germany
L. Clochard & E. Duffy
Nines Photovoltaics, Dublin, Ireland
K. Duncker, K. Petter & S. Peters
Hanwha Q CELLS, Bitterfeld-Wolfen, Germany