8th WORLD CONFERENCE
ON PHOTOVOLTAIC ENERGY CONVERSION

26 – 30 SEPTEMBER 2022
MILANO CONVENTION CENTRE · MILAN · ITALY

CONFERENCE PROGRAMME

EU PVSEC | PVSEC | IEEE PVSC
European Photovoltaic Solar Energy Conference and Exhibition |
International PV Science and Engineering Conference |
Photovoltaic Specialists Conference

WCPEC-8 is hosted by EU PVSEC

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.wcpec-8.com.

(i) = invited

MONDAY, 26 SEPTEMBER 2022

MONDAY MORNING

COFERENCE OPENING

Plenary Presentations 3AP.1

08:30- 09:30 Reliable and High Performance PV Modules

Chairpersons:

Werner HERRMANN *(i)*
TÜV Rheinland, Cologne, *Germany*

Robert P. KENNY *(i)*
European Commission JRC, Ispra, *Italy*

3AP.1.1

Investigation of Technology Evolution of PV Industry: Learning from Historical and Recent Progress

Yifeng Chen[1], Le Wang[1], Sam Lee[1], Daming Chen[1], Xueling Zhang[1], Pietro P. Altermatt[1], Zhiqiang Feng[1], Pierre Verlinden[1;2;3]

[1]Trina Solar, Changzhou, China; [2]AMROCK, QLD , Australia; [3]UNSW, NSW, Australia

3AP.1.2

Evaluation of Bifacial Module Technologies with Combined-Accelerated Stress Testing (C-AST)

Peter Hacke[1], Akash Kumar[2], Ashwini Pavgi[2], Sergiu V. Spataru[3], Kaushik Roy-Choudhury[4], Govindasamy Tamizhmani[2]

[1]NREL, Golden, CO, United States; [2]Arizona State University, Mesa, AZ, United States; [3]DTU Fotonik, Roskilde, Denmark; [4]DuPont, Wilmington, DE, United States

3AP.1.3

Blind Photovoltaic Modeling Intercomparison

Marios Theristis[1], Joshua S. Stein[1], Nicholas Riedel-Lyngskær[2], Leonardo Micheli[3], Lelia Marie Deville[1], Mark Campanelli[4], Rajiv Daxini[5], Anton Driesse[6], William B. Hobbs[7], Heather Hodges[7], Javier Ramirez Ledesma[8], Ismael Lokhat[9], Brendan Mccormick[10], Bin Meng[11], Bill Miller[7], Silvana Ayala Pelaez[12], Megan Parker[7], Jesús Polo[13], Daniel Powell[14], Miguel Angel del Pozo[15], Matthew Prilliman[12], Steve Ransome[16], Martin Schneider[17], Branislav Schnierer[18], Bowen Tian[11], Frederik Werder[19], Robert Williams[20], Bruno Wittmer[21], Julio Yuzo[22], Changrui Zhao[23]

[1]Sandia National Laboratories, Albuquerque, United States; [2]Technical University of Denmark, Roskilde, Denmark; [3]University of Jaén, Jaén, Spain; [4]Intelligent Measurement Systems, Bozeman, United States; [5]University of Nottingham, Nottingham, United Kingdom; [6]PV Performance Labs, Freiburg, Germany; [7]Southern Power, Birmingham, United States; [8]UPM, Madrid, Spain; [9]Cythelia Energy, La Motte-Servolex, France; [10]Solphi Engineering, Savannah, United States; [11]Eindhoven University of Technology, Eindhoven, The Netherlands; [12]NREL, Golden, United States; [13]CIEMAT, Madrid, Spain; [14]Intersect Power, Oakland, United States; [15]Qualifying Photovoltaics, Madrid, Spain; [16]Steve Ransome Consulting, Kingston upon Thames, United Kingdom; [17]Terabase Energy Inc., Berkeley, United States; [18]Solargis, Bratislava, Slovakia; [19]Valentin Software, Berlin, Germany; [20]NEO Virtus Engineering, Littleton, United States; [21]Pysyst, Satigny, Switzerland; [22]Fotovoltec Solar Engineering, Londrina, Brazil; [23]CSI Solar, Jiangsu, China

10:00- 12:35

Award/Prize Ceremony

Opening Addresses

Moderated Panel Discussion

**Detailed programme will be published soon*

Oral Presentations 2AO.1

13:30- 15:00 Advanced Modelling and Computational Methods

Chairpersons:

Iñigo RAMIRO *(i)*
University of Lisbon, Caparica, *Spain*

Tonio BUONASSISI *(i)*
MIT, Cambridge, *United States*

2AO.1.1

Loss Analysis of Tandem Solar Cells in PV Systems Under Realistic Operating Conditions

Malte Vogt[1], Youri Blom[1], Carlos Mario Ruiz Tobon[1], Miro Zeman[1], Rudi Santbergen[1], Olindo Isabella[1]

[1]Delft University of Technology, Delft, The Netherlands

2AO.1.2

RayFlare: A Powerful and Flexible Open-Source Modelling Tool for Solar Cells

Phoebe Pearce[1], Nicholas Ekins-Daukes[1]

[1]UNSW, Sydney, Australia

2AO.1.3

Machine Learning for Accelerated Analyses of Time-resolved Photoluminescence Data Via Bayesian Inference

Calvin Fai[1], Anthony J.C. Ladd[1], Charles Hages[1]

[1]University of Florida, Gainesville, United States

2AO.1.4

Machine Learning-Based Additives Optimization for Single-Crystal Perovskite Synthesis

Noor Titan Putri Hartono[1;2], Mansoor Ani Najeeb Nellikkal[3], Zhi LI[4], Emory Chan[4], Joshua Schrier[5], Alexander Norquist[3], Tonio Buonassisi[6]

[1]HZB, Berlin, Germany; [2]HZB, Cambridge, United States; [3]Haverford College, United States; [4]Lawrence Berkeley National Laboratory, United States; [5]Fordham University, United States; [6]MIT, Cambridge, United States

2AO.1.5

A Machine Learning Strategy for Analysing PERC and TOPCon Solar Cells in Mass-Production

Hannes Wagner-Mohnsen[1], Bernhard Klöter[1], Bernhard Mitchell[1], Daming Chen[2], Yifeng Chen[2], Pietro P. Altermatt[2]

[1]WAVELABS, Leipzig, Germany; [2]Trina Solar, Changzhou, China

2AO.1.6

Impact of Lateral Effects on large Scale Perovskite/Silicon Tandem Solar Cell Performance

S. Kasimir Reichmuth[1;2], Andreas Fell[1], Gerald Siefer[1], Michael Schachtner[1], David Chojniak[1], Oliver Fischer[1;2], Michael Rauer[1], Jochen Hohl-Ebinger[1], Martin C. Schubert[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany; [2]University of Freiburg, Freiburg im Breisgau, Germany

Oral Presentations 1AO.4

13:30- 15:00 Silicon Materials and Limiting Defects

Chairpersons:

Deren YANG *(i)*
Zhejiang University, Hangzhou, *China*

Nathan STODDARD *(i)*
Leading Edge Crystal Technologies, Wilmington*, United States*

1AO.4.1

Progress in the Development of Upgraded Metallurgical Silicon Solar Cells for Industrial Production

Carlos del Cañizo[1], David Fuertes Marrón[1], Nerea Dasilva-Villanueva[1], Manuel Funes[1], Juan José Torres[1], Bo-Kyung Hong[1], Bülent Arikan[2], Hasan Hüseyin Canar[2], Rasit Turan[2;3], Hasan Asav[2], Ahmet Emin Keçeci[2], Sümeyye Koçak Bütüner[2], Guillermo Sánchez Plaza[4], Laura Méndez[5], Eduardo Forniés[5]

[1]UPM, Madrid, Spain; [2]GÜNAM, Turkey; [3]METU, Turkey; [4]Valencia Polytechnic University, Valencia, Spain; [5]Aurinka PV, Rivas-Vaciamadrid, Spain

1AO.4.2

Epitaxially Grown p-Type Silicon Wafers Ready for Cell Efficiencies Exceeding 25 %

Clara Rittmann[1], Jonas Dalke[1], Bernd Steinhauser[1], Armin Richter[1], Marion Drießen[1], Florian Schindler[1], Charlotte Weiss[1], Martin C. Schubert[1], Stefan Janz[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany

1AO.4.3

Design of a Growth Process of High-Quality Quasi-Monocrystalline Silicon Ingot Integrating Experimental, Theoretical, Computational, and Data Sciences

Noritaka Usami[1], Xin Liu[1], Yusuke Fukuda[1], Hiroyuki Tanaka[1], Kentaro Kutsukake[2], Takuto Kojima[3]

[1]Nagoya University, Nagoya, Japan; [2]RIKEN, Tokyo, Japan

1AO.4.4

High Lifetime Ga Doped CZ-Si for Carrier Selective Junction Solar Cells

Jörg Horzel[1], Sebastian Mack[1], Sattar Bashardoust[1], Dirk Wagenmann[1], Jochen Rentsch[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany

1AO.4.5

Investigating the Impurity Gettering Effect in Polycrystalline-Silicon Based Passivating Contacts

Zhongshu Yang[1], Jan Krügener[2], Frank Feldmann[3], J.-I. Polzin[3], Bernd Steinhauser[3], Tien Le[1], Daniel Macdonald[1], Anyao Liu[1]

[1]ANU, Canberra, Australia; [2]Leibniz University of Hannover, Germany; [3]Fraunhofer ISE, Germany

1AO.4.6

Study on the Dissociation of Gallium-Hydrogen Pairs in Crystalline Silicon During Illuminated Annealing

Jochen Simon[1], Axel Herguth[1], Fabian Geml[1], Giso Hahn[1]

[1]University of Konstanz, Konstanz, Germany

Oral Presentations 4AO.7

13:30- 15:00 Vehicle and Road Integrated Photovoltaics

Chairpersons:

Bonna NEWMAN *(i)*
TNO Energy Transition, Petten, *The Netherlands*

Kenji ARAKI *(i)*
University of Miyazaki, Miyazaki, *Japan*

4AO.7.1

Analysis for Potential of High-Efficiency and Low-cost Vehicle Integrated Photovoltaics

Masafumi Yamaguchi[1], Taizo Masuda[2], Kenichi Okumura[3], Akinori Satou[3], Takashi Nakado[4], Kazumi Yamada[4], Tsutomu Tanimoto[5], Yusuke Zushi[5], Kenji Araki[6], Yasuyuki Ota[6], Kensuke Nishioka[6], Kyotaro Nakamura[7], Ryo Ozaki[7], Nobuaki Kojima[8], Yoshio Ohshita[8]

[1]Toyota Technological Institute, Nagoya, Japan; [2]TotalEnergies, Susono, Japan; [3]Toyota, Susono, Japan; [4]Toyota, Toyota, Japan; [5]Nissan Motor, Yokosuka, Japan; [6]University of Miyazaki, Miyazaki, Japan

4AO.7.2

VIPV Irradiation Modelling and Verification with Measured Travel Data

Evgenii Sovetkin[1], Neel Patel[1], Andreas Gerber[1], Bart E. Pieters[1]

[1]Forschungszentrum Jülich, Jülich, Germany

4AO.7.3

Experimental Measurement and Modellint of Solar Irradiation on a PV-powered Urban Bus

Miguel Centeno Brito[1], Teresa Santos[2], Michał Jan Gęca[3], Mirosław Wendeker[3]

[1]University of Lisbon, Lisboa, Portugal; [2]FCSH, Lisboa, Portugal; [3]Lublin University of Technology, Lublin, Poland

4AO.7.4

PV Roofing for High Ranking Road Networks: Technical Feasibility and Yield Estimation

Rita Ebner[1], Christoph Mayr[1], Marcus Rennhofer[1], Karl A. Berger[1], Martin Heinrich[2], Felix Basler[2], Andreas J. Beinert[2], Jonas D. Huyeng[2], Manfred Haider[3], Dominik Prammer[3], Alois Vorwagner[3], Markus Fehringer[4], Tobias Beck[5]

[1]AIT, Vienna, Austria; [2]Fraunhofer ISE, Germany; [3]AIT, Wien, Austria; [4]Forster Industrietechnik, Waidhofen an der Ybbs, Austria

4AO.7.5

High-Voltage Vehicle Integrated Photovoltaics System Concept and Demonstrator Truck

Christoph Kutter[1], Jörg Bornwasser[1], Stefan Reichert[1], Luis Eduardo Alanis[1],

[1]Fraunhofer ISE, Germany

4AO.7.6

Reliability Assessment and Development of Ultra-Lightweight PV Modules Towards Vehicle-Integrated Photovoltaics

Bin Luo[1;2], Jonathan Govaerts[2], Rik Van Dyck[1;2], Marta Casasola Paesa[2;4], Tom Borgers[2], Arvid van der Heide[2], Fabiana Lisco[5], Michaël Daenen[4], Aart Willem Van Vuure[1], Jozef (Jef) Poortmans[1;2;4]

[1]KU Leuven, Leuven, Belgium; [2]imec, Genk, Belgium; [3]Hasselt University, Hasselt, Belgium; [4]EPFL, Neuchâtel, Switzerland

Visual Presentations 2AV.1

13:30- 15:00 Perovskite Photovoltaics

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

Oral Presentations 2AO.2

15:15- 16:45 Advanced Characterization

Chairpersons:

Phoebe PEARCE *(i)*
UNSW, Sydney, *Australia*

Louise HIRST *(i)*
University of Cambridge, Cambridge, *United Kingdom*

2AO.2.1

Increasing the Scope and Precision of the Steady-State Photocarrier Grating

Leonardo Kopprio[1], Javier Schmidt[2], Christophe Longeaud[3]

[1]IPVF, Palaiseau, France; [2]IFIS Litoral, Santa Fe, Argentina; [3]GeePs, Gif-sur-Yvette, France

2AO.2.2

Contactless Inline IV-Measurement of Solar Cells Using an Empirical Model

Philipp Kunze[1], Johannes Greulich[1], Wiebke Wirtz[1], Hannes Höffler[1], Nico Wöhrle[1], Stefan Rein[1], Stefan W. Glunz[1], Matthias Demant[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany

2AO.2.3

Spatially Resolved Transient and Spectral Analysis of Perovskites or III-V Devices

Marie Legrand[1], Maxime Giteau[2], Celia Aider[1], Jean-Francois Guillemoles[3], Daniel Ory[1]

[1]EDF R&D, Palaiseau, France; [2]C2N, France; [3]CNRS, France

2AO.2.4

Resolution of Band Diagram on Perovskite Solar Cells by X-Ray Photoemission Spectroscopy considering X-Ray Photovoltage and Ion Migration

Pilar Lopez-Varo[1], Jean-Baptiste Puel[1;2], Davide Regaldo[1;3;4], Philip Schulz[1;5]

[1]IPVF, Palaiseau, France; [2]EDF R&D, Palaiseau, France; [3]IPVF, Gif-sur-Yvette, France; [4]IPVF, Paris, France; [5]CNRS, Palaiseau, France

2AO.2.5

Imaging Electrical Properties of Perovskite Solar Cells by Illumination Intensity and Temperature Dependent Photoluminescence

Anh Dinh Bui[1], Khoa Dang Nhat Nguyen[1], Daniel Macdonald[1], Hieu Nguyen[1]

[1]ANU, Australia

2AO.2.6

Investigating Metastability Behaviour of Perovskites Solar Cells with Voltage Dependent Photoluminescence Imaging

George Koutsourakis[1], Simone Meroni[2], Carys Worsley[2], Dimitrios Raptis[2], James Blakesley[1], Trystan Watson[2], Fernando Castro[1]

[1]National Physical Laboratory, United Kingdom; [2]Swansea University, Swansea, United Kingdom

Oral Presentations 1AO.5

15:15- 16:45 Passivating Contacts - Materials

Chairpersons:

Giso HAHN *(i)*
University of Konstanz, Konstanz, *Germany*

Sébastien DUBOIS *(i)*
CEA INES, Le Bourget-du-Lac, *France*

1AO.5.1

Pinhole-Enabled p-Type poly-Si/SiNy/SiOx Passivating Contact Fabrication by Nano-Galvanic Corrosion Process

Caroline Lima Salles de Souza[1;2], Harvey Guthrey[1], William Nemeth[1], Sumit Agarwal[1;2], Paul Stradins[1]

[1]NREL, United States; [2]Colorado School of Mines, United States

1AO.5.2

In Situ Monitoring of High-temperature Passivating Contact Fabrication via X-ray Scattering

Audrey Morisset[1], Theodosios Famprikis[2], Franz-Josef Haug[1], Andrea Ingenito[3], Christophe Ballif[1], Lars Bannenberg[2]

[1]EPFL, Neuchatel, Switzerland; [2]Delft University of Technology, Delft, The Netherlands; [3]CSEM, Neuchâtel, Switzerland

1AO.5.3

ALD Al2O3/SiOx Multilayers for Silicon Surface Passivation: Influence of Voltage Stress and Plasma Treatments

Armin Richter[1], Hemangi Patel[1;2], Christian Reichel[1], Paul Masuch[1], Jan Benick[1], Stefan W. Glunz[1;5]

[1]Fraunhofer ISE, Freiburg, Germany; [2]DLR- German Aerospace Center, Cologne, Germany; [3]University of Freiburg, Freiburg, Germany

1AO.5.4

Stress-Induced Depassivation of Poly-Si/SiNx Layer Stacks

Jan Hoß[1], Jan Lossen[1], Jonathan Linke[1], Radovan Kopecek[1], Florian Buchholz[1]

[1]ISC Konstanz, Konstanz, Germany

1AO.5.5

The Impact of Tunneling Oxide Thickness, Boron Emitter and Polysilicon Doping on the Long-Term Stability of TOPCon Structures

Chukwuka Madumelu[1], Robert Underwood[1], Jie Bao[2], Jia Chen[2], Zheren Du[2], Genghua Ji[2], Ran Chen[1], Fiacre Emile Rougieux[1], Bram Hoex[1], Brett Hallam[1], Matthew Wright[3]

[1]UNSW, Australia; [2]Jolywood solar, China; [3]University of Oxford, United Kingdom

1AO.5.6

Surface Polarisation of n+ poly Si / SiO2 Passivation Layers: A New Approach to Study Surface Related Degradation in TOPCon

Donghao Liu[1], Sebastian Bonilla[1], Matthew Wright[1], Peter Wilshaw[1], Phillip Hamer[2]

[1]University of Oxford, Oxford, United Kingdom; [2]UNSW, Sydney, Australia

Oral Presentations 4AO.8

15:15- 16:45 Agrivoltaics

Chairpersons:

Robby PEIBST *(i)*
ISFH, Emmerthal, *Germany*

Carlos David RODRÍGUEZ-GALLEGOS *(i)*
National University of Singapore, Singapore, *Singapore*

4AO.8.1

Multiple-Objective Optimisation of Nature-Inclusive Solar Parks and Agrivoltaics Systems

Bas Van Aken[1], Eduardo Barros[2], Bernardo Maestrini[3], Frank de Ruijter[3], Ilkay Cesar[1]

[1]TNO, Petten, The Netherlands; [2]TNO, Utrecht, The Netherlands; [3]Wageningen University & Research, Wageningen, The Netherlands

4AO.8.2

Biodiversity and Ecosystems in Swedish Solar Farms: Current Practice and a Planning Framework for Net Gain

Michiel van Noord[1], Ida Pettersson[2], Karin Morell[3], Tora Råberg[3], Ursula Zinko[4], Agnes Sandström[5]

[1]RISE, Stockholm, Sweden; [2]Ecogain, Malmö, Sweden; [3]RISE, Lund, Sweden; [4]Ecogain, Stockholm, Sweden; [5]Ecogain, Uppsala, Sweden

4AO.8.3

Novel Measurement Concept for AgriPVplus Systems - A Triple Use Approach

Hugo Sánchez-Ortiz[1], Sebastian Dittmann[1], Santiago Tosello[1], Carlos Meza[1], Sandra Dullau[1], Maren Helen Meyer[1], Pascal Scholz[1], Sabine Tischew[1], Ralph Gottschalg[1]

[1]Anhalt University of Applied Sciences, Köthen, Germany

4AO.8.4

Rainwater Management in Agrivoltaic Systems - Research & Development Potential

Johanna-Viktoria Rößner[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany

4AO.8.5

First Results from Insolagrin, a Novel Solution for Dynamic Agrivoltaics

Gaël Nardin[1], Mathilde Duchemin[1], Laetitia Anglade[1], Mathieu Ackermann[1], Delphine Petri[2], Jacques Levrat[2], Dominika Chudy[2], Matthieu Despeisse[2], Christophe Ballif[2], Matthias Baumann[3], Bastien Christ[3], André Ançay[3], Christoph Carlen[3]

[1]Insolight, Switzerland; [2]CSEM, Switzerland; [3]Agroscope, Switzerland

4AO.8.6

Key Parameters for the Simulation of Agrivoltaics in Greenhouses with Bifacial PV Modules

Jesus Robledo Bueno[1], Babacar Sarr[1], Ibrahim El Boujdaini[1], Roxane Bruhwyler[2], Jonathan Leloux[1], Christian A. Gueymard[3], Frédéric Lebeau[2]

[1]LuciSun, Villers-la-Ville, Belgium; [2]University of Liege, Gembloux, Belgium; [3]Solar Consulting Services, Colebrook, United States

Visual Presentations 2AV.2

15:15- 16:45 CIGS, CdTe, Organic, DSC and Novel Concept Solar Cells and Materials

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

Oral Presentations 2AO.3

17:00- 18:30 Novel Materials for Photovoltaic Devices

Chairpersons:

Jozef (Jef) POORTMANS *(i)*
imec, Leuven, *Belgium*

Jean-Paul KLEIDER *(i)*
CNRS, Gif-sur-Yvette, *France*

2AO.3.1

Towards a Graphene Transparent Conducting Electrode Alternative for Tandem Solar Cells

John O'sullivan[1], Matthew Wright[1], Peter Wilshaw[1], Sebastian Bonilla[1]

[1]University of Oxford, Oxford, United Kingdom

2AO.3.2

Innovative Processing Method of Q1-D Sb2Se3 Solar Cell Absorbers Under Very High Pressures

Ivan Caño Prades[1], Maykel Jimenez Guerra[1], Sergio Giraldo[1], Zacharie Jehl[1], Yudenia Sánchez[2], Lorenzo Calvo-Barrio[3;4], Xavier Alcobe[3], Joachim Puigdollers González[1], Marcel Placidi[1], Edgardo Saucedo[1]

[1]UPC, Barcelona, Spain; [2]IREC, Barcelona, Spain; [3]University of Barcelona, Barcelona, Spain

2AO.3.3

The first Operation of P-Ion-Implanted n-BaSi2/p-Si Solar Cells

Sho Aonuki[1], Kaoru Toko[1], Takashi Suemasu[1]

[1]University of Tsukuba, Tsukuba-city, Ibaraki-prefecture, Japan

2AO.3.4

Synthesis and Characterization of the Ternary Nitride Semiconductor Zn2VN3: Combinatorial Screening and Epitaxial Stabilization

Siarhei Zhuk[1], Andrey Kistanov[2], Simon Boehme[1;3], Noémie Ott[1], Fabio La Mattina[1], Michael Stiefel[1], Aliaksandr Khinevich[4], Raman Palikarpau[5;6], Maksym Kovalenko[1;3], Sebastian Siol[1]

[1]EMPA, Dübendorf, Switzerland; [2]University of Oulu, Oulu, Finland; [3]ETH Zurich, Zürich, Switzerland; [4]BSUIR, Minsk, Belarus; [5]Nanyang Technological University, Singapore; [6]Shopee, Singapore

2AO.3.5

AgBiI4 Rudorffite for Photovoltaic Application

Vasanth Babu[1;2], Govindaraj Rajamanickam[2], Ramasamy Perumalsamy[2]

[1]SSN Research Centre, Chennai, India

2AO.3.6

Harvesting Solar Energy below Si Bandgap Using Metal-Silicon Junction through Hot Carrier Effect

Ching-Fuh Lin[1], Jia-CI Jhou[1], Chung-Han Chang[1]

[1]NTU, Taipei, Taiwan

Oral Presentations 1AO.6

17:00- 18:30 Passivating Contacts - Materials and Devices

Chairpersons:

Stefan W. GLUNZ *(i)*
Fraunhofer ISE, Freiburg, *Germany*

Barbara TERHEIDEN *(i)*
University of Konstanz, Konstanz, *Germany*

1AO.6.1

Sputtered Poly-Si and its Implementation in Passivating Contacts at the Rear of Industrial N-PERT Solar Cells

Christophe Allebé[1], Antoine Descoeudres[1], Juan José Diaz Leon[1], Andrea Ingenito[1], Simon Hübner[2], Torsten Dippell[2], Bertrand Paviet-Salomon[1], Christophe Ballif[1]

[1]CSEM, Neuchatel, Switzerland; [2]SINGULUS TECHNOLOGIES, Kahl am Main, Germany

1AO.6.2

Analysis of Losses in POLO-IBC Cells in the Constraints of Module Integration

Christina Hollemann[1], Felix Haase[1], Nadine Wehmeier[1], Byungsul Min[1], Karsten Bothe[1], Jan Krügener[2], Rolf Brendel[1;3;4], Robby Peibst[1;2]

[1]ISFH, Emmerthal, Germany; [2]Leibniz University of Hannover, Hannover, Germany

1AO.6.3

Status and Perspective of Industrial TOPCon Solar Cell Development at Fraunhofer ISE

Sebastian Mack[1], Bishal Kafle[1], Christopher Teßmann[1], Katrin Krieg[1], Sattar Bashardoust[1], Elmar Lohmüller[1], Udo Belledin[1], Tobias Fellmeth[1], Bernd Steinhauser[1], Sven Kluska[1], Andreas Wolf[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany

1AO.6.4

Soft Deposition of Indium Tin Oxide on Ultra-Thin Poly-Silicon Passivating Contacts

Mike Ah Sen[1;2], Fatemeh S. Minaye Hashemi[1], Jimmy Melskens[1], Astrid Gutjahr[1], Jons Bolding[1], Arthur Weeber[1;2], Agnes Mewe[1]

[1]TNO, The Netherlands; [2]Delft University of Technology, Delft, The Netherlands

1AO.6.5

Towards Cost-Competitive High-Efficiency POLO IBC Solar Cells with Minimal Conversion Invest for Existing PERC+ Production Lines

Thorsten Dullweber[1], Verena Mertens[1], Larissa Mettner[1], Ulrike Baumann[1], Jonathan Langlois[1], Maximilian Stöhr[1], Felix Haase[1], Rolf Brendel[1], Joris Libal[2], Aaron Vogt[3], Norbert Ambrosius[3], Thomas Pernau[4], Helge Haverkamp[4]

[1]ISFH, Emmerthal, Germany; [2]ISC Konstanz, Konstanz, Germany; [3]LPKF Laser & Electronics, Garbsen, Germany; [4]centrotherm international, Blaubeuren, Germany

1AO.6.6

Wet-Chemical Ozone-Based Silicon Oxide Layers and Electron-Beam Evaporated Silicon Layers for Passivating Contacts

Nathan Nicholson[1], Johannes Frisch[2], Maurice Nuys[3], Uwe Breuer[3], Mohammed Jaber[3], Jannik Kleesiek[5], Daniel Amkreutz[5], Lars Korte[1], Steve Albrecht[1], Bernd Rech[6]

[1]HZB, Berlin, Germany; [2]Forschungszentrum Jülich, Jülich , Germany

Oral Presentations 4AO.9

17:00- 18:30 Floating PV

Chairpersons:

Thomas REINDL *(i)*
National University of Singapore, Singapore, *Singapore*

Maarten DÖRENKÄMPER *(i)*
TNO, Eindhoven, *The Netherlands*

4AO.9.1

Floating Photovoltaics in Europe: Techno-Economic Analysis and Perspectives

Leonardo Micheli[1], Diego L. Talavera[1], Florencia Almonacid-Cruz[1], Eduardo F. Fernandez[1]

[1]University of Jaén, Jaén, Spain

4AO.9.2

A Critical Review of Floating PV's Potential Gain, and Physics-Based Modelling to Find its Root Cause

Gofran Chowdhury[1;2;3], Mohamed Haggag[1;2;3], Jozef (Jef) Poortmans[1;2;3;5]

[1]KU Leuven, Leuven, Belgium; [2]imec, Leuven, Belgium; [3]EnergyVille, Genk, Belgium; [4]Hasselt University, Diepenbeek, Belgium

4AO.9.3

Impact of Water Waves on the Output Power of Floating PV Systems on Water Bodies

Manish Kumar[1], Vilde Stueland Nysted[1], Gaute Otnes[1], Torunn Kjeldstad[1], Nathan Roosloot[1], Josefine Helene Selj[1]

[1]Institute for Energy Technology, Kjeller, Norway

4AO.9.4

Application of DNV-RP-0584 Recommended Practice for Development, Design and Operation of Floating Solar Photovoltaic Systems

Michele Tagliapietra[1]

[1]DNV, Imola, Italy

4AO.9.5

The Impact of Floating Solar Power Plants on the Water Quality of Quarry Lakes

Konstantin Ilgen[1], Jens Lange[2], Dirk Schindler[2], Stefan Wieland[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany; [2]University of Freiburg, Freiburg im Breisgau, Germany

4AO.9.6

Techno-Economic Study – Our Way to the Bifacial FPV System "Gömbhal"

Markus Balz[1], Verena Göcke[1], Fabian Gross[1], Vanessa Lippert[1]

[1]sbp sonne, Germany

Visual Presentations 2AV.3

17:00- 18:30 Tandem Solar Cells / III-V and Related Compound Semiconductors **Poster Area**

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

TUESDAY, 27 September 2022

Oral Presentations 1BO.1

08:30- 10:00 Surface Passivation and Stability

Chairpersons:

Jan SCHMIDT *(i)*
ISFH, Emmerthal, *Germany*

Invited

1BO.1.1

Outstanding Surface Passivation and Low Contact Resistivity on c-Si Using Alumina-Titania Electron-Selective Contact

Mohamed Ismael[1], Daniel Macdonald[1], Lachlan Black[1]

[1]ANU, Acton, Australia

1BO.1.2

Interface Treatment for High-Efficient Dopant-Free MoOx Silicon Heterojunction Solar Cells

Liqi Cao[1], Luana Mazzarella[1], Paul A. Procel Moya[1], Yifeng Zhao[1], Jin Yan[1], Can Han[1], Guangtao Yang[1], Zhirong Yao[1], Miro Zeman[1], Olindo Isabella[1]

[1]Delft University of Technology, Delft, The Netherlands

1BO.1.3

Towards High Efficiency Inversion Layer Cells Based on Ion-Charged Dielectrics

Mingzhe Yu[1], Matthew Wright[1], Jingyan Chen[1], Yifu Shi[1], Brett Hallam[2], En-Te Hwu[3], John Murphy[4], Nicholas Grant[4], Peter Wilshaw[1], Sebastian Bonilla[1]

[1]University of Oxford, Oxford, United Kingdom; [2]UNSW, Sydney, Australia; [3]Technical University of Denmark, Lyngby, Denmark; [4]University of Warwick, United Kingdom

1BO.1.4

Surface Passivation with a-Si: Determining the Role of Interface Defects and Field-Effect Using Modeling of Lifetime Curves

Fiacre Rougieux[1], Chandany Sen[1], Malcolm Abbott[1]

[1]UNSW, Sydney, Australia

1BO.1.5

High Intensity Illuminated Annealing of Silicon Heterojunction Solar Cells: a Stability Study

Matthew Wright[1], Chukwuka Madumelu[2], Anastasia H. Soeriyadi[2], Bruno Vicari-Stefani[3], Dmitrii Andronikov[4], Sebastian Bonilla[1], Brett Hallam[2]

[1]University of Oxford, Oxford, United Kingdom; [2]UNSW, Kensington, Australia; [3]CSIRO Energy, Newcastle, Australia; [4]Hevel Solar, St. Petersburg , Russian Federation

1BO.1.6

Improve Thermal Stability of Metal Oxide Passivated Contacts for Si Solar Cells

Jingnan Tong[1], Tien Le[1], Wensheng Liang[1], MD. Anower Hossain[2], Keith Mcintosh[3], Parvathala Narangari[1], Stephane Armand[1], Teng Kho[1], Kean Khoo[2], Yahya Zakaria[4], Amir A. Abdallah[4], Sachin Surve[1], Marco Ernst[1], Bram Hoex[2], Kean Chern Fong[1]

[1]ANU, Australia; [2]UNSW, Australia; [3]PVlighthouse, Australia; [4]HBKU, Qatar

Oral Presentations 2BO.6

08:30- 10:00 Novel Photovoltaic Solar Cell Architectures

Chairpersons:

Antonio MARTÍ VEGA *(i)*
UPM, Madrid, *Spain*

Yoshitaka OKADA *(i)*
The University of Tokyo, Tokyo, *Japan*

2BO.6.1

Fabrication of Silicon Heterojunction Solar Cells with Light Trapping Structures Specialized for Near-Infrared Light by Nanoimprinting

Yuto Kimata[1], Kazuhiro Gotoh[1], Satoru Miyamoto[1], Shinya Kato[1], Yasuyoshi Kurokawa[1], Noritaka Usami[1]

[1]Nagoya University, Japan

2BO.6.2

Scalable Antireflective Huygens's Metasurface with Correlated Disorder Made from High-Index Disks

Peter Piechulla[1], Evgeniia Slivina[2], Derk L. Bätzner[3], Ivan Fernandez-Corbaton[4], Prerak Dhawan[2], Ralf B. Wehrspohn[1], Alexander N. Sprafke[1], Carsten Rockstuhl[2]

[1]Martin Luther University, Halle (Saale), Germany; [2]Karlsruhe Institute of Technology - KIT, Karlsruhe, Germany; [3]Meyer Burger Research, Hauterive, Switzerland; [4]Karlsruhe Institute of Technology - KIT, Eggenstein-Leopoldshafen, Germany

2BO.6.3

State of the Art Voc and Record Quasi-Fermi Level Splitting in GaAs/InGaP Nanowire Solar Cells directly Grown on Si

Capucine Tong[1;2], Amaury Delamarre[2], Romaric De Lépinau[1;2], Andrea Scaccabarozzi[2], Fabrice Oehler[2], Jean-Christophe Harmand[2], Stephane Collin[1;2], Andrea Cattoni[1;3]

[1]IPVF, Palaiseau, France; [2]C2N, Palaiseau, France

2BO.6.4

Oxyde Ferroelectric Perovskite Nanoparticles Dispersed in Biopolymer-Matrix for High-Performance Solar Cell (Ferro-OPV) for Indoor Applications

Rémi Ndioukane[1], Fanta Balde[1], Diouma Kobor[1], Laurence Motte[2]

[1]UASZ, Ziguinchor, Senegal; [2]LVTS, France

2BO.6.5

Advanced Sub-Micron Pyramidal Texturing for Silicon Bottom Cell for Perovskite-Silicon Tandem Application

Devika Rajagopal[1;2;3;4], Hariharsudan Sivaramakrishnan Radhakrishan[1;2;4], Mateusz Gocyla[5], René-Chris Brachvogel[6], Ahmed Eljaouhari[6], Jozef (Jef) Poortmans[1;2;3;4]

[1]imec, Genk, Belgium; [2]KU Leuven, Leuven, Belgium; [3]Hasselt University, Genk, Belgium; [4]imec, Leuven, Belgium; [5]RENA Technologies, Germany

2BO.6.6

Generation of Electrical Power Through Radiative Emission from a Thermoradiative Diode

Michael Nielsen[1], Andreas Pusch[1], Muhammad H. Sazzad[1], Phoebe Pearce[1;2], Peter Reece[3], Nicholas Ekins-Daukes[1]

[1]UNSW, Sydney, Australia; [2]University of Cambridge, Cambridge, United Kingdom

Oral Presentations 3BO.11

08:30- 10:00 PV Characterization and Imaging Techniques

Chairpersons:

Yoshihiro HISHIKAWA *(i)*
AIST, Tsukuba, *Japan*

Matthias PANDER *(i)*
Fraunhofer CSP, Halle (Saale), *Germany*

3BO.11.1

Investigation on Linearity of Spectroradiometers

Diego Pavanello[1], Harald Müllejans[1]

[1]European Commission JRC, Ispra, Italy

3BO.11.2

Primary Calibration of Solar Modules with Direct Sunlight

Stefan Riechelmann[1], Dirk Friedrich[1], Michael Müller[1], Frank Schmaljohann[1], Stefan Winter[1]

[1]PTB, Braunschweig, Germany

3BO.11.3

Advanced UV-Fluorescence Image Analysis for Early Detection of PV-Power Degradation

Lukas Neumaier[1], Gabriele C. Eder[2], Yuliya Voronko[2], Karl A. Berger[3], Gusztáv Újvári[3], Karl Knöbl[4]

[1]SAL Silicon Austria Labs, Villach, Austria; [2]OFI, Wien, Austria; [3]AIT, Wien, Austria; [4]UAS Technikum Wien, Wien, Austria

3BO.11.4

Photovoltaic Module Characterization Using Light-Induced Electroluminescence of Solar Modules with Parallel Cell String Interconnection

Marc Köntges[1], Michael Siebert[2], Stefan Bordihn[3], Jan, Kolja Wagner[4], Carsten Schinke[4]

[1]ISFH, Emmerthal, Germany; [2]Insolight, Hamelin, Germany; [3]ISFH, Hamelin, Germany; [4]Leibniz University of Hannover, Hannover, Germany

3BO.11.5

Polymer-Determined Degradation-status of PV-Modules in the Field

Claudia Buerhop-Lutz[1], Tobias Pickel[1], Oleksandr Stroyuk[1], Jens Hauch[1], Marius Peters[1]

[1]HI ERN, Erlangen, Germany

3BO.11.6

Machine Aided Estimation of Solar Cell Crack Caused Power Loss from Electroluminescence Images

Rodrigo del Prado Santamaría[1], Thøger Kari Hass[1], Gisele Alves Dos Reis Benatto[1], Peter Poulsen[1], Sergiu V. Spataru[1]

[1]DTU, Roskilde, Denmark

Oral Presentations 4BO.16

08:30- 10:00 Solar Resource Modelling and Monitoring

Chairpersons:

Manajit SENGUPTA *(i)*
NREL, *United States*

Ana Maria GRACIA AMILLO *(i)*
CENER, Sarriguren, *Spain*

4BO.16.1

Novel Spectral Irradiance Simulation Approach for PV Systems in Geometrically Complex Environments

Andres Calcabrini[1], David Gribnau[1], Ruben Cardose[1], Patrizio Manganiello[1], Miro Zeman[1], Olindo Isabella[1]

[1]Delft University of Technology, Delft, The Netherlands

4BO.16.2

Clustering of Sun Positions for Fast Calculation of Time Resolved Insolation Using Ray Tracing

Dennis Bredemeier[1;2], Carsten Schinke[1;2], Timo Gewohn[1;2], Raphael Niepelt[1;2], Rolf Brendel[1;2]

[1]Leibniz University of Hannover, Hanover, Germany; [2]ISFH, Emmerthal, Germany

4BO.16.3

ICAROS#2: Large-Scale Solar Irradiance Measurements with a Flying Monitoring Platform on a Quadcopter and its Data Evaluation

Mike Zehner[1], Andreas Boschert[1], Fabian Pauls[1], Maik Jäkel[1], Martin Heigl[1], Josef Schreder[2], Gerd Becker[3], Fabian Flade[3]

[1]TH Rosenheim, Rosenheim, Germany; [2]CMS Ing. Dr. Schreder, Kirchbichl, Austria; [3]SeV Bavaria, Munich, Germany

4BO.16.4

Effectiveness of Short Ground-Based Measurement Campaigns of Variable Duration for the Characterization of Local Surface Albedo

Vicente Lara Fanego[1], Christian A. Gueymard[2], Tomas Cebecauer[1], Marcel Suri[1]

[1]Solargis, Slovakia; [2]Solar Consulting Services, United States

4BO.16.5

Optimising Effective Albedo Data for Bifacial PV Systems

James Blakesley[1], George Koutsourakis[1], Jenna Holder[2], Fuaad Mukadam[2], Daniel Ruiz[2]

[1]National Physical Laboratory, United Kingdom; [2]RINA Tech UK, Brighton, United Kingdom

4BO.16.6

Simulation of the Irradiance and Yield Calculation of Bifacial PV Systems in the USA and Germany by Combining Ray Tracing and View Factor Model

Eva-Maria Grommes[1], Ulf Blieske[1], Sebastian Nows[1], Frederik Klag[1], Felix Schemann[1]

[1]Cologne University of Applied Sciences, Germany

Visual Presentations 4BV.1

08:30- 10:00 PV Integrated in the Built Environment Demonstratrion and Performances of Different Technologies / Infrastructure-integrated PV (VIPV, Agri-PV, Floating PV) **Poster Area**

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

Oral Presentations 1BO.2

10:30- 12:00 Heterojunction and Tandem Device Architectures

Chairpersons:

Kaining DING *(i)*
Forschungszentrum Jülich, Jülich, *Germany*

Laurie-Lou SENAUD *(i)*
CSEM, Neuchâtel, *Switzerland*

1BO.2.1

Simplified Cell Cutting, Efficient Edge Passivation, Copper Metallization: Tackling the last Hurdles for Optimized SHJ Integration in Shingle Module Configuration

Samuel Harrison[1], Vincent Barth[1], Carolyn Carrière[1], Mickael Albaric[1], Benoit Martel[1], Marco Galiazzo[2], Enrico Sovernigo[2], Nicola Frasson[2]

[1]CEA, Le Bourget Du Lac, France; [2]Applied Materials, Olmi Di S.Biagio Di Callalta, Italy

1BO.2.2

Short-Circuit Current Density of 40.19 mA/cm2 for Sillicon Heterojunction Solar Cells with Phosphorus Catalytic Doping

Gilbert Mains[1], Weiyuan Duan[1], Andreas Lambertz[1], Karsten Bittkau[1], Uwe Breuer[1], Uwe Rau[1], Kaining Ding[1]

[1]Forschungszentrum Jülich, Jülich, Germany

1BO.2.3

Closing the Gap Between n & p-Type Silicon Heterojunction Solar Cells: 24 % Efficiency on Lightly Doped GA Wafers

Adrien Danel[1], Nicolas Chaugier[1], Jordi Veirman[1], Renaud Varache[1], Mickael Albaric[1], Etienne Pihan[1]

[1]INES, Le Bourget-du-Lac, France

1BO.2.4

21% Efficient SHJ Using Compensated and Intentionally Contaminated p-Type Wafer with Defect Engineering Pre-Fabrication Process

Anastasia Soeriyadi[1], Matthew Wright[2], Bruno Vicari-Stefani[3], Shude Zhang[4], Ilya Nyapshaev[5], Sergey Abolmasov[5], Dmitrii Andronikov[5], Brett Hallam[1]

[1]UNSW, Sydney, Australia; [2]University of Oxford, Oxford, United Kingdom; [3]CSIRO Energy, Mayfield West, Australia; [4]Suzhou Talesun Solar Technologies, Suzhou, China; [5]R&D Center TFTE, Russian Federation

1BO.2.5

Effects of (i)a-Si:H Deposition Temperature on High-Efficiency Silicon Heterojunction Solar Cells for High-Efficiency Four-Terminal Tandem Solar Cells

Yifeng Zhao[1], Paul A. Procel Moya[1], Luana Mazzarella[1], Can Han[1], Guangtao Yang[1], Liqi Cao[1], Zhirong Yao[1], Dong Zhang[2;3], Valerio Zardetto[2], Mehrdad Najafi[2], Adriana Creatore[4], René Janssen[3], Sjoerd Veenstra[2], Gianluca Coletti[2], Arthur W. Weeber[1;2], Miro Zeman[1], Olindo Isabella[1]

[1]Delft University of Technology, Delft, The Netherlands; [2]TNO, Eindhoven, The Netherlands; [3]Eindhoven University of Technology, Eindhoven, The Netherlands

1BO.2.6

All Si Tandem Solar Cells by Low Temperature PECVD Epitaxy

Alizadeh Maryam[1], Antonio de Jesus Olivares-Vargas[2], Pere Roca I Cabarrocas[3]

[1], France; [2]LPICM, CNRS, Ecole po, Palaiseau, France; [3], Palaiseau, France

Oral Presentations 2BO.7

10:30- 12:00 Materials and Processing for Perovskites Solar Devices

Chairpersons:

Sjoerd VEENSTRA *(i)*
TNO, Eindhoven, *The Netherlands*

Takeru BESSHO *(i)*
University of Tokyo, Tokyo, *Japan*

2BO.7.1

Dynamic Co-evaporation Schemes and their Impact on the Growth of Methylammonium Lead Iodide Absorbers for Inverted Solar Cells.

Robert Heidrich[1;2], Paul Pistor[2;3], Karl Heinze[2], Sebastian Berwig[2], Jie Ge[2], Roland Scheer[2]

[1]Fraunhofer CSP, Halle (Saale), Germany; [2]Martin Luther University, Halle (Saale), Germany; [3]University Pablo de Olavide, Sevilla, Spain

2BO.7.2

Modification of Sputtered NiOx Hole Transport Layer by Blade Coated Self-Assembled Monolayers for Highly Efficient and Fully Scalable p-i-n Perovskite Solar Cells and Modules

Merve Tutundzic[1;2;3], Xin Zhang[2;3;4;5], Stijn Lammar[2;3;4], Tamara Merckx[2;3], Aranzazu Aguirre[2;3], Tom Aernouts[2;3], Yinghuan Kuang[2;3], Bart Vermang[1;2;3]

[1]Hasselt University, Hasselt, Belgium; [2]Imec, Genk, Belgium; [3]EnergyVille, Genk, Belgium; [4]KU Leuven, Leuven, Belgium; [5]Fudan University, Shanghai, China

2BO.7.3

Interfacial Limitations of ALD-grown Tin Oxide as an Electron Selective Layer in Perovskite-Based Solar Cells

Félix Gayot[1], Elise Bruhat[1], Matthieu Manceau[1], Eric de Vito[2], Denis Mariolle[2], Stéphane Cros[1]

[1]CEA, Le-Bourget-Du-Lac, France; [2]CEA, Grenoble, France

2BO.7.4

Optical Characteristics of Semi-Transparent FAPb(Br1-XClx)3 Perovskite for BIPV Applications through Temperature-Dependent Photoluminescence

Minjin Kim[1], Olivier Fournier[1], Fabio Matteocci[2], Jean-Francois Guillemoles[1], Aldo Dicarlo[2], Stefania Cacovich[1], Daniel Ory[3]

[1]CNRS, Palaiseau, France; [2]University of Rome II, Roma, Italy; [3]EDF R&D, Palaiseau, France

2BO.7.5

Improving the Stability of CsPbIBr2 Through Solvent Engineering

Alexander Wyn Stewart[1], Bernabé Marí Soucase[1]

[1]Valencia Polytechnic University, València, Spain

2BO.7.6

High-Throughput Synthesis and Characterization of Cs2AgxNa1-xBiyIn1-yCl6 Perovskites with Near-Unity Photoluminescence Quantum Yield

Oleksandr Stroyuk[1], Oleksandra Raievska[1], Manuel Daum[1;2], Jens Hauch[1], Christoph J. Brabec[1;2]

[1]Forschungszentrum Jülich, Erlangen , Germany; [2]FAU, Erlangen, Germany

Oral Presentations 3BO.12

10:30- 12:00 Outdoor Performances

Chairpersons:

Carolin ULBRICH *(i)*
HZB, Berlin, *Germany*

Mauro PRAVETTONI *(i)*
NUS, Singapore, *Singapore*

3BO.12.1

Long-term Performance Analysis of Solar PV Modules Installed in Open-Rack and BIPV Mounting Configurations

Ebrar Özkalay[1;2], Gabi Friesen[2], Alessandro Virtuani[1], Andrew Fairbrother[1], Mauro Caccivio[2], Christophe Ballif[1;3]

[1]EPFL, Neuchâtel , Switzerland; [2]SUPSI, Mendrisio, Switzerland; [3]CSEM, Neuchâtel, Switzerland

3BO.12.2

Monitoring of Perovskite Module Performance in Real Operating Conditions

Gianluigi Bovesecchi[1], Giulia Bontempi[1], Marco Pierro[2], David Moser[2], Antonio Agresti[3], Sara Pescetelli[3], Enrico Leonardi[4], Aldo DI Carlo[1], Cristina Cornaro[1]

[1]University of Rome II, Rome, Italy; [2]Eurac Research, Bozen, Italy; [3]University of Rome II, Roma, Italy; [4]GreatCell Solar Italia, Rome, Italy

3BO.12.3

Influence of Environmental Parameters on Soiling Deposition for Silicon-PV Modules

Suellen Caroline Silva Costa[1], Denio Cassini[1], Vinícius Augusto Camatta Santana[1], Lawrence Kazmerski[2], Antônia Sônia Alves Cardoso Diniz[1]

[1]Pontifical Catholic University of Minas Gerais, Belo Horizonte, Brazil; [2]University of Colorado Boulder, Boulder, United States

3BO.12.4

Extrapolating CIGS Module Performance from Laboratory Cell Performance Using Outdoor Data

Timon Sebastian Vaas[1;2], Bart E. Pieters[1], Theresa Magorian-Friedlmeier[3], Uwe Rau[1;2]

[1]IEK-5 Photovoltaics, Jülich, Germany; [2]Forschungszentrum Jülich, Aachen, Germany; [3]ZSW, Stuttgart, Germany

3BO.12.5

An Approach for a Shading Resistance Classification of PV Modules

Hendrik Sträter[1], Stefan Riechelmann[1], Stefan Winter[1]

[1]PTB, Braunschweig, Germany

3BO.12.6

Outdoor Monitoring Results of a Full-Scale Reconfigurable PV Module

Andres Calcabrini[1], Mirco Muttillo[1], Patrizio Manganiello[1], Miro Zeman[1], Olindo Isabella[1]

[1]Delft University of Technology, Delft, The Netherlands

Oral Presentations 4BO.17

10:30- 12:00 Forecasting of Solar Radiation and PV Output

Chairpersons:

Christos PROTOGEROPOULOS *(i)*
EEPS, Athens, *Greece*

Wilfried G.J.H.M. VAN SARK *(i)*
Utrecht University, Utrecht, *The Netherlands*

4BO.17.1

Hybrid Modeling Approach Using Cloud Dynamics and Deep Learning for Solar Nowcasting

Jun Sasaki[1], Kenji Utsunomiya[1], Maki Okada[1], Shigeyuki Yoshikawa[1], Koji Yamaguchi[1]

[1]Japan Weather Association, Toshima City, Japan

4BO.17.2

Evaluation of WRF-Solar Cloud Forecast Using the NSRDB

Jaemo Yang[1], Manajit Sengupta[1], Yu Xie[1], Aron Habte[1], Pedro A. Jimenez[2], Ju-Hye Kim[2]

[1]NREL, United States; [2]UCAR, United States

4BO.17.3

Benchmark of Eight Commercial Solutions for Deterministic Intra-Days Solar Forecast

Jonathan Lehmann[1], Christian Koessler[2], Stijn Scheerlinck[1], Lina Ruiz Gomez[2]

[1]ENGIE, Linkebeek, Belgium; [2]Engie Green, Lille, France

4BO.17.4

Improved Blending of PV Power Forecasts in Case of Measurements with Limited Reliability

Wiebke Herzberg[1], Nicolas Holland[1], Jefferson Bor[1], Elke Lorenz[1]

[1]Fraunhofer ISE, Freiburg, Germany

4BO.17.5

Single-Site Forecasts for 100 PV Systems at DSO Level, Using a Hybrid-Physical Approach, to Improve Grid-Integration and Enable Future Smart-Grid Operation

Daniel Koster[1], David Fiorelli[1], Pierrick Bruneau[1], Christian Braun[1]

[1]LIST, Esch-sur-Alzette, Luxembourg

4BO.17.6

Effect of Climate on Photovoltaic Yield Prediction Using Machine Learning Models

Alba Alcañiz[1], Anders Lindfors[2], Miro Zeman[1], Olindo Isabella[1], Hesan Ziar[1]

[1]Delft University of Technology, Delft, The Netherlands; [2]Finnish Meteorological Institute, Helsinki, Finland

Visual Presentations 2BV.2

10:30- 12:00 Emerging and Novel Approaches for Photovoltaics / Advanced Modelling and Characterization **Poster Area**

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

Oral Presentations 1BO.3

13:30- 15:00 Processing Solutions for Transparent Contacts / Selective Absorbers

Chairpersons:

Pere ROCA I CABARROCAS *(i)*
CNRS, Palaiseau, *France*

Arthur W. WEEBER *(i)*
Delft University of Technology, Petten, *The Netherlands*

1BO.3.1

Indium Reduction by 75% Using TCO Multilayers: an Industry-Ready Approach for Indium-Lean SHJ Cell?

Martin Bivour[1], Henning Nagel[1], Philipp Schmid[1], Winfried Wolke[1], Vasileios Georgiou-Sarlikiotis[1], Leonard Tutsch[1], Sebastian Pingel[1], Baljeet Singh Goraya[1], Anamaria Steinmetz[1], Sebastian Nold[1], Martin Hermle[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany

1BO.3.2

Sources of Sputter Damage in Transparent Passivating Contacts

Alexander Eberst[1;2], Weiyuan Duan[1], Depeng Qiu[1;2], Vladimir Smirnov[1], Uwe Rau[1;2], Kaining Ding[1]

[1]Forschungszentrum Jülich, Jülich, Germany; [2]RWTH Aachen University, Aachen, Germany

1BO.3.3

Substitution of ITO by a Low-cost Sprayed TiOx Capping Layer for SHJ Solar Cells

Ulrike Heitmann[1], Leonard Tutsch[1], Angela De Rose[1], Dominik Dreja[1], Leonie Jakob[1], Radwa Elgazzar[1], Martin Bivour[1], Jonas Bartsch[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany

1BO.3.4

Impact of Spectrally-selective Thin-Film Si PV on Photosynthetic Organisms

Lucia V. Mercaldo[1], Marco Della Noce[1], Manuela Ferrara[1], Fabrizio Carteni[2], Maurizio Zotti[2], Stefano Mazzoleni[2], Paola Delli Veneri[1]

[1]ENEA, Portici (NA), Italy; [2]University of Naples Federico II, Portici (NA), Italy

1BO.3.5

Wavelength-selective Ultrathin a-Si:H/oxide Transparent Solar Cells

Alex J. Lopez-Garcia[1], Cristóbal Voz Sánchez[2], Joachim Puigdollers González[2], V. Izquierdo-Roca[1], Alejandro Pérez-Rodríguez[3]

[1]IREC, Sant Adrià de Besòs, Spain; [2]UPC, Barcelona, Spain; [3]IREC, Barcelona, Spain

1BO.3.6

Effect of Wafer Thickness on the Performance of Silicon Heterojunction Solar Cells under 1-Sun and Indoor Illumination

Ugochi Kaosisochukwu Chime[1;2], Leon Wolf[1], Viktoriia Buga[1], Daniel Weigand[1], Alaaeldin Gad[1], Julian Köhler[1], Andreas Lambertz[1], Weiyuan Duan[1], Kaining Ding[1], Uwe Rau[1;2], Tsvetelina Merdzhanova[1], Oleksandr Astakhov[1]

[1]Forschungszentrum Jülich, Jülich, Germany; [2]RWTH Aachen University, Aachen, Germany

Oral Presentations 2BO.8

13:30- 15:00 Advanced Characterization and Modelling of Perovskite Devices

Chairpersons:

Paul PISTOR *(i)*
Martin-Luther-University Halle-Wittenberg, Halle, *Germany*

Marion PROVOST *(i)*
Institute of Photovoltaics Ile de France (IPVF), Palaiseau, *France*

2BO.8.1

Correlative Imaging of Optical Properties for Perovskite Materials in Single-Junction and Tandem Solar Cells

Khoa Dang Nhat Nguyen[1], Anh Dinh Bui[1], Thien Ngoc Truong[1], Daniel Macdonald[1], Hieu Nguyen[1]

[1]ANU, Canberra, Australia

2BO.8.2

Passivation and Interface Optimization in the Lead and Tin-Based Perovskite Solar Cells Revealed by Photo Hall and Surface Photovoltage Measurements

Artem Musiienko[1], Fengjiu Yang[2], Hussein Mahmoud Hussein Mohamed[2]

[1]HZB, Berlin, Germany; [2]HZB, Germany

2BO.8.3

Electro-thermal Model for Lock-in Infrared Imaging of Defects in Perovskite Solar Cells

Ennio Comi[1], Evelyne Knapp[1], Mattia Battaglia[1], Kirsch Christoph[1], Sandra Jenatsch[2], Hiestand Roman[2], Mathias Bonmarin[1], Beat Ruhstaller[1;2]

[1]ZHAW, Winterthur, Switzerland; [2]Fluxim, Winterthur, Switzerland

2BO.8.4

Charge Transport in Mixed Metal Halide Perovskite Semiconductors

Krishanu Dey[1], Dr. Sam Stranks[2]

[1]University of Cambridge, Cambridge, United Kingdom

2BO.8.5

The Role of Reabsorption in Pero/Si Tandems Assessed by Optoelectronic Simulation

Simon Zeder[1;2], Beat Ruhstaller[1;3], Urs Aeberhard[1;4]

[1]Fluxim, Winterthur, Switzerland; [2]EPFL, Neuchâtel, Switzerland; [3]ZHAW, Winterthur, Switzerland; [4]ETH Zurich, Zürich, Switzerland

2BO.8.6

Developing Strategies for Reliable Performance Evaluation of Perovskite Solar Cells: State-of-the-Art at the European Solar Test Installation

Giorgio Bardizza[1], Blago Mihaylov[1], Diego Pavanello[1], Harald Müllejans[1], Ewan Dunlop[1]

[1]*European Commission JRC, Italy*

PANEL DISCUSSION BO.13

13:30- 15:00

Visual Presentations 3BV.3

13:30- 15:00 PV Characterization, Modelling and Energy Rating **Poster Area**

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

Oral Presentations 1BO.4

15:15- 16:45 Passivation of Surfaces, Interfaces and Contacts

Chairpersons:

Karsten BOTHE *(i)*
ISFH, Emmerthal, *Germany*

Daniel MACDONALD *(i)*
ANU, Canberra, *Australia*

1BO.4.1

Passivation Properties of p-Type Rear Junction Passivating Contact Silicon Solar Cells with Local Hole Selective Front Contacts

Dongkyun Kang[1], Yoonmook Kang[1], Hae-Seok Lee[1], Donghwan Kim[1]

[1]*Korea University, Seoul, Korea, Rep. of South*

1BO.4.2

Optimization of Front PECVD SiNx:H Layer Passivating the Emitter of PERC Solar Cells

Hasan Hüseyin Canar[1;2], Gence Bektas[1;2], Ahmet Emin Keçeci[1;2], Hasan Asav[1;2], Sümeyye Koçak Bütüner[1], Selin Seyrek[1;2], Bülent Arikan[1], Rasit Turan[1;2]

[1]ODTÜ- GÜNAM, Ankara, Turkey; [2]METU, Ankara, Turkey

1BO.4.3

Nafion Passivation of c-Si Surface and Edge for Electron Paramagnetic Resonance

Kejun Chen[1;2], Abigail R. Meyer[1;2], Harvey Guthrey[1], William Nemeth[1], San Theingi[1], Matthew Page[1], Sumit Agarwal[2], David Young[1], Paul Stradins[1]

[1]NREL, Golden, United States; [2]Colorado School of Mines, Golden, United States

1BO.4.4

Insights into the Recombination at the Interface of poly-Si Passivating Contacts for Application in c-Si Solar Cells

Audrey Morisset[1], Raphael Cabal[2], Franz-Josef Haug[1], José Alvarez[3], Sébastien Dubois[2], Jean-Paul Kleider[3]

[1]EPFL, Neuchatel, Switzerland; [2]CEA, Le Bourget-du-Lac, France; [3]University Paris Saclay, CentraleSupélec, CNRS, IPVF, Gif-sur-Yvette, France

1BO.4.5

Insights into MoOx/i-aSi:H Interface for High Efficiency Solar Cells

Paul A. Procel Moya[1], Alba Alcañiz[1], Liqi Cao[1], Luana Mazzarella[1], Yifeng Zhao[1], Can Han[1], Guangtao Yang[1], Rudi Santbergen[1], Miro Zeman[1], Olindo Isabella[1]

[1]Delft University of Technology, Delft, The Netherlands

1BO.4.6

Insights into Cut-edges of SHJ Solar Cells by EL and LBIC Characterization

Matevz Bokalic[1], Miha Kikelj[1], Benjamin Lipovsek[1], Samuel Harrison[2], Marko Topic[1]

[1]University of Ljubljana, Ljubljana, Slovenia; [2]CEA, Le Bourget-du-Lac, France

Oral Presentations 2BO.9

15:15- 16:45 Stability of Perovskite Solar Cells and Mini-Modules

Chairpersons:

Giorgio BARDIZZA *(i)*
European Commission JRC, Ispra, *Italy*

Christopher FELL *(i)*
CSIRO, Mayfield West, *Australia*

2BO.9.1

The impact of high negative bias on perovskite solar cells in PID testing

Kristijan Brecl[1], Marko Jošt[1], Matevz Bokalic[1], Jernej Ekar[2], Janez Kovač[2], Marko Topic[1]

[1]University of Ljubljana, Slovenia; [2]JSI, Slovenia

2BO.9.2

Thermal Stability and Degradation Kinetics of Lead Halide Perovskites

Paul Pistor[1;2], Thomas Burwig[2]

[1]University Pablo de Olavide, Sevilla, Spain; [2]Martin Luther University, Halle (Saale), Germany

2BO.9.3

Improvement in Stability and Efficiency of Tin-Lead Perovskite Solar Cells Using Combination of Monolayers

Gaurav Kapil[1], Takeru Bessho[2], Qing Shen[1], Hiroshi Segawa[2], Shuzi Hayase[1]

[1]University of Electro-Communications, Chofu, Japan; [2]The University of Tokyo, Tokyo, Japan

2BO.9.4

Perovskite PV Accelerator for Commercializing Technology (PACT)

Joshua S. Stein[1], Laura Schelhas[2], Bruce King[1], Wanyi Nie[3], Ralph Romero[4], Jim Crimmins[5], Cara Libby[6], Angelique Montgomery[1], Charles Robinson[1], Christa Torrence[1], Marios Theristis[1], Joseph Berry[2], Timothy J Silverman[2], Michael Owen-Bellini[2], Ingrid Repins[2], Dana Sulas-Kern[2], Michael G. Deceglie[2], Robert White[2], Kirsten Perry[2], Paul Ndione[2], Nikos Kopidakis[2], Rob Foree[4], Daniel Zirzow[5], James Richards[5], Colin Sillerud[5], Wayne LI[6], Michael Bolen[6]

[1]Sandia National Laboratories, United States; [2]NREL, United States; [3]Los Alamos National Laboratory, United States; [4]Black & Veatch, United States; [5]CFV Labs, United States; [6]Electric Power Research Institute, United States

2BO.9.5

Understanding Perovskite Experimental Degradation Pathways Combining Experimental Measurements and Simulations

Arthur Julien[1], Jean-Baptiste Puel[2], Jean-Francois Guillemoles[3]

[1]IPVF, Palaiseau, France; [2]EDF R&D, Palaiseau, France; [3]CNRS, Palaiseau, France

2BO.9.6

Indoor and Outdoor Ageing of Perovskite Solar Cells: Long-Term Stability vs Meta-Stability

Mark Khenkin[1], Hans Köbler[2], Marko Remec[1;3], Quiterie Emery[1], Jinzhao LI[1], Paolo Graniero[1], Eva Unger[1], Rutger Schlatmann[1], Antonio Abate[2], Carolin Ulbrich[1]

[1]HZB, Berlin, Germany; [2]HZB, Germany; [3]University of Ljubljana, Ljubljana, Slovenia

Oral Presentations 3BO.14

15:15- 16:45 Modelling the Performance

Chairpersons:

Steve RANSOME *(i)*
Steve Ransome Consulting, Kingston upon Thames, *United Kingdom*

Anton DRIESSE *(i)*
PV Performance Labs, Freiburg, *Germany*

3BO.14.1

Special Introductory Presentation: PV Module Performance Measurements – Statistical Analysis of Technological Trends

Ulli Kräling[1], Paul Gebhardt[1], Daniel Philipp[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany

3BO.14.2

Modeling and Measuring the Power Output of Vertical Bifacial Solar Panels in Nordic Conditions

Sami Jouttijärvi[1], Mehmet Tok[1], Hugo Huerta Medina[2], Samuli Ranta[2], Kati Miettunen[1]

[1]University of Turku, Turku, Finland; [2]TUAS, Turku, Finland

3BO.14.3

Model to Estimate the Performance of Full-Colored Solar Panels

Lenneke H. Slooff-Hoek[1], Antonius R. (Teun) Burgers[1], Tom Minderhoud[2], Ger Gijzen[2], Thijs Sepers[3;4], Wouter van Strien[3]

[1]TNO, Petten, The Netherlands; [2]UNStudio, Amsterdam, The Netherlands; [3]Solar Visuals, Oudkarspel, The Netherlands; [4]Trinity Solarbeteiligungen, Oudkarspel, The Netherlands

3BO.14.4

Deep Learning Temperature Estimation Model for PV Modules

Anastasios Kladas[1], Bert Herteleer[1], Jan Cappelle[1]

[1]KU Leuven, Ghent, Belgium

3BO.14.5

Energy-yield Modelling and Real Data: a Case Study on a Rooftop PV System in Israel

Klaus Jäger[1;2], Peter Tillmann[1;2], Asher Karsenti[3], Lev Kreinin[3], Christiane Becker[1]

[1]HZB, Berlin, Germany; [2]ZIB, Berlin, Germany; [3]Solaround, Jerusalem, Israel

Visual Presentations 4BV.4

15:15- 16:45 Solar Resource and Forecasting **Poster Area**

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

Oral Presentations 1BO.5

17:00- 18:30 Optical and Electrical Solar Cell Characterization

Chairpersons:

Francesca FERRAZZA *(i)*
ENI, San Donato Milanese, *Italy*

Marko TOPIC *(i)*
University of Ljubljana, Ljubljana, *Slovenia*

1BO.5.1

Accurate IV-Measurements of Silicon Heterojunction Solar Cells without Front Metallization Using FEM Simulations

Malte Brinkmann[1], Felix Haase[1], Karsten Bothe[1], Karsten Bittkau[2], Andreas Lambertz[2], Weiyuan Duan[2], Kaining Ding[2], Hans-Peter Sperlich[3], Andreas Waltinger[3], Henning Schulte-Huxel[1]

[1]ISFH, Emmerthal, Germany; [2]Forschungszentrum Jülich, Juelich, Germany; [3]Meyer Burger, Hohenstein-Ernstthal, Germany

1BO.5.2

Accurate Linearity Measurements of the Short-Circuit Current Using a Spectral Shaping Setup

Matthias Mühleis[1], S. Kasimir Reichmuth[1], Jochen Hohl-Ebinger[1]

[1]Fraunhofer ISE, Freiburg, Germany

1BO.5.3

Photoluminescence Imaging Using Non-Uniform Excitation: Recent Progress

Shuai Nie[1], Yan Zhu[1], Oliver Kunz[1], Thorsten Trupke[1], Ziv Hameiri[1]

[1]*UNSW, Australia*

1BO.5.4

Accurate High Throughput Current-Voltage Classification of High Efficiency Silicon Solar Cells With RapidWave®

Bernhard Mitchell[1], Don Clugston[1], Bernhard Klöter[1], Britta Mette[1], Hannes Wagner-Mohnsen[1], Sascha Esefelder[1]

[1]*WAVELABS, Leipzig, Germany*

1BO.5.5

Role of the Electron Dark Current and Early Behaviour in the Degradation of the Open Circuit Voltage and S-shape Distortion in a-Si:H(p)/c-Si SHJ Solar Cells with Schottky Contact

Moustafa Ghannam[1], Yaser Abdulraheem[1], Ivan Gordon[2], Jozef (Jef) Poortmans[2]

[1]*Kuwait University, Kuwait;* [2]*imec, Leuven, Belgium*

1BO.5.6

Characterizing the Capacitance of Various Industrial c-Si Cell Technologies

David van Nijen[1], Patrizio Manganiello[1], Mirco Muttillo[1], Miro Zeman[1], Olindo Isabella[1]

[1]*Delft University of Technology, The Netherlands*

Oral Presentations 2BO.10

17:00- 18:30 Scaling Up Manufacturing Processes for Perovskite Devices and First Applications

Chairpersons:

Wolfgang TRESS *(i)*
ZHAW, Winterthur, *Switzerland*

Mark KHENKIN *(i)*
HZB, Berlin, *Germany*

2BO.10.1

Process Engineering and 2D Interfacial Defects Passivation of Large Area Perovskite Solar Modules

Luigi Vesce[1], Maurizio Stefanelli[1], Stefano Razza[1], Luigi Angelo Castriotta[1], Francesco DI Giacomo[1], Aldo DI Carlo[1;2]

[1]*University of Rome II, Rome, Italy;* [2]*CNR, Rome, Italy*

2BO.10.2

Efficient Upscaling of Perovskite Photovoltaics: Investigation of Slot-Die Coated Perovskite Solar Cells Dried via Gas-Quenching

Kristina Geistert[1;2], Ulrich Wilhelm Paetzold[1;2], Simon Ternes[1;2;3], Felix Laufer[2], Benjamin Hacene[2]

[1]Karlsruhe Institute of Technology - KIT, Eggenstein-Leopoldshafen, Germany; [2]Karlsruhe Institute of Technology - KIT, Karlsruhe, Germany

2BO.10.3

Scalable Manufacturing and Characterization of Large-Scale Perovskite Solar Device

Aider Celia[1], Iwan Zimmermann[2], Sophie Bernard[2], Frédéric Sauvage[3], Daniel Ory[1], Jean Rousset[1]

[1]EDF R&D, Palaiseau, France; [2]IPVF, Palaiseau, France; [3]LRCS, France

2BO.10.4

Flash Annealed Nickel Oxide for the Fast Production of Large Area Perovskite Solar Cells

Efrain Ochoa Martinez[1], Shanti Bijani[2], Ullrich Steiner[1], Jovana Milic[1]

[1]Adolphe Merkle Institute, Fribourg, Switzerland; [2]UMA, Malaga, Spain

2BO.10.5

In-Situ & Ex-Situ Study of Protons Irradiations of Perovskites Solar Cells for Space Applications

Carla Costa[1;2], Matthieu Manceau[2], Thierry Nuns[1], Sophie Duzellier[1], Romain Cariou[2]

[1]ONERA, Toulouse, France; [2]CEA, Le Bourget-du-Lac, France

2BO.10.6

Envisaging Building-Integrated Translucent Tandem Photovoltaics: Process Optimization and Transfer to Perovskite Tandem Cells

David Benedikt Ritzer[1], Marco A. Ruiz-Preciado[2], Bahram Abdollahi Nejand[2], Tobias Abzieher[2], Ulrich Wilhelm Paetzold[1;2]

[1]Karlsruhe Institute of Technology - KIT, Eggenstein-Leopoldshafen, Germany; [2]Karlsruhe Institute of Technology - KIT, Karlsruhe, Germany

Oral Presentations 3BO.15

17:00- 18:30 Energy Yield and Energy Rating

Chairpersons:

Tom BETTS *(i)*
Loughborough University, Loughborough, *United Kingdom*

Ana Rosa LAGUNAS *(i)*
Tomato-gsl, Sarriguren-Navarra, *Spain*

3BO.15.1

Energy Performance of Commercial c-Si PV-Modules in Accordance with IEC 61853-1,-2 and Impact on the Annual Specific Yield

Christos Monokroussos[1], Eleanor W. L. Lee[2], Frank Xu[1], Allen Zhou[1], Yichi Zhang[1], Werner Herrmann[3]

[1]TÜV Rheinland, Shanghai, China; [2]TÜV Rheinland, Taipei, Taiwan; [3]TÜV Rheinland, Cologne, Germany

3BO.15.2

Virtual Energy Rating: a Method for Optimizing Module Performance Through Cell-To-Module Analysis

Alexander Aguilar Protti[1], Jibran Shahid[1], Max Mittag[1], Holger Neuhaus[1], Ulli Kräling[1], Martin Kaiser[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany

3BO.15.3

Impact of Various Photovoltaic Module Characteristics across Geographic Regions

Madhuri Kumari[1], Marios Theristis[1], Joshua S. Stein[1]

[1]Sandia National Laboratories, Albuquerque, United States

3BO.15.4

Differentiation of PV Devices According to Energy Rating Standard IEC 61853

Ana Maria Gracia Amillo[1], Robert P. Kenny[1], Diego Pavanello[1]

[1]European Commission JRC, Ispra, Italy

3BO.15.5

Developing an Energy Rating for Bifacial PV Modules

Malte Vogt[1], Giorgos Pilis[1], Miro Zeman[1], Rudi Santbergen[1], Olindo Isabella[1]

[1]Delft University of Technology, Delft, The Netherlands

3BO.15.6

Comparison of Energy Performance of Vertical and Tilted Bifacial PV Modules in Arid Environments

Maulid M. Kivambe[1], Giovanni Scabbia[1], Amir A. Abdallah[1], Benjamin Figgis[1], Juan Lopez-Garcia[1]

[1]QEERI, Doha, Qatar

Visual Presentations 4BV.5

17:00- 18:30 Performance and Monitorisation of PV Systems Poster Area

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

Plenary Presentations 4CP.1

08:30- 10:00 PV Works Everywhere

Chairpersons:

Marion SCHROEDTER-HOMSCHEIDT *(i)*
DLR, Oldenburg, *Germany*

Minne M. DE JONG *(i)*
TNO, Eindhoven, *The Netherlands*

4CP.1.1

The Photovoltaic Potential of a Fleet of Urban Vehicles

Dora de Jong[1], Vasiliki Sionti[1], Hesan Ziar[1]

[1]Delft University of Technology, The Netherlands

4CP.1.2

Impact of the 2019-2020 Australian Black Summer Wildfires on Photovoltaic Energy Production

Ethan Ford[1], Bram Hoex[1], Marius Peters[2]

[1]UNSW, Kensington, Australia; [2]Forschungszentrum Jülich, Erlangen, Germany

4CP.1.3

Stastical Assessment of PV System Tickets

Sascha Lindig[1], Magnus Herz[2], David Moser[1], Guillermo Oviedo-Hernandez[3], Sarah Southern[4], Leonardo Moretti[5]

[1]Eurac Research, Bolzano, Italy; [2]TUS, Cologne, Germany; [3]BayWa, Roma, Italy; [4]Statkraft UK, United Kingdom; [5]ENEL Green Power, Roma, Italy

4CP.1.4

Invited

Plenary Presentations 1CP.2

10:30- 11:30 Advances in Efficiency and Production of Crystalline Silicon

Chairpersons:

Delfina MUÑOZ *(i)*
CEA-INES, Le Bourget-du-Lac, *France*

Invited

1CP.2.1

25 Years Production Technology Research & Development at Fraunhofer ISE

Ralf Preu[1], Jochen Rentsch[1], Stefan Rein[1], Florian Clement[1], Jan-Frederik Nekarda[1], Andreas W. Bett[1]

[1]Fraunhofer ISE, Freiburg, Germany

1CP.2.2

Over 26% Efficiency SHJ Solar Cell Using Nanocrystalline Silicon Oxide Window Layer

Xiaoning Ru[1], Miao Yang[1], Chengjian Hong[1], Shi Yin[1], Fuguo Peng[1], Minghao Qu[1], Xixiang Xu[1]

[1]LONGi Solar Technology, Xi'an, China

1CP.2.3

ZEBRA IBC: 24% Efficient Solar Cells in Mass Production without Passivating Contacts

Radovan Kopecek[1], Joris Libal[1], Florian Buchholz[1], Jan Lossen[1], Valentin Dan Mihailetchi[1], Dominik Rudolph[1], Haifeng Chu[1], Ning Chen[1], Christoph Peter[1], Tudor Timofte[1], Andreas Halm[1], Jianda Liu[2], Y. Guo[2], Xiaoyong Qu[2], Xiang Wu[2], Jianqiing Gao[2], P. Dong[2]

[1]ISC Konstanz, Germany; [2]SPIC Solar Power, China

Plenary Presentations 2CP.3

11:30- 12:30 Thin Film Progress for Photovoltaic Devices

Chairpersons:

Charles HAGES *(i)*
University of Florida, Gainesville, *United States*

Ayodhya Nath TIWARI *(i)*
EMPA, Dübendorf, *Switzerland*

2CP.3.1

Perovskite/Silicon Tandem Solar Cells with Sinusoidal Nanotextures Achieving 29.80% Certified Efficiency

Philipp Tockhorn[1], Johannes Sutter[2], Alexandros Cruz[3], Klaus Jäger[2], Felix Lang[4], Max Grischek[1], Philipp Wagner[1], Danbi Yoo[2], Dr. Martin Stolterfoht[4], Bernd Stannowski[3], Steve Albrecht[1], Christiane Becker[2]

[1]HZB, Berlin, Germany; [2]University of Potsdam, Potsdam, Germany

2CP.3.2

Novel Semitransparent Solar Cell Based on Ultrathin Multiple Si/GE Quantum Wells

Hosni Meddeb[1], Maximilian Götz[1], Kai Gehrke[1], Martin Vehse[1]

[1]DLR- German Aerospace Center, Oldenburg, Germany

2CP.3.3

Invited

Oral Presentations 2CO.1

13:30- 15:00 Targeting High Efficiencies with Perovskite Silicon Tandem Solar Cells

Chairpersons:

Jan Christoph GOLDSCHMIDT *(i)*
University of Marburg, *Germany*

Erkan AYDIN *(i)*
KAUST, Jeddah, *Saudi Arabia*

2CO.1.1

Special Introductory Presentation: Pathways to High-Efficiency and Outdoor-Stable Perovskite/Silicon Tandem Solar Cells

Stefaan De Wolf[1]

[1]KAUST, Thuwal, Saudi Arabia

2CO.1.2

Interface between Poly-Si on Oxide Passivated Si Bottom and Perovskite Top Cells – Search for the Leanest and best Working Layer Stack

Christian Schwarz[1], Yevgeniya Larionova[1], Sascha Wolter[1], Michael Rienäcker[1], Tobias Wietler[1], Marvin Diederich[1], Rolf Brendel[1], Robby Peibst[1]

[1]ISFH, Emmerthal, Germany

2CO.1.3

Alkali Salt Interfacial Passivation Strategy for Hysteresis-Free Monolithic Perovskite/silicon Tandem Solar Cells

Yongcai He[1], Xiaobing Gu[2], Lei Ding[3], Xin Dong[3], Xiaoning Ru[3], Miao Yang[3], Minghao Qu[3], Bo He[1], Xixiang Xu[2]

[1]LONGi Clean Energy, Xi'An, China

2CO.1.4

Two-Terminal Perovskite/Silicon Tandem Based on Double Cation Formulation

Elisa Nonni[1], Fabio Matteocci[1], Luca Serenelli[2], Erica Magliano[1], Mario Tucci[2], Luca Martini[2], Francesca Menchini[2], Aldo DI Carlo[1;3]

[1]University of Rome II, Rome, Italy; [2]ENEA, Roma, Italy; [3]CNR, Roma, Italy

2CO.1.5

Potential of NiOx/Nickel Silicide/n+Poly-Si Contact for Perovskite/TOPCon Tandem Solar Cells

Dowon Pyun[1], Jiryang Kim[2], Dongjin Choi[1], Jeong Seokhyun[1], Changhyun Lee[1], Ji Yeon Hyun[1], Ha Eun Lee[1], Sang-Won Lee[1], Hoyoung Song[1], Solhee Lee[1], Donghwan Kim[1], Yoonmook Kang[2], Hae-Seok Lee[2]

[1]Korea University, Seoul, Korea, Rep. of South

Oral Presentations 3CO.4

13:30- 15:00 Cell Interconnection

Chairpersons:

Antonin FAES *(i)*
CSEM, Neuchâtel, *Switzerland*

Loïc TOUS *(i)*
imec, Leuven, *Belgium*

3CO.4.1

Interconnection Heterojunction Industrial and Sustainable Strategy

Vincent Barth[1], Remi Monna[1], Romain Soulas[1], Florent Pernoud[1], Armand Bettinelli[1], Carolyn Carrière[1], Bertrand Hladys[1], Corentin Lucas[1], Samuel Harrison[1], Nouha Gazbour[1]

[1]CEA, Le Bourget-du-Lac, France

3CO.4.2

Improvement of Silicon Heterojunction Module Efficiency Using fast Illumination Post-treatments

Tristan Gageot[1], Jordi Veirman[1], Jean-Sébastien Caron[1], Pedro Jeronimo[1], Romain Soulas[1], Sylvain De Vecchi[1], Wilfried Favre[1], Lorenzo Carbone[2], Gaetano Izzo[2], Antonino Ragonesi[2], Francesco Rametta[2], Alessandro Fucile[2], Cosimo Gerardi[2]

[1]CEA, Le Bourget-du-Lac, France; [2]Enel Green Power, Catania, Italy

3CO.4.3

Influence of IR Soldering Profile on Industrial Silicon Heterojunction Solar Cells

Angela De Rose[1], Cristina Rosado Alberdi[1], Achim Kraft[1]

[1]Fraunhofer ISE, Freiburg, Germany

3CO.4.4

Development of Shingle Matrix Technology for Integrated PV Applications

Daniel von Kutzleben[1], Torsten Roessler[1], Julian Weber[1], Sanjeev Sigdel[1], Nils Klasen[1], Philipp Zahn[2], Achim Kraft[1], Holger Neuhaus[1]

[1]Fraunhofer ISE, Freiburg, Germany; [2]M10 Industries, Freiburg, Germany

3CO.4.5

Feasibility Study of Synergistic Back-Contact Silicon Solar Cells Metallization and Electrically Conductive Adhesive Interconnection Approach

Tudor Timofte[1], Robert Wade[2], Tobias Messmer[1], Ignacia Devoto[1;3], Karl Wienands[1], Daniel Tune[1], Frank Köhler[2], Thomas Fischer[2], Stephan Großer[4], Christof Erban[5], Joris Libal[1], Andreas Halm[1]

[1]ISC Konstanz, Konstanz, Germany; [2]teamtechnik Maschinen und Anlagen, Freiberg am Neckar, Germany; [3]Anhalt University of Applied Sciences, Köthen (Anhalt), Germany; [4]Fraunhofer CSP, Halle (Saale), Germany; [5]SUNOVATION, Elsenfeld, Germany

3CO.4.6

Pushing the Limits of Heterojunction Shingle Modules Performance, Cost and Sustainability

Carolyn Carrière[1], Samuel Harrison[1], Vincent Barth[1], Armand Bettinelli[1], Eszter (Esther) Voroshazi[1], Marco Galiazzo[2], Enrico Sovernigo[2]

[1]CEA, Le Bourget-du-Lac, France; [2]Applied Materials, SAN BIAGIO DI CALLALTA, Italy

PANEL DISCUSSION CO.7

13:30- 15:00

Visual Presentations 4CV.1

13:30- 15:00 4CV.1 **Poster Area**

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

Oral Presentations 2CO.2

15:15- 16:45 Innovative Material and Tandem Concepts

Chairpersons:

Stefaan DE WOLF *(i)*
King Abdullah University of Science and Technology, Thuwal, *Saudi Arabia*

Muriel MATHERON *(i)*
CEA-INES, Le Bourget du Lac, *France*

2CO.2.1

Sustainability Evaluations on Material Consumption for Terawatt Scale Manufacturing of Silicon based Tandem Solar Cells

LI Wang[1], Yuchao Zhang[2], Moonyong Kim[2], Robert Underwood[1], Storm Drury[1], Brett Hallam[1]

[1]UNSW, Sydney, Australia

2CO.2.2

Flexible GaAs//Cu(In1-x,Gax)(Sy,Se1-y)2-based Three-Junction Solar Cells Using Modified Smart Stack Technology

Kikuo Makita[1], Hiroshi Tomita[1], Hidenori Mizuno[1], Ryuji Oshima[1], Yasushi Shoji[1], Ralph Müller[2], David Lackner[2], Frank Dimroth[2], Takeyoshi Sugaya[1]

[1], Japan; [2], Germany

2CO.2.3

25+% Large Area Efficient Semi-Transparent Stable Perovskite Solar Modules in 4T Hybrid Tandem Configurations

Valerio Zardetto[1], Lukas Simurka[1], Dong Zhang[1], Wiljan Verhees[1], Giulia Lucarelli[1], Henri Fledderus[1], Mehrdad Najafi[1], Ilker Dogan[1], Dorrit Roosen-Melsen[1], Petra Manshanden[2], Gianluca Coletti[2], Veronique Gevaerts[1], Sjoerd Veenstra[1]

[1]TNO, Eindhoven, The Netherlands; [2]TNO, Petten, The Netherlands

2CO.2.4

Highly Efficient Monolithic Perovskite/CuIn(Ga)Se2 Tandem Solar Cells

Marco A. Ruiz-Preciado[1;2], Fabrizio Gota[1;2], Ihteaz Muhaimeen Hossain[1;2], Paul Fassl[1;2], Felix Laufer[1;2], Fabian Schackmar[1;2], Thomas J. Feeney[1;2], Ahmed Farag[1;2], Isabel Allegro[1], Hang Hu[1;2], Saba Gharibzadeh[1;2], Bahram Abdollahi Nejand[1;2], Veronique Gevaerts[3], Marcel Simor[3], Pieter Jan Bolt[3], Ulrich Wilhelm Paetzold[1;2]

[1]Karlsruhe Institute of Technology - KIT, Karlsruhe, Germany; [2]Karlsruhe Institute of Technology - KIT, Eggenstein-Leopoldshafen, Germany; [3]TNO, Eindhoven, The Netherlands

2CO.2.5

In-Depth Characterization and Optimization of Hole-Transport Layers for Efficient Shunt Quenching and Charge-Carrier Collection in CIGS-Perovskite Tandem Solar Cells

Ivona Kafedjiska[1], Igal Levine[2], Artem Musiienko[2], Natalia Maticiuc[3], Hannes Hempel[3], Tobias Bertram[1], Guillermo Antonio Farias Basulto[1], Pablo Itzam Reyes-Figueroa[1], Amran Al-Ashouri[2], Christian Kaufmann[1], Steve Albrecht[2;4], Rutger Schlatmann[1;5], Iver Lauermann[1]

[1]HZB, Berlin, Germany; [2]HZB, Germany; [3]Berlin University of Technology, Berlin, Germany; [4]Berlin University of Applied Sciences, Berlin, Germany

2CO.2.6

Laser-based Monolithic Series Interconnection of CIGSE-Perovskite Tandem Solar Cells – Determination of Optimum Scribe Line Properties

Christof Schultz[1], Guillermo Antonio Farias Basulto[2], Nico Hansen[1], Janardan Dagar[3], Rutger Schlatmann[1], Eva Unger[3], Bert Stegemann[1]

[1]Berlin University of Applied Sciences, Berlin, Germany; [2]HZB, Berlin, Germany

Oral Presentations 3CO.5

15:15- 16:45 Thermomechanical Design, Integration and Materials for Modules

Chairpersons:

Daniel KRAY *(i)*
University of Applied Sciences Offenburg, Offenburg, *Germany*

Silvia Maria PIETRALUNGA *(i)*
CNR-IFN, Milano, *Italy*

3CO.5.1

Thermomechanical Design Rules for PV Modules

Andreas J. Beinert[1;2], Pascal Romer[1], Martin Heinrich[1], Jarir Aktaa[2], Holger Neuhaus[1]

[1]Fraunhofer ISE, Freiburg, Germany; [2]Karlsruhe Institute of Technology - KIT, Eggenstein-Leopoldshafen, Germany

3CO.5.2

PV Integration in Curved Parts: Mechanical Limits and Key Parameters from a Theoretical Point of View

Jean-Baptiste Charpentier[1], Tatiana Duigou[1], Bertrand Chambion[1], Philippe Voarino[1], Fabien Chabuel[1]

[1]CEA, Le Bourget du Lac, France

3CO.5.3

The Beauty as well as the Beast: Towards Appealing Aesthetics and Reliable Photovoltaics for Vehicle Integration and Beyond

Jonathan Govaerts[1;2;3], Tom Borgers[1;2;3], Bin Luo[1;2;3;4], Rik Van Dyck[1;2;3;4], Arvid van der Heide[1;2;3], Bart Reekmans[1;2;3], Luc Vastmans[1;2;3], Reinoud Moors[1;2;3], Geert Doumen[1;2;3], Loïc Tous[1;2;3], Jozef (Jef) Poortmans[1;2;3;4]

[1]imec, Genk, Belgium; [2]EnergyVille, Genk, Belgium; [3]Hasselt University, Hasselt, Belgium; [4]KU Leuven, Leuven, Belgium

3CO.5.4

Impact of Modern Cell Concepts and Module Layouts on Hot-spot Temperatures in Solar Modules

Klaus Ramspeck[1], Christian Müller[1], Michael Meixner[1]

[1]halm, Frankfurt, Germany

3CO.5.5

Effect of Cooling Press on Residual Stresses, Optical Properties and Lifetime of Photovoltaic Modules

Bertrand Chambion[1], Vincent Meslier[1], Amandine Boulanger[1], Ichrak Rahmoun[1], Fabien Chabuel[1]

[1]CEA, Le Bourget-du-Lac, France

3CO.5.6

Comparative Optical Performance Analysis of Micro- and Nanotextures on PV Glasses

Danbi Yoo[1], Tobias Kraus[2], Hubert Hauser[2], Christiane Becker[1]

[1]HZB, Berlin, Germany; [2]temicon, Freiburg, Germany

Oral Presentations 4CO.8

15:15- 16:45 Experimental Studies of Building Integrated PV Solutions

Chairpersons:

Rebecca YANG *(i)*
RMIT University, Melbourne, *Australia*

Natasha HJERRILD *(i)*
GAF, San Jose, *United States*

4CO.8.1

1-Year Outdoor Performance Test Results of Luminescent Solar Concentrators with Embedded Nanocrystals

Thomas de Bruin[1], Natalia Zawacka[2], Anne de Waal[1], Stijn Verkuilen[3], Tim Prins[4], Paul Leblans[5], Daniel Vanmaekelbergh[4], Zeger Hens[2], Celso de Mello Donegá[4], Wilfried G.J.H.M. van Sark[1]

[1]Utrecht University, Utrecht, The Netherlands; [2]Ghent University, Gent, Belgium; [3]Heijmans, Rosmalen, The Netherlands; [4]Agfa, Mortsel, Belgium

4CO.8.2

Experimental Study of Cool Roof Paint for Albedo Increase in Bifacial PV Systems

Daniel Valencia-Caballero[1], Salim Bouchakour[2], Alvaro Luna[3], Borja Garcia-Marco[3], Ana Huidobro[1], Asier Sanz Martinez[1], Eduardo Román Medina[1]

[1]TECNALIA, Donostia - San Sebastián, Spain; [2]CDER, Algiers, Algeria; [3]UPC, Terrassa, Spain

4CO.8.3

Impact Resistance of BIPV Systems: Proposal of a Test Procedure to Harmonize Building and Electrical Performance Assessment

Pierluigi Bonomo[1], Fabio Parolini[1], Francesco Frontini[1], Mauro Caccivio[1], Giovanni Bellenda[1]

[1]SUPSI, Mendrisio, Switzerland

4CO.8.4

Design of "hotspot-free" BIPV Modules - Peranakan PV

Min Hsian Saw[1], Srinath Nalluri[1], Kong Fai Tai[1], Mauro Pravettoni[1]

[1]NUS, Singapore

4CO.8.5

Bifacial PV Balcony and Terrace Fences

Roland M. E. Valckenborg[1], Bas Van Aken[1], Simona Villa[1], Teun Burgers[1]

[1]TNO, Eindhoven, The Netherlands

4CO.8.6

Most Demanding Standard Combination to Support BIPV Development and Sustainability – Fire Safety

Simon Boddaert[1], Fabio Parolini[2], Pierluigi Bonomo[2], Muhammad Awais[3], Claudio Pirotta[3], José Jimenez[4], Jose M. Vega de Seoane[5], Daniel Valencia-Caballero[5]

[1]CSTB, Sophia Antipolis, France; [2]SUPSI, Canobbio, Switzerland; [3]PIZ, Cosio Valtellino, Italy; [4]ONYX SOLAR, Avila, Spain; [5]TECNALIA, Donastia - San Sebastian, Spain

Oral Presentations 5CO.10

15:15- 16:45 System Integration, Conversion and Storage

Chairpersons:

Kai-Philipp KAIRIES *(i)*
ACCURE Battery Intelligence, Aachen, *Germany*

Ingrid WEISS *(i)*
WIP Renewable Energies, Munich, *Germany*

5CO.10.1

Rapid, Deep and Cheap Emissions Reductions

Andrew Blakers[1]

[1]ANU, canberra, Australia

5CO.10.2

A Simple Guide for Designing a Photovoltaic and Battery System Coupled with a Heat Pump across Europe

Mattia Dallapiccola[1], Jennifer Adami[1], David Moser[1]

[1]Eurac Research, Bozen, Italy

5CO.10.3

Second-Life Batteries for Collective PV Self-Consumption

Guilherme Gaspar[1], André Pereira[1], Miguel Centeno Brito[1]

[1]University of Lisbon, Lisboa, Portugal

5CO.10.4

Upcycling Lithium-Ion Batteries: a Use Case

Ana Catarina Neves Foles[1], Luis Fialho[1], Joscha Winzer[2], Nuria Gonzalez[3], Pedro André Dos Santos Ribeiro Horta[1], Manuel Pedro Ivens Collares-Pereira[1]

[1]University of Évora, Évora, Portugal; [2]betteries AMPS, Berlin, Germany

5CO.10.5

Optimal PV Configuration for Stand-Alone Hydrogen Generation

Victor Arturo Martinez Lopez[1], Hesan Ziar[1], Miro Zeman[1], Olindo Isabella[1]

[1]Delft University of Technology, Delft, The Netherlands

5CO.10.6

CEOTRES: a Project for the Photovoltaic Generation OF Solar Fuels

Antonio Martí Vega[1], Alfonso González del Valle[1], Pablo Garcia-Linares[1], Elisa Antolín[1], Inés Durán[1], Simon A. Svatek[1], Antonio L De Lacey[2], Marcos Pita[2], Maria V. Martínez-Huerta[2], José Carlos Conesa[2]

[1]UPM, Madrid, Spain; [2]ICP, Madrid, Spain

Visual Presentations 1CV.2

15:15- 16:45 High Temperature Route for Si Solar Cells **Poster Area**

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

Oral Presentations 2CO.3

17:00- 18:30 Upscaling and Processing of Perovskite-based Tandem Solar Cells

Chairpersons:

Ivan GORDON *(i)*
imec, Leuven, *Belgium*

Luana MAZZARELLA *(i)*
Delft University of Technology, Delft, *The Netherlands*

2CO.3.1

From Single Junction Perovskite Solar Cells to Large-area Silicon/Perovskite Tandems: Implications of Changing Substrate and Increasing Device Surface

Muriel Matheron[1], Andrii Voznyi[2], Lisa Champault[2], Jean-Patrice Rakotoniaina[2], Carine Roux[2], Séverine Bailly[2], Noella Lemaitre[2], Matthieu Manceau[2], Olivier Dupré[2]

[1]CEA, Le Bourget-du-Lac, France; [2]CEA, Le Bourget du Lac, France

2CO.3.2

Scaling of Monolithic Perovskite/Silicon Tandem Solar Cells: Targeting for Industrial Process by Dry and Wet Approaches

Bernd Stannowski[1], Zih-Wei Peng[1], Ke Xu[1], Angelika Harter[1], Silvia Mariotti[1;3], Alexandros Cruz[1], Jona Kurpiers[1], Marcel Roß[1], Eike Köhnen[1], Lars Korte[1], Eva Unger[1], Steve Albrecht[1], Rutger Schlatmann[1]

[1]HZB, Germany; [2]Okinawa Institute of Science and Technology, Japan

2CO.3.3

Hybrid PVD/VTD Vapor Deposition Processing for Perovskite Tandem Solar Cell Upscaling

Quentin Guesnay[1], Florent Sahli[2], Quentin Jeangros[2], Christophe Ballif[1;2], Christian Wolff[1]

[1]EPFL , Neuchâtel, Switzerland; [2]CSEM , Neuchâtel, Switzerland

2CO.3.4

Solution-Processed Perovskites on Textured Interfaces: a Successful Platform for Efficient Perovskite/Silicon Tandem Solar Cells

Erkan Aydin[1], Jiang Liu[1], Esma Ugur[1], Randi Azmi[1], Furkan Halis Isikgor[1], Shynggys Zhumagali[1], George T. Harrison[1], Anand Selvin Subbiah[1], Ahmed Ali Said[2], Maxime Babics[1], Michele De Bastiani[1], Thomas Allen[1], Frédéric Laquai[1], Stefaan De Wolf[1]

[1]KAUST, Thuwal, Saudi Arabia; [2]KAUST Solar Center, Thuwal, Saudi Arabia

2CO.3.5

Shunt Mitigation in Large Area Si-PK Tandem Devices

Olivier Dupré[1], Nathalie Nguyen[1], Caroline Bal[1], Perrine Carroy[1], Elise Bruhat[1], Noella Lemaitre[1], Muriel Matheron[1], Matthieu Manceau[1]

[1]CEA, Le Bourget-du-Lac, France

Oral Presentations 3CO.6

17:00- 18:30 New Module Concepts and Markets

Chairpersons:

Yifeng CHEN *(i)*
Trina Solar, Changzhou, *China*

Klaus RAMSPECK *(i)*
h.a.l.m. elektronik, Frankfurt am Main, *Germany*

3CO.6.1

A Low Concentration Approach to Spectral Splitting Optics for Bifacial 4-T Modules

Andrea Farina[1], Alice Carlotto[2], Stefano Varas[2], Alessandro Chiasera[2], Silvia Maria Pietralunga[1]

[1]CNR, MILANO, Italy; [2]CNR, Povo-TN, Italy

3CO.6.2

Three Terminal Tandem Solar Cells – a Module Perspective

Henning Schulte-Huxel[1], Robert Witteck[1], Susanne Blankemeyer[1], Marc Köntges[1]

[1]ISFH, Emmerthal, Germany

3CO.6.3

Overview of Key Results Achieved in H2020 HighLite Project Helping to Raise the EU PV Industries' Competitiveness

Loic Tous[1;2;3], Jonathan Govaerts[1;2], Samuel Harrison[4], Carolyn Carrière[4], Florian Buchholz[5], Andreas Halm[5], Antonin Faes[6], Gizem Nogay[6], Andrew Fairbrother[7], Franz-Josef Haug[7], Torsten Roessler[8], Tobias Fellmeth[8], Dirk Reinwand[8], Felix Haase[9], Christina Hollemann[9], Arnaud Morlier[9], Matevz Bokalic[10], Kristijan Brecl[10], Marko Topic[10], Josco Kester[11], Stefan Wendlandt[12], Marco Galiazzo[13], Alessandro Voltan[13], Giuseppe Galbiati[14], Marc Estruga Ortiga[14], Frank Torregrosa[15], Michael Grimm[16], Julius Denafas[17], Tadas Radavicius[17], Povilas Lukinskas[18], Tuukka Savisalo[19], Thomas Regrettier[20]

[1]imec, Genk, Belgium; [2]Hasselt University, Hasselt, Belgium; [3]EnergyVille, Genk, Belgium; [4]CEA, Le Bourget-du-Lac, France; [5]ISC Konstanz, Konstanz, Germany; [6]CSEM, Neuchâtel, Switzerland; [7]EPFL, Lausanne, Switzerland; [8]Fraunhofer ISE, Freiburg im Breisgau, Germany; [9]ISFH, Emmerthal, Germany; [10]University of Ljubljana, Ljubljana, Slovenia; [11]TNO , Petten, The Netherlands; [12]PI Berlin,

Berlin, Germany; [13]Applied Materials, Olmi TV, Italy; [14]Henkel, Westerlo, Belgium; [15]Ion Beam Services IBS, Peynier, France; [16]3D-Micromac, Chemnitz, Germany; [17]SoliTek, Vilnius, Lithuania; [18]Valoe, Vilnius, Lithuania; [19]Valoe, Mikkeli, Finland; [20]Voltec Solar, Dinsheim-sur-Bruche, France

3CO.6.4

Design and Fabrication of Ultra-High Efficiency Hybrid Solar Modules based on CPV Micro-Tracking System

Jacques Levrat[1], Delphine Petri[1], Matthieu Despeisse[1], Dominika Chudy[1], Christophe Ballif[1;2], X. Niquille[2], Gaël Nardin[3], Mathieu Ackermann[4], Florian Gerlich[3], Mathilde Duchemin[3], José María Sanchis Ronda[3], Stephen Askins[5], César Domínguez[5], Guido Vallerotto[5], Ignacio Antón Hernández[5], Gerald Siefer[6], Marc Steiner[6], Juan Francisco Martinez Sanchez[6], Antonio Valor[7], Susana Soto[7], Aitor Apraiz[7]

[1]CSEM, Neuchâtel, Switzerland; [2]EPFL, Neuchâtel, Switzerland; [3]Insolight, Renens, Switzerland; [4]INL, Renens, Switzerland; [5]UPM, Madrid, Spain; [6]Fraunhofer ISE, Freiburg, Germany; [7]Mondragon Assembly, Aretxabaleta, Spain

3CO.6.5

Reliable Lego®-style Assembled Stretchable Photovoltaic Module for 3-Dimensional Arbitrary Surface Application

Min Ju Yun[1], Yeon Hyang Sim[1], Dong Yoon Lee[1], Seung I. Cha[1]

[1]KERI, 창원시, Korea, Rep. of South

3CO.6.6

Extensive Module Interconnection Optimization by Simulation Balancing High Performance, Low Cost and Ag Consumption

Corentin Lucas[1], Yannick Veschetti[1], Remi Monna[1], Vincent Barth[1], Eszter (Esther) Voroshazi[1]

[1]CEA, Le Bourget-du-Lac, France

Oral Presentations 4CO.9

17:00- 18:30 Multi-Scale Design and Analysis Tools for the Integration of Photovoltaics in the Built Environment

Chairpersons:

Francesco FRONTINI *(i)*
SUPSI, Canobbio, *Switzerland*

Veronika SHABUNKO *(i)*
National University of Singapore, Singapore, *Singapore*

4CO.9.1

The Art and Science of Integrating Photovoltaics in the Built Environment

Isadora Pauli Custódio[1], Ísis Portolan Dos Santos[2], Ricardo Rüther[3]

[1]Silla University, Florianópolis, Brazil; [2]UFSM, Brazil; [3]UFSC, Florianópolis, Brazil

4CO.9.2

A GIS-based Large-Scale Visibility Assessment Tool for PV Planning on Building Roofs

Yilong Zhou[1], Dennis Wilmink[1], Miro Zeman[1], Hesan Ziar[1], Olindo Isabella[1]

[1]Delft University of Technology, Delft, The Netherlands

4CO.9.3

Light Reflection Analysis of PV Modules: Comparison to Building Façades and Assessing the Possibility of Glare

Janina Moereke[1], Peter Borowski[1], Stefan Grünsteidl[1], Jörg Palm[1], Subarna Sapkota[2], Thomas Dalibor[1]

[1]Avancis, München, Germany; [2]Avancis, Torgau, Germany

4CO.9.4

Optical and Colorimetric Study of a Digital Printer on Glass for Optimization of Aesthetics and Performance of BIPV

Benjamin Riedel[1], Philippe Thony[1], Christophe Ménézo[2], Ioannis (John) Tsanakas[1]

[1]CEA, Le Bourget-du-Lac, France; [2]Savoy Mont Blanc University, Le Bourget-du-Lac, France

4CO.9.5

Lightweight PV Modules and Strategies for Steady Power Production: Making Industrial-Commercial Buildings Suitable for PV

Simona Villa[1], Maarten Dörenkämper[1], Menno van den Donker[2], Minne M. de Jong[1]

[1]TNO, Eindhoven, The Netherlands; [2]Solarge, Eindhoven, The Netherlands

4CO.9.6

LED Module with a Minimum Shading Loss for Media Façade on a Building Integrated Photovoltaic Module

Dong-Youn Shin[1], Woo Gyun Shin[2], Gi-Hwan Kang[2]

[1]Pukyong National University, Busan, Korea, Rep. of South; [2]KIER, Daejeon, Korea, Rep. of South

Oral Presentations 5CO.11

17:00- 18:30 Flexiblity Options for the Future Energy System

Chairpersons:

Rui PESTANA *(i)*
R&D NESTER, Sacavém, *Portugal*

Eva SCHÜPBACH *(i)*
BUAS, Bern, *Switzerland*

5CO.11.1

Flexible PV and 'Implicit' Storage Ancillary Services to balance Demand and Supply

Marco Pierro[1], Mario Barba[2], David Moser[1], Richard Perez[3], Cristina Cornaro[2]

[1]Eurac Research, Bozen, Italy; [2]University of Rome II, Italy; [3]SUNY, Albany, United States

5CO.11.2

Energy Sharing Control Strategies: a Benchmark Analysis in a Configurable Italian Demonstrator

Mattia Secchi[1], Grazia Barchi[1], David Moser[1], Stefano Nassuato[2], Daniele Pellizzari[3], Alessandro Costa[3]

[1]Eurac Research, Bozen, Italy; [2]Regalgrid, Mignagola, Italy; [3]Alperia, Bolzano, Italy

5CO.11.3

24/365 Firm Solar Power Generation in Switzerland

Jan Remund[1], Richard Perez[2], Marc Perez[3]

[1]Meteotest, Bern, Switzerland; [2]SUNY, Albany, NY, United States; [3]Clean Power Research, Kirkland, United States

5CO.11.4

User Behavior Optimization In Energy Communities with High PV Penetration

Lukas Gaisberger[1]

[1]FH OOE, Wels, Austria

5CO.11.5

Hydro-Floating PV Hybrid Operational Analysis – Dispatchability Expectations Under Different Operational Modes

Imke Meyer[1], Konstantinos Priftis[1], Christian Kaufmann[1], Shilpee Sinha[1]

[1]Mott MacDonald , Brighton, United Kingdom

5CO.11.6

Technoeconomics Optimization Model for Utility-Scale FPV/Hydro Power Plants

Øyvind Sommer Klyve[1;2], Jonathan Fagerström[1], Marianne Zeyringer[2], Erik Stensrud Marstein[1;2]

[1]Institute for Energy Technology, Kjeller, Norway; [2]University of Oslo, Kjeller, Norway

Visual Presentations 1CV.3

17:00- 18:30 Feedstock, Crystallisation, Wafering and Defects in Silicon **Poster Area**

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

Oral Presentations 4DO.1

08:30- 10:00 Statistical Methodologies and Artificial Intelligence in O&M

Chairpersons:

Peter HACKE *(i)*
NREL, Golden, *United States*

David MOSER *(i)*
Eurac Research, Bolzano, *Italy*

4DO.1.1

Improving Operations and Maintenance at Large-Scale PV Plants Through Statistical Bootstrapping

Michael Bolen[1], Daniel Fregosi[1]

[1]Electric Power Research Institute, Charlotte, United States

4DO.1.2

Photovoltaics in Brussels: an Overview of the PV Installed Park after 15 years and 11,000 Installations

Ibrahim El Boujdaini[1], Babacar Sarr[1], Jonathan Leloux[1;2], Philippe Macé[3], Xavier Simons[3], Guillaume Declève[4], Renaud Tieterickx[5], Jonathan de Lathouwer[5], Régis Lambert[5]

[1]LuciSun, Villers-la-Ville, Belgium; [2]ULB, Bruxelles, Belgium; [3]Becquerel Institute, Bruxelles, Belgium; [4]Sun7, Woluwe-Saint-Pierre, Belgium; [5]Brugel, Bruxelles, Belgium

4DO.1.3

New Artificial Intelligence Method for PV Annual Degradation Rate Estimation

Benoit Braisaz[1], Ibrahima Tounkara[2], Axel Becker[2]

[1]EDF R&D, Écuelles, France; [2]EDF Renewables, Paris La Défense, France

4DO.1.4

Precise On-Site Power Analysis of Photovoltaic Arrays by Self-Reference Algorithm

Martin Scheler[1], Darwin Daume[1], Dharmik Sojitra[2], Tina Neumeyer[2], Simon Steinbach[2], Tamara Beck[2], Achim Schulze[3], Bernd Hüttl[2]

[1]University of Applied Sciences Coburg, Coburg, Germany; [2], Coburg, Germany; [3], Rosenheim, Germany

4DO.1.5

Effect of Availability and Quality of Data on the Detection of Defects Utilizing Artificial Neural Networks in PV System's Monitoring Data

David Daßler[1], Stephanie Malik[1], Matthias Ebert[1]

[1]Fraunhofer CSP, Halle (Saale), Germany

4DO.1.6

Intelligent Fault Diagnosis of Photovoltaic Arrays based on Deep Belief Network and Extreme Learning Machine

Kun Ding[1], Zenan Yang[1], Jingwei Zhang[1], LI Feng[2], Shuai Weng[1]

[1]Hohai University, Changzhou, China; [2]University of Applied Sciences Bielefeld, Minden, Germany

Oral Presentations 2DO.6

08:30- 10:00 Processes for CIGS, CdTe and Organic Solar Cells

Chairpersons:

Alexandre CROSSAY *(i)*
IPVF, Palaiseau, *France*

Veronica BERMUDEZ BENITO *(i)*
QEERI, Doha, *Qatar*

2DO.6.1

Back Surface Passivation of Chalcopyrite Solar Cells with Metal Oxide Interlayers

Taowen Wang[1], Farooq Muhammad Uzair[2], Michele Melchiorre[1], Alex Redinger[2], Susanne Siebentritt[1]

[1]University of Luxembourg, Esch-sur-Alzette, Luxembourg; [2]University of Luxembourg, Luxembourg, Luxembourg

2DO.6.2

Alkali Post-Deposition Treatment Strategies for Cu(In,Ga)(S,Se)2 Solar Cell Absorbers

Pablo Itzam Reyes-Figueroa[1], Tobias Bertram[1], Shevan Alhasan[1], Erik Waack[1], Ralf Haberecht[1], Thomas P. Niesen[3], Jakob Bombsch[1], Thomas Dalibor[3], Regan G. Wilks[1], Marcus Bär[1;5;6], Christian Kaufmann[1], Reiner Klenk[1], Rutger Schlatmann[1;7]

[1]HZB, Berlin, Germany; [2]AVANCIS, München, Germany; [3]HI ERN, Berlin, Germany; [4]FAU, Nürnberg, Germany; [5]Berlin University of Applied Sciences, Berlin, Germany

2DO.6.3

In+Se Capping on Cu(In,Ga)Se2 Thin Film Solar Cells for Improved Voc

Rico Gutzler[1], Stefan Paetel[1], Wolfram Hempel[1], Theresa Magorian-Friedlmeier[1], Michael Powalla[1]

[1]ZSW, Stuttgart, Germany

2DO.6.4

Selenium-Free Annealing of Cesium Fluoride on CIGS Thin Film Solar Cells

Ishwor Khatri[1], Pedro Santos[1], Pedro Anacleto[1], Deepanjan Sharma[1], Mohamed Belmoubarik[1], Nicoleta Nicoara[1], Mutsumi Sugiyama[2], Sascha Sadewasser[1]

[1]INL, Braga, Portugal; [2]TUAS, Chiba, Japan

2DO.6.5

A Comprehensive Study of CdSeTe/CdTe Devices Fabricated by Thermal Evaporation

Elisa Artegiani[1], Prabeesh Punathil[1], Solidea Zanetti[1], Narges Torabi[1], Alessandro Romeo[1]

[1]University of Verona, Verona, Italy

2DO.6.6

Mixing of Non Fullerene Acceptors Ionization Energies: an Additional Tool to Increase the Quantum Efficiency of Ternary Organic Solar Cells

Safakath Karuthedath[1], Sri Harish Kumar Paleti[1], Anirudh Sharma[1], Nicolas Ramos[2], Hang Yin[3], Catherine Suenne De Castro[1], Nisreen Alshehri[1], Jafar Khan[1], Jaim Martin[2], Gang LI[3], Frédéric Laquai[1], Derya Baran[1], Julien Gorenflot[1]

[1]KAUST Solar Center, Thuwal, Saudi Arabia; [2]UPV/EHU, Lejona, Spain; [3]The Hong Kong Polytechnic University, Hong Kong

Oral Presentations 1DO.11

08:30- 10:00 Advanced Silicon Cell Processing

Chairpersons:

Peter FATH *(i)*
RCT Solutions, Konstanz, *Germany*

Adrien DANEL *(i)*
CEA, Le Bourget-du-Lac, *France*

1DO.11.1

Review, Present and Outlook for Edge Isolation Processes for Manufacturing of high Efficient Silicon Solar Cells

Tobias Dannenberg[1], Damian Brunner[1], Katrin Krieg[2], Holger Kühnlein[1], Michael Passig[1], Caroline Scheiwe[1], Jan Temmler[1], Christopher Teßmann[2], Iron Wang[1], Weiwei Xie[1], Sufan Xu[1], Martin Zimmer[2]

[1]Rena Technologies, Freiburg im Breisgau, Germany; [2]Fraunhofer ISE, Freiburg im Breisgau, Germany

1DO.11.2

Novel Maskless Fabrication Process for HJT IBC Solar Cells

Erik V. Johnson[1], Junkang Wang[1], Monalisa Ghosh[1], Pere Roca I Cabarrocas[1], Pavel Bulkin[1], Dmitri Daineka[1], Sergej Filonovich[2], Josè Alvarez[3]

[1]LPICM, CNRS, Ecole Polytechnique, Palaiseau, France; [2]TotalEnergies, France; [3]GeePs, France

1DO.11.3

Towards Totally Screen-Printed IBC Cells with Diffused Junctions

Emine Hande Ciftpınar[1;2], Ateşcan Aliefendioğlu[1;2], Mona Mona Zolfaghari Borra[1], Rasit Turan[1;2;3]

[1]ODTÜ - GÜNAM, Turkey; [2]METU, Turkey

1DO.11.4

R&D Project NextTec – Next Generation High Throughput Production Processes & Inline Characterization for Si Solar Cells

Florian Clement[1], Marius Meßmer[1], Hannes Höffler[1], Daniel Ourinson[1], Baljeet Singh Goraya[1], Gernot Emanuel[1], Fabian Meyer[1], Andreas Lorenz[1], Jonas Bartsch[1], Matthias Demant[1], Sebastian Nold[1], Andreas Wolf[1], Martin Zimmer[1], Ralf Preu[1], Klaus Ramspeck[2], Marc Hemsendorf[3], Bendikt Straub[4], Christian Ebert[5], Matthias Drews[6], Wolfgang Jooss[7], Elina Schmid[8], Stephan Schoenfelder[9], Ringo Koepge[10]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany; [2]halm, Frankfurt am Main, Germany; [3]GP Inspect, Neuried , Germany; [4]RENA Technologies, Gütenbach, Germany; [5]SCHMID Group, Freudenstadt, Germany; [6]ASYS, Dornstadt, Germany; [7]RCT Solutions, Konstanz , Germany; [8]ISC Konstanz, Konstanz, Germany; [9]Leipzig University of Applied Science, Leipzig, Germany; [10]Fraunhofer CSP, Halle (Saale), Germany

1DO.11.5

Screen-Printing of Fire-Through Ag Paste on APCVD (n) Poly-Si Passivating Contacts

Raphael Glatthaar[1], Tobias Okker[1], Frank Huster[1], Sven Seren[2], Giso Hahn[1], Barbara Terheiden[1]

[1]University of Konstanz, Konstanz, Germany; [2]SCHMID Group, Freudenstadt, Germany

1DO.11.6

Efficiency Increase and Rear Contact Formation of TOPCon Cells via LECO

Hannes Höffler[1], Tobias Fellmeth[2], Alexander Haack[2], Katrin Krieg[2], Sebastian Mack[2], Eve Krassowski[4], Bishal Kafle[2], Johannes Greulich[2]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany; [2]CE Cell Engineering, Kabelsketal, Germany

Oral Presentations 4DO.16

08:30- 10:00 Concentrators and Space PV

Chairpersons:

Stephen TAYLOR *(i)*
ESA, Noordwijk, *The Netherlands*

Ignacio ANTÓN HERNÁNDEZ *(i)*
UPM, Madrid, *Spain*

4DO.16.1

Avoiding Shading Losses in Concentrator Photovoltaics Using a Soft-imprinted Cloaking Geometry

Stefan Wil Tabernig[1;2], Anastasia H. Soeriyadi[2], Udo Römer[2], Andreas Pusch[2], Dimitry Lamers[1], Michael Nielsen[2], Albert Polman[1], Nicholas Ekins-Daukes[2]

[1]AMOLF, Amsterdam, The Netherlands; [2]UNSW, Kensington, Australia

4DO.16.2

A New Method to Analyse the Soiling in Multi-Junction, III-V Based CPV Modules

Gianluca Timò[1], Nicola Castagnetti[1], Alessandro Minuto[1], Edoardo Celi[1], Stefano Rizzi[1]

[1]RSE, Piacenza, Italy

4DO.16.3

Optical Design and Optics Manufacturing of a Highly Integrated Micro-CPV for Space Applications

Anderson Bermudez-Garcia[1], Philippe Voarino[1], Olivier Raccurt[1]

[1]CEA, Le Bourget Du Lac, France

4DO.16.4

Particle-induced Degradation of III-V Multi-Junction Solar Cells under Different Configurations of Displacement Damage Dose

Sophie Duzellier[1], Thierry Nuns[1], Romain Rey[1], Claude Pons[1], Soufian Yjjou[2], Athina Varotsou[2], Carsten Baur[3], Christel Noemayr[4], Ainhoa Martinez de Olcoz[5], Ana Gras[5]

[1]ONERA, Toulouse, France; [2]TRAD, Labège, France; [3]ESA, Noordwijk, The Netherlands; [4]Airbus Defence and Space, Munich, Germany; [5]Spasolab INTA, Torrejón de Ardoz, Spain

4DO.16.5

Ultra-Lightweight Inverse Metamorphic grown Multijunction Solar Cells for Space Applications

Malte Klitzke[1], Jonas Schön[1], Rosalinda H. van Leest[2], Gunther M. M. W. Bissels[2], Elias Vlieg[2], Michael Schachtner[1], Gerald Siefer[1], Frank Dimroth[1], David Lackner[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany; [2]tf2 devices, Nijmegen, The Netherlands

Visual Presentations 3DV.1

08:30- 10:00 Module Design and Manufacturing Posters **Poster Area**

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

Oral Presentations 4DO.2

10:30- 12:00 Performance, Degradation and Faults of PV Systems

Chairpersons:

Dirk STELLBOGEN *(i)*
ZSW, Stuttgart, *Germany*

Joshua S. STEIN *(i)*
Sandia National Labs, Albuquerque, *United States*

4DO.2.1

Assessment of String Performance Using Self-referencing Method in Comparison to Performance Ratio

Claudia Buerhop-Lutz[1], Tobias Pickel[1], Jens Hauch[1], Marius Peters[1]

[1]HI ERN, Erlangen, Germany

4DO.2.2

Global Quantitative Study of PV Condensation and Soiling

Benjamin Figgis[1], Marília Braga[2], Muhammad Zahid Khan[3], Carlos David Rodríguez-Gallegos[4], Aaron Sahm[5], William Snyder[6], Laurie Burnham[6], Fabian Wolfertstetter[7], Fernanda Norde Santos[7], Sebastian Dittmann[8], Veronica Bermudez Benito[1], Brahim Aissa <[1], Giovanni Scabbia[1]

[1]QEERI, Qatar; [2]Fotovoltaica-UFSC, Brazil; [3]Fraunhofer CSP, Germany; [4]SERIS, Singapore; [5]University of Nevada, United States; [6]Sandia National Laboratories, United States; [7]DLR- German Aerospace Center, Spain; [8]Anhalt University of Applied Sciences, Germany

4DO.2.3

Combined Soiling and Degradation (CODS) with Validation against Independent Soiling Station Measurements

Magnus Moe Nygård[1], Åsmund Skomedal[1], Marie Syre Wiig[1], Erik Stensrud Marstein[1]

[1]Institute for Energy Technology, Kjeller, Norway

4DO.2.4

Autonomous Measurement System for PV and Radiometer Soiling Losses

Stefan Wilbert[1], Laura Campos[1], José Carballo[2], Fabian Wolfertstetter[1], José La Casa[1], Erik Borg[3], Karsten Schmidt[3], Luis F. Zarzalejo[2], Aranzazu Fernandez[2], Fernanda Norde Santos[1], Ginés García[2]

[1]DLR- German Aerospace Center, Almeria, Spain; [2]CIEMAT, Spain; [3]DLR- German Aerospace Center, Germany

4DO.2.5

Development and Evaluation of an Automatic Failure Detection System for O&M of PV Portfolios

Eduardo Abdon Sarquis Filho[1;2], Bernd Kollosch[3], Björn Müller[1], Nicolas Holland[4], Klaus Kiefer[4], Christian Reise[4], Paulo J. Costa Branco[2]

[1]ENMOVA, Freiburg, Germany; [2]IDMEC, Lisboa, Portugal; [3]Pohlen - Bedachungen, Geilenkirchen, Germany; [4]Fraunhofer ISE, Freiburg im Breisgau, Germany

4DO.2.6

RoboPV: an Aerial Robots' Embedded Code for Intelligent Monitoring and Fault Detection of Large-Scale PV Plants Using Deep Neural Network Models

Amir Mohammad Moradi Sizkouhi[1], Seyyed Majid Esmailifar[2], Mahdi Karimkhani[2], Mohammadreza Aghaei[3]

[1]Concordia University, Montréal, Canada; [2]Amirkabir University of Technology, Tehran, Iran; [3]NTNU, Ålesund, Norway

Oral Presentations 2DO.7

10:30- 12:00 CIGS and CIGSSe, Module Efficiency and Stability

Chairpersons:

Alessandro ROMEO *(i)*
University of Verona, Verona, *Italy*

Ana KANEVCE *(i)*
ZSW, Stuttgart, *Germany*

2DO.7.1

Improved World Record Efficiency of CIGSSe 30x30cm2 Laminated Module with Cd-free Sputtered ZnOS Buffer Layer

Patrick Eraerds[1], Hossam Elanzeery[1], Matej Hála[1], Julian Röder[1], Stefan Grünsteidl[1], Christian Schubbert[1], Michael Algasinger[1], Thomas P. Niesen[1], Anastasia Zelenina[1], Marko Stölzel[1], Peter Borowski[1], Thomas Dalibor[1]

[1]AVANCIS, München, Germany

2DO.7.2

High-Performance CIGS Solar Cells on Low-Cost Low Carbon Steel

Maarten van der Vleuten[1], Ganesan Palaniswamy[2], Jacques Wijenberg[2], Marcel Simor[3], Remi Aninat[3]

[1]TNO, Eindhoven, The Netherlands; [2]TATA Steel, IJmuiden, The Netherlands

2DO.7.3

Micro-Structured Semi-Transparent Cu(In,Ga)Se2 Solar Cells

Pedro Santos[1], Pedro Anacleto[1], Shilpi Shital[2], Alice Debot[2], Phillip Dale[2], Sascha Sadewasser[1]

[1]INL, Portugal; [2]University of Luxembourg, Luxembourg

2DO.7.4

Insights into the Water-Induced Degradation Mechanisms on Field-deployed CIGS Modules

Simona Villa[1], Remi Aninat[1], Pelin Yilmaz[1;2], Aldo Kingma[1], Mikolaj Dziechciarz[1], Joran van den Berg[1], Klaas Bakker[1], Mirjam Theelen[1]

[1]TNO, Eindhoven, The Netherlands; [2]University of Twente, Enschede, The Netherlands

2DO.7.5

The Impact of Atmospheric Aerosol Pollutants on the Degradation of CIGS-Based Solar Cells

Adèle Debono[1;2], Shan-Ting Zhang[2], Noor Fikree[1;2], Inger Odnevall[3], Nathanaelle Schneider[2], Jean-Francois Guillemoles[2], Polina Volovitch[1]

[1]Chimie ParisTech-CNRS, PSL Research University, Paris, France; [2]IPVF, Palaiseau, France; [3]KTH Royal Institute of Technology, Stockholm, Sweden

2DO.7.6

Validation and Benchmarking of Physics-Based Thin-Film CIGS Electrical Model with Field Data

Santhosh Ramesh[1;2;3;4], Arttu Tuomiranta[1;2;3], Georgi H. Yordanov[4], Jozef (Jef) Poortmans[2;3;4], Bart Vermang[1;2;3]

[1]Hasselt University, Hasselt, Belgium; [2]Imec, Genk, Belgium; [3]EnergyVille , Genk, Belgium; [4]KU Leuven, Leuven, Belgium

Oral Presentations 1DO.12

10:30- 12:00 Silicon Manufacturing and Material Issues

Chairpersons:

Derk L. BÄTZNER *(i)*
Meyer Burger Research, Hauterive, *Switzerland*

Pierre VERLINDEN *(i)*
AMROCK Pty Ltd., Sydney, *Australia*

1DO.12.1

Vertical and Horizontal Integration of GW Scale Factories: the Future of Local Manufacturing for Global Markets Towards TW Scale PV?

Peter Fath[1], Wolfgang Jooss[1], Wolfgang Herbst[2], Sukumar Madugula[1], Mehul C. Raval[1]

[1]RCT Solutions, Konstanz, Germany; [2]viridis.iq, Konstanz, Germany

1DO.12.2

The Role of Silver Usage in Manufacturing Costs of Silicon Solar Cells

Yuchao Zhang[1], Nathan Chang[1], Moonyong Kim[1], LI Wang[1], Storm Drury[1], Robert Underwood[1], Michael Woodhouse[2], Brett Hallam[1]

[1]UNSW, Sydney, Australia; [2]NREL, United States

1DO.12.3

Large Area Bifacial Inline Ni/Cu/Ag Plated iTOPCon Solar Cells Surpassing 24%

Mathias Kamp[1], Damian Brunner[1], Markus Sieber[1], Benjamin Grübel[2], Sven Kluska[2], Michael Passig[1], Benjamin Brix[1], Gisela Cimiotti[2], Christian Schmiga[2], René Haberstroh[2], Andreas Nägele[2], Andreas Brand[2], Sufan Xu[3], Jim Wu[3], Holger Kühnlein[1], Ulrich Jäger[4], Stephen Fox[2]

[1]RENA Technologies, Freiburg im Breisgau, Germany; [2]Fraunhofer ISE, Freiburg im Breisgau, Germany; [3]RENA Shanghai Trading, Shanghai, China; [4]RENA Technologies, Gütenbach , Germany

1DO.12.4

Self-aligned Copper Electrodeposition Process for Silicon Heterojunction Solar Cells

Agata Lachowicz[1], Nicolas Badel[1], Julien Gay[1], Gaëlle Andreatta[1], Nicolas Blondiaux[1], Antonin Faes[1], Juan J. Diaz Leon[1], Jun Zhao[1], Antoine Descoeudres[1], Bertrand Paviet-Salomon[1], Christophe Ballif[1]

[1]CSEM , Switzerland

1DO.12.5

Potential of Sputtered AZO Layers for the Industrial Manufacturing of Hetero Junction Solar Cells

Eric Schneiderlöchner[1], Martin Dimer[1], Uwe Graupner[1], Alexandros Cruz[2], Bernd Stannowski[3], Stefan Janke[4], Stefan Wendlandt[2], Martin Bivour[5], Winfried Wolke[5]

[1], Dresden, Germany; [2], Berlin, Germany; [3], Freiburg im Breisgau, Germany

1DO.12.6

Reduction of Indium Deposition for Silicon Heterojunction Solar Cells with Short Term Industrial Perspective

Frédéric Jay[1], Tristan Gageot[1], Raphael Cabal[1], Sylvain De Vecchi[1], Jordi Veirman[1], Benjamin Thiriot[1], Wilfried Favre[1]

[1]CEA, Le Bourget du Lac, France

Oral Presentations 3DO.17

10:30- 12:00 Backsheets and Encapsulations

Chairpersons:

Christian CAMUS *(i)*
LayTec, Berlin, *Germany*

Guy BEAUCARNE *(i)*
Dow Silicones, Seneffe, *Belgium*

3DO.17.1

Special Introductory Presentation: Crack Propensity of PV Backsheets – Comparison of Laminated and Co-extruded Backsheets

Gernot Oreski[1], Chiara Barretta[1], Astrid Macher[1], Gabriele C. Eder[2], Lukas Neumaier[3], Markus Feichtner[4], Minna Aarnio-Winterhof[5]

[1]PCCL, Leoben, Austria; [2]OFI, Wien, Austria; [3]SAL Silicon Austria Labs, Villach, Austria; [4]KIOTO SOLAR, Sankt Veit an der Glan, Austria; [5]Borealis Polyolefine, Linz, Austria

3DO.17.2

Quantification of Additives within Polymer Films in Photovoltaic Modules

Robert Heidrich[1], Anton Mordvinkin[1], Ralph Gottschalg[1]

[1]Fraunhofer CSP, Halle (Saale), Germany

3DO.17.3

Extensive Module Backsheet Qualification Protocol Correlated to SHJ Module Reliability

Timea Bejat[1], Marion Sérasset[1], Eszter (Esther) Voroshazi[1], Romain Soulas[1], Lorenzo Carbone[2], Lionel Sicot[1], Vincent Barth[1], Marion Vite[1], Gaetano Izzo[2], Antonino Ragonesi[2], Francesco Rametta[2], Alessandro Fucile[2], Cosimo Gerardi[2]

[1]CEA, Le Bourget du Lac, France; [2]ENEL Green Power, Catania, Italy

3DO.17.4

The Lamination Process Quantified Through In-Situ Optical Thermo-Mechanical Sensing

Philippe Nivelle[1;2;3], Tine Engelen[1;3], Tatjana Vavilkin[4], Stefan Dewallef[4], Jozef (Jef) Poortmans[1;2;3;5], Michaël Daenen[1;3]

[1]Hasselt university, Hasselt, Belgium; [2]imec, Genk, Belgium; [3]Energyville, Genk, Belgium; [4]Soltech, Tienen, Belgium; [5]KU Leuven, Leuven, Belgium

3DO.17.5

Are PV-Module Backsheets with an Outer Fluoropolymer Layer the Better Solution?

Jonathan Kriening[1], Peter Lechner[1], Maximilian Engel[1], Heiko Wirth[1], Dieter Geyer[1]

[1]ZSW, Stuttgart, Germany

Visual Presentations 5DV.2

10:30- 12:00 Energy System Integration; Storage / Sustainability, Environment, and Circularity of PV / Modelling and Scenarios for Renewables, Policy, Global Challenges / Costs, Economics, Finance and Markets / Regional Experiences; Combatting Energy Poverty / Societal Challenges; Citizens' Participation, Awareness **Poster Area**

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

Oral Presentations 4DO.3

13:30- 15:00 Performance and Monitoring of PV Systems

Chairpersons:

Gerhard MÜTTER *(i)*
Enery Development, Vienna, *Austria*

Sandy RODRIGUEZ *(i)*
HI-ERN, *Germany*

4DO.3.1

Photovoltaic System Monitoring Using Peer Systems

Alba Alcañiz[1], Maitheli M. Nikam[1;2], Yitzi Snow[2], Miro Zeman[1], Olindo Isabella[1], Hesan Ziar[1]

[1]Delft University of Technology, Delft, The Netherlands; [2]Solar Monkey, Den Haag, The Netherlands

4DO.3.2

A New Approach for Filtering PV Performance Data Based on Acceptance Bands Around the Ideal PV System Power Curve

Julián Ascencio-Vásquez[1], Zoe Defreitas[1]

[1]Envision Digital, Redwood City, United States

4DO.3.3

Evaluation of Bifacial PV Gain Projection by Use of Novel Side-By-Side Monofacial Reference and Application to a 150 MW PV Project

Dirk Stellbogen[1], Alexander Eckert[2], Peter Lechner[1], Olaf Schanz[1]

[1]ZSW, Stuttgart, Germany; [2]EnBW Energie Baden-Württemberg, Stuttgart, Germany

4DO.3.4

Performance of Heterojunction PV Technologies at the Atacama Desert

Elias Urrejola[1]

[1], Chile

4DO.3.5

Photovoltaics Modules and Systems Monitoring within HighLite H2020 Project

Antonin Faes[1], Nicolas Wyrsch[2], Gizem Nogay[1], Andreas Halm[3], Jonathan Govaerts[4], Loïc Tous[4], Julius Denafas[5], Thomas Regrettier[6], Janez Krc[7], Matevz Bokalic[7], Alessandro Virtuani[2], Martin Heinrich[8], Dirk Reinwand[8], Hervè Colin[9], Tadas Radavicius[5], Renaud Langou[1], Tuukka Savisalo[10], Andrew Fairbrother[2], Stefan Wendlandt[11], Ismail Kaaya[4], Constantin Klyk[3], Matthieu Despeisse[1], Kristijan Brecl[7], Samuel Harrison[9], Marko Topic[7], Christophe Ballif[1]

[1]CSEM, Switzerland; [2]EPFL, Switzerland; [3]ISC Konstanz, Germany; [4]imec, Belgium; [5]Solitek, Lithuania; [6]Voltec Solar, France; [7]University of Ljubljana, Slovenia; [8]Fraunhofer ISE, Germany; [9]CEA, France; [10]Valoe, Finland; [11]PI Berlin, Germany

4DO.3.6

Imagery and Monitoring Data Coupling Towards Complete PV Plant Diagnostics

Dhiaeddine Melliti[1], Duy Long Ha[1], Ioannis (John) Tsanakas[1], Laurent Sauvage[2], Pascal Raux[2], Philippe Bellon[2],

[1]INES, Le Bourget-du-Lac, France; [2]Ener-Pacte, Lyon, France

Oral Presentations 2DO.8

13:30- 15:00 Ag Alloying in CIGS and Other Chalcogenide Solar Cells

Chairpersons:

Sascha SADEWASSER *(i)*
INL, Braga, *Portugal*

Patrick ERAERDS *(i)*
AVANCIS, Munich, *Germany*

2DO.8.1

Impact of Ag on Device Properties of Cu(In,Ga)Se2 Solar Cells

Ana Kanevce[1], Stephanie Essig[2], Stefan Paetel[1], Dimitrios Hariskos[1], Wolfram Hempel[1], Theresa Magorian-Friedlmeier[1]

[1]ZSW, Stuttgart, Germany; [2]Insolight, Stuttgart, Germany

2DO.8.2

High Efficiency Bifacial (Ag,Cu)(In,Ga)Se2 Thin Film Solar Cells Grown at Low Temperature

Shih-Chi Yang[1], Tzu-Ying Lin[2], Mario Ochoa[1], Huagui Lai[1], Ayodhya Nath Tiwari[1], Romain Carron[1]

[1]EMPA, Switzerland; [2]National Tsing Hua University, Taiwan

2DO.8.3

Absorber and Interface Properties of (Ag,Cu)(In,Ga)Se2 Solar Cells: Results of the EFFCIS-II Project

Wolfram Witte[1], Dimitrios Hariskos[1], Rico Gutzler[1], Stefan Paetel[1], Matthias Maiberg[2], Semih Agca[2], Heiko Kempa[2], Roland Scheer[2], Dirk Hauschild[3;4;5], Elizaveta Pyatenko[3;4], Mary Blankenship[5], Lothar Weinhardt[3;4;5], Clemens Heske[3;4;5], Azam Karami[6], Oana Cojocaru-Mirédin[6], Markus Mock[7], Elaheh Ghorbani[7], Karsten Albe[8], Xiaowei Jin[3], Reinhard Schneider[3], Dagmar Gerthsen[3], Sinju Thomas[10], Jose Antonio Marquez-Prieto[10], Daniel Abou-Ras[10], Thomas Unold[10], Roland Mainz[10], Michael Dao[3], Michael Hetterich[3], Michael Powalla[13]

[1]ZSW, Stuttgart, Germany; [2]Martin Luther University, Halle, Germany; [3]Karlsruhe Institute of Technology - KIT, Karlsruhe, Germany; [4]Karlsruhe Institute of Technology - KIT, Eggenstein-Leopoldshafen, Germany; [5]UNLV, Las Vegas, United States; [6]RWTH Aachen University, Aachen, Germany; [7]Technical University of Darmstadt, Darmstadt, Germany; [8]TSEC, Darmstadt, Germany; [9]HZB, Berlin, Germany

2DO.8.4

AG-Alloyed Wide Gap CU(In,GA)S2 for Tandem Application: Optimization of Metallic Precursor and Sulfurization

Alexandre Crossay[1], Jackson Lontchi[2], Amelle Rebai[1], Baptiste Bérenguier[1], Eugène Bertin[3;4], Olivier Durand[3], Nicolas Barreau[4], Jean-Francois Guillemoles[1], Negar Naghavi[1], Daniel Lincot[1]

[1]CNRS, Palaiseau, France; [2]IPVF, Palaiseau, France; [3]University of Rennes, CNRS, Rennes, France; [4]University of Nantes, CNRS, Nantes, France

2DO.8.5

Investigations on the Impact of RbF Post-deposition Treatment in ACIGS Solar Cells

Tim Helder[1], Ana Kanevce[1], Mario Zinßer[1], Rico Gutzler[1], Stefan Paetel[1], Theresa Magorian-Friedlmeier[1], Michael Powalla[1]

[1]ZSW, Stuttgart, Germany

2DO.8.6

Silver Incorporated Sb2Se3 Bi-layer Thin-Film Solar Cells: Mechanism for the Improved Schottky Barrier

Sanghyun (Philip) Lee[1], Michael Mcinerney[2]

[1]Indiana State University, United States; [2]Rose-Hulman Institute of Technology, United States

PANEL DISCUSSION DO.13

13:30- 15:00

Visual Presentations 3DV.3

13:30- 15:00 PV Module Reliability **Poster Area**

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

Oral Presentations 4DO.4

15:15- 16:45 Inspecting Modules and Systems

Chairpersons:

João M. SERRA *(i)*
University of Lisbon, Lisbon, *Portugal*

Peter LECHNER *(i)*
ZSW, Stuttgart, *Germany*

4DO.4.1

Review of On-Site Inspection Techniques for the Qualification of PV Power Plants

Werner Herrmann[1], Gabriele C. Eder[2], Boris Farnung[3], Gabi Friesen[4], Marc Koentges[5], Bernhard Kubicek[6], Oliver Kunz[7], Haitao Liu[8], David Parlevliet[9], Ioannis (John) Tsanakas[10], Jan Vedde[11]

[1]TÜV Rheinland, Cologne, Germany; [2]OFI, Vienna, Austria; [3]VDE Renewables, Alzenau, Germany; [4]SUPSI, Mendrisio, Switzerland; [5]ISFH, Hamelin, Germany; [6]AIT, Vienna, Austria; [7]UNSW, Sydney, Australia; [8]CAS, Beijing, China; [9]Murdoch University, Perth, Australia; [10]CEA, Le Bourget-du-Lac, France; [11]European Energy, Birkerød, Denmark

4DO.4.2

Evolution of Inverter Ground Impedances for PV-Modules with Various Backsheet Types

Claudia Buerhop-Lutz[1], Tobias Pickel[1], Oleksandr Stroyuk[1], Jens Hauch[1], Marius Peters[1]

[1]HI ERN, Erlangen, Germany

4DO.4.3

Identify, Analyse, Mitigate – Quantification of Technical Risks in PV Power Systems

Magnus Herz[1], Gabi Friesen[2], Ulrike Jahn[3], Marc Koentges[4], Sascha Lindig[5], David Moser[5]

[1]TÜV Rheinland, Cologne, Germany; [2]SUPSI, Switzerland; [3]VDE Renewables, Germany; [4]ISFH, Germany; [5]Eurac Research, Italy

4DO.4.4

Technical Considerations Resulting from Photovoltaic Module Heating During Electroluminescence Inspection

Lukas Koester[1], Emanuel Vallarella[2], David Moser[1]

[1]Eurac Research, Bozen, Italy; [2]Huawei Nuremberg Research Center, Nürnberg, Germany

4DO.4.5

Outdoor Photoluminescence Imaging of PV Modules Based on String Inverter's IV Curve Sweeps

Marija Vukovic[1], Marko Jakovljevic[1], Andreas Svarstad Flø[1], Espen Olsen[1], Ingunn Burud[1]

[1]Norwegian University of Life Sciences, Ås, Norway

4DO.4.6

Evaluation of Snow Removal Methods for Rooftop Photovoltaics

Alexander Granlund[1], Mattias Lindh[1], Anna Malou Petersson[1], Tommy Vikberg[2]

[1]RISE, Piteå, Sweden; [2]RISE, Skellefteå, Sweden

Oral Presentations 2DO.9

15:15- 16:45 III-V and Related Compound Semiconductors

Chairpersons:

Gianluca TIMÒ *(i)*
RSE, Piacenza, *Italy*

Roberta CAMPESATO *(i)*
CESI, *Italy*

2DO.9.1

Special Introductory Presentation: How to Nicely Break Up? Engineering the Lift-Off of Tunable Epitaxial Germanium Foils for Multijunction Solar Cells

Valérie Depauw[1;2;3], Clément Porret[2], Roger Loo[2], Jinyoun Cho[4], Guillaume Courtois[4], Rufi Kurstjens[4], Kristof Dessein[4], Víctor Orejuela[5], Ignacio Rey-Stolle[5], Iván García[5]

[1]Hasselt University, Belgium; [2]imec, Belgium; [3]EnergyVille, Belgium; [4]Umicore, Belgium; [5]UPM, Spain

2DO.9.2

Graphene/GaAs Templates for the Epitaxy of Releasable GaAs Thin Films: Towards Substrate Recycling in III-V Photovoltaics

Carlos Macias[1;2], Jean-Christophe Harmand[2], Antonella Cavanna[2], Ali Madouri[2], Stephane Collin[1;2], Solène Béchu[3], Andrea Cattoni[1;2], Amaury Delamarre[1;2]

[1]IPVF, Palaiseau, France; [2]C2N, Palaiseau, France; [3]ILV, Versailles, France

2DO.9.3

Electron Channeling Contrast Imaging of Defects after an Improved III-V Nucleation on Si(100) Including Al

Manali Nandy[1], Agnieszka Paszuk[1], Markus Feifel[2], Christian Koppka[1], Peter Kleinschmidt[1], Frank Dimroth[2], Thomas Hannappel[1]

[1]Ilmenau University of Technology, Germany; [2]Fraunhofer ISE, Germany

2DO.9.4

Insights in Light Trapping Mechanisms in 100-NM-Thin GaAs Solar Cell with Subwavelength Nanopatterning

Daniel Micha[1;2], Maxime Giteau[2;3], Andrea Cattoni[2], Jean-Francois Guillemoles[1;4], Stephane Collin[1;2]

[1]IPVF, Palaiseau, France; [2]C2N, Palaiseau, France; [3]University of Tokyo, Meguro City, Tokyo, Japan; [4]CNRS, Palaiseau, France

2DO.9.5

Overview and Loss Analysis of III-V Single-Junction and Multi-Junction Solar Cells

Masafumi Yamaguchi[1;2], Frank Dimroth[3], John Geisz[4], Nicholas Ekins-Daukes[5], Nobuaki Kojima[2], Yoshio Ohshita[2]

[1]Toyota Technological Institute, Nagoya, Japan; [2]Fraunhofer ISE, Freiburg, Germany; [3]NREL, Golden, United States; [4]UNSW, Sydney, Australia

Oral Presentations 5DO.14

15:15- 16:45 Sustainability Aspects, Life Cycle Analysis and Recycling of PV

Chairpersons:

Karsten WAMBACH *(i)*
Wambach-Consulting, Petersdorf, *Germany*

Martin P. BELLMANN *(i)*
SINTEF, Trondheim, *Norway*

5DO.14.1

Insights into Current and Potentially Circular Material and Waste Flows from c-Si PV Industry

Peter Brailovsky[1], Kerstin Baumann[2], Boris Mertvoy[2], Estelle Gervais[1], Karsten Wambach[2], Ann-Kathrin Briem[3], Sina Herceg[1], Michael Held[3], Sebastian Nold[1], Jochen Rentsch[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany; [2]bifa Environmental Institute, Augsburg, Germany; [3]Fraunhofer IBP, Stuttgart, Germany

5DO.14.2

Sustainability of Photovoltaic System´s Manufacture, Operation and Decommissioning in Future Net-Zero Emissions Scenarios

Antonio Urbina[1]

[1]Public University of Navarra, Pamplona, Spain

5DO.14.3

Toward a Sustainability-Driven Technological Roadmap for PV: Case Study with the Silicon Heterojunction Technology

Alexis Barrou[1], Laurie-Lou Senaud[1], Christophe Ballif[1], Bertrand Paviet-Salomon[1]

[1]CSEM, Neuchâtel, Switzerland

5DO.14.4

The Strategic Research and Innovation Agenda for Reliable, Bankable, Sustainable and Circular Solar PV

David Moser[1], Delfina Muñoz[2], Ulrike Jahn[3]

[1]Eurac Research, Bolzano, Italy; [2]CEA, Le Bourget-du-Lac, France; [3]VDE Renewables, Alzenau, Germany

5DO.14.5

Identifying Methods to Reduce Emission Intensity of Centralised PV Deployment: Life Cycle Assessment Case Study of a 30MW PV Plant

Storm Drury[1], Moonyong Kim[1], Pablo Dias[1], Yuchao Zhang[1], Robert Underwood[1], LI Wang[1], Pietro P. Altermatt[2], Brett Hallam[1]

[1]UNSW, Sydney, Australia; [2]Trina Solar, Changzhou, China

5DO.14.6

End-of-Life Management of Solar Photovoltaic in the Energy Transition

Jinlei Feng[1], Ute Collier[1], Emanuele Bianco[1], Anindya Bhagirath[1], Karsten Wambach[2], Garvin Heath[3], Taylor Curtis[3], Phoebe O'connor[3]

[1]IRENA, Abu Dhabi, United Arab Emirates; [2]Wambach-Consulting, Germany; [3]NREL, United States

Oral Presentations 3DO.18

15:15- 16:45 Module Ageing, Degradation and Simulation

Chairpersons:

Ulrike JAHN *(i)*
VDE Renewables, Alzenau, *Germany*

Eszter (Esther) VOROSHAZI *(i)*
CEA, Le Bourget-du-Lac, *France*

3DO.18.1

Detailed Performance & Degradation Assessment of Different PV Technologies with more than 10 Years Lifetime

Sascha Lindig[1], Atse Louwen[1], Lukas Koester[1], Alexander Astigarraga[1], David Moser[1]

[1]Eurac Research, Bolzano, Italy

3DO.18.2

Lifetime Prediction of Photovoltaic Modules: Towards a Generalized Physics-Based Approach

Ismail Kaaya[1;3], Santhosh Ramesh[1;3], Arttu Tuomiranta[1;3], Arvid van der Heide[1;3], Julián Ascencio-Vásquez[4], Ivan Gordon[1;3]

[1]imec, Genk, Belgium; [2]Hasselt University, Hasselt, Belgium; [3]Envision Digital, United States

3DO.18.3

A Study of Module Degradation From a 10-Year Installation in the Urban Tropical Environment

Mauro Pravettoni[1], Amit Singh Rajput[1], Wan LI[2], Selvam Valliappan[3]

[1]SERIS, Singapore, Singapore; [2]VISTEC, Rayong, Thailand; [3]BCA Academy, Singapore, Singapore

3DO.18.4

Silicon Heterojunction Solar Technology at the Gate of the Giga-Watt-Age: Reliability and Long-Term Performance

Olatz Arriaga Arruti[1], Alessandro Virtuani[1], Christophe Ballif[1;2]

[1]EPFL, Switzerland; [2]CSEM, Switzerland

3DO.18.5

Extended Durability Tests of PV Modules Fabricated from Treated Solar Cells by Laser Enhanced Contact Optimization (LECO) And Energy Yield Comparison After 1 Year of Outdoor Exposure

Eve Krassowski[1;2;3], Bengt Jäckel[2], Matthias Pander[2], David Daßler[2], Stephanie Malik[2]

[1]CE Cell Engineering, Kabelsketal, Germany; [2]Fraunhofer CSP, Halle (Saale), Germany; [3]Martin Luther University, Halle (Saale), Germany

3DO.18.6

Glass-Glass PV Modules: Characterization of Chemical and Mechanical Degradation

Laura Schelhas[1], Laura Spinella[1], Sonna Uliccna[2], Archana Sinha[2], Dana Sulas-Kern[1], Michael Owen-Bellini[1], Steve Johnston[1]

[1]NREL, Golden, United States; [2]SLAC National Accelerator Laboratory, Menlo Park, United States

Visual Presentations 1DV.4

15:15- 16:45 Characterisation & Simulation of solar cells **Poster Area**

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

17:00- 18:30 Poster Award Winners Sessions

Oral Presentations 4DO.5

17:00- 18:30 PV System Optimization

Chairpersons:

Franz P. BAUMGARTNER *(i)*
ZHAW, Winterthur, *Switzerland*

Urs MUNTWYLER *(i)*
Dr. Schüpbach&Muntwyler, Bern, *Switzerland*

4DO.5.1

State-of-Play and Emerging Challenges in PV Energy Yield Simulations: a Multi-case Mult i-model Benchmarking Study

Ioannis (John) Tsanakas[1], Ismael Lokhat[2], Arnaud Jay[1], Clément Gregoire[1], Branislav Schnierer[3], Jozef Rusnak[3], Lukas Dvonc[3], Josephine Berthelot[4], Chloé Monet[5], Kevin Garcia[5], Ivan Lombardero[6], Jonathan Leloux[7], Babacar Sarr[7], Alfons Armbruster[8], Jefferson Bor[8]

[1]CEA, Le Bourget-du-Lac, France; [2]Cythelia Energy, La Motte-Servolex, France; [3]Solargis, Bratislava, Slovakia; [4]Akuo, Paris, France; [5]CNR, Lyon, France; [6]Qualifying Photovoltaics, Madrid, Spain; [7]LuciSun, Villers-la-Ville, Belgium; [8]Fraunhofer ISE, Freiburg im Breisgau, Germany

4DO.5.2

End-User Financial Optimization of Commercial Rooftop Fixed-Tilt PV Systems

Jennifer Braid[1], Joshua S. Stein[1], Pierre Lacerte[2], Francois Gilles-Gagnon[2]

[1]Sandia National Laboratories, Albuquerque, United States; [2]Opsun Systems, Quebec, Canada

4DO.5.3

Wind Effects on PV-Structures: When and How to Design for Wind

Francesco Dorigatti[1], Matthew Browne[2], Chiara Pozzuoli[1], Zachary J. Taylor[2]

[1]RWDI, Milano, Italy; [2]RWDI, Guelph, Canada

4DO.5.4

Technical due Diligence of PV Trackers – a Key Ingredient for Success

Gerhard Weinrebe[1], Benjamin Sauer[1], Vinh Hiep Nguyen[1], Jack Lehrecke[2], Verena Göcke[1], Yue Pan[1], Thomas Keck[1], Minxiang Gao[2]

[1]sbp sonne, Stuttgart, Germany; [2]sbp, Berlin, Germany

4DO.5.5

Impact of Structural Elements on the Bifacial Energy Gain of Photovoltaic Arrays

Jesus Robledo Bueno[1], Babacar Sarr[1], Ibrahim El Boujdaini[1], Roxane Bruhwyler[2], Jonathan Leloux[1], Christian A. Gueymard[3], Anton Driesse[4], Frédéric Lebeau[5]

[1]LuciSun, Villers-la-Ville, Belgium; [2]University of Liege, Gembloux, Belgium; [3]Solar Consulting Services, Colebrook, United States; [4]PV Performance Labs, Freiburg, Germany

4DO.5.6

Bifacial PV Canopy System in High Latitude, Model Development and Validation with First Months of Monitoring Data

Samuli Ranta[1], Hugo Huerta Medina[1], Sami Jouttijärvi[2], Aleksi Heinonen[3], Kati Miettunen[2]

[1]TUAS, Turku, Finland; [2]University of Turku, Turku, Finland; [3]TUBITAK-NMI, Turku, Finland

Oral Presentations 5DO.10

17:00- 18:30 Regional Prospects / Societal Aspects in the Deployment of PV

Chairpersons:

Simona DE IULIIS *(i)*
ENEA, Rome, *Italy*

Juzer VASI *(i)*
IIT Bombay, Mumbai, *India*

5DO.10.1

Invited

5DO.10.2

Photovoltaic Solar Mapping of Vulnerable Areas as a Tool for the Development of Solar Energy Cooperatives in Slums

Diego Souza Caetano[1;2], Louise Land Bittencourt Lomardo[2], Barbara Simões de Breyer[1], Luciane Martins Do Pilar[1], Jhennyfer Rodrigues Parente[1]

[1]La Salle University Center of Rio de Janeiro, Brazil; [2]UFF, Brazil

5DO.10.3

Cities as Pioneers of the Energy Transition: Evidence and Challenges from the Covenant of Mayors and the EU Cities Mission

Giulia Ulpiani[1], Valentina Palermo[1], Giulia Melica[1], Nadja Vetters[1], Paolo Bertoldi[1]

[1]European Commission JRC, Ispra, Italy

5DO.10.4

Consumers' Willingness to Pay for Residential Rooftop Photovoltaics in Pakistan

Inayatullah Jan[1], Riaz Shahid[2]

[1]University of Agriculture Peshawar, Peshawar, Pakistan; [2]University of Agriculture, Peshawar, Pakistan

5DO.10.5

Socio-economic Factors and Demographic Statistics behind the Deployment of Distributed Photovoltaic and Solar Thermal Systems in Sweden

Sofia Ekbring[1], David Lingfors[1], Robert Johansson[2], Johan Lindahl[3]

[1]Uppsala University, Sweden; [2]Becquerel Sweden, Sweden; [3]Chalmers University of Technology, Götebrog, Sweden

5DO.10.6

Assessment of Consumers' Willingness to Pay for Solar-Powered Bus Rides

Si Ying Lee[1], Mavian Tay[1], Stephen Tay[1;2]

[1]NUS, Singapore, Singapore; [2]SERIS, Singapore, Singapore

Oral Presentations 5DO.15

17:00- 18:30 Costs, Economics, Finance, Markets

Chairpersons:

Izumi KAIZUKA *(i)*
RTS, Chuo-ku, *Japan*

Christian BREYER *(i)*
LUT University, Lappeenranta, *Finland*

5DO.15.1

A Snapshot of Global PV Markets - the Latest Survey Results on PV Markets and Policies from the IEA PVPS Programme in 2021

Gaëtan Masson[1], Arnulf Jäger-Waldau[2], Izumi Kaizuka[3], Johan Lindahl[4], Jose Donoso Alonso[5]

[1]IEA PVPS, France; [2]European Commission JRC, Italy; [3]RTS Corporation, Japan; [4]Becquerel Sweden, Sweden; [5]UNEF, Spain

5DO.15.2

Impact of Disruptive Technologies on PV Decarbonization Cost

Billy Stanbery[1], Jao Van de Lagemaat[2]

[1]Hamburg University of Applied Sciences, Tucson, United States; [2]NREL, Golden, United States

5DO.15.3

Impact of Performance Degradation Curves on the Profitability of Solar Photovoltaic Projects

Alessandro Virtuani[1], Luca Morganti[1], Mauro Pravettoni[2]

[1]Officina del Sole, Milan, Italy; [2]SERIS, Singapore, Singapore

5DO.15.4

Levelized Profits for Residential PV-Battery Systems in Germany: an Approach for a Comprehensive Investment Appraisal

Christopher Ball[1], Wilhelm Kuckshinrichs[1], Gianmarco Aniello[1]

[1]Forschungszentrum Jülich, Jülich, Germany

5DO.15.5

A Solar PV Profitability Study as a Function of Wholesale Market Price Variation Patterns

Philippe Macé[1], Elina Bosch[1], Monica Aleman[1], André Penas[1], Adrien van Rechem[1]

[1]Becquerel Institute, Belgium

5DO.15.6

The Influence of Falling Costs for Electrolysers on the Location Factors for Green Hydrogen Production

Raphael Niepelt[1;2], Marlon Schlemminger[1;2], Dennis Bredemeier[1;2], Florian Peterssen[1], Clemens Lohr[3], Astrid Bensmann[3], Richard Hanke-Rauschenbach[3], Rolf Brendel[1;2]

[1]ISFH, Emmerthal, Germany; [2]Leibniz University of Hannover, Hanover, Germany

Oral Presentations 3DO.19

17:00- 18:30 Stability Testing and Qualification of PV Modules

Chairpersons:

Teresa M. BARNES *(i)*
NREL, Golden, *United States*

Tony SAMPLE *(i)*
European Commission JRC, Ispra, *Italy*

3DO.19.1

Investigating Long-term UV-Durability of Glass/Transparent Backsheet Laminates for Bifacial Photovoltaics

Xiaohong Gu[1], Soshana Smith[1], Stephanie Moffitt[1], Stefan Mitterhofer[1], Songsyun Jhang[1], Stephanie Watson[1], LI-Piin Sung[1]

[1]NIST, Gaithersburg, United States

3DO.19.2

Highly Accelerated Durability Testing of Encapsulant/PV Module Interfaces by Superposition of Cyclic Mechanical Stresses and Environmental Influences

Gabriel Riedl[1], Gernot M. Wallner[1], Robert Pugstaller[1]

[1]Johannes Kepler University, Linz, Austria

3DO.19.3

The Preconditioning Effect of Uncured EVA Rolls on the Long-Term UV Exposure of Glass/Glass Modules

Luca Gnocchi[1], Alessandro Virtuani[1], Christophe Ballif[1]

[1]EPFL, Neuchâtel, Switzerland

3DO.19.4

Mitigating the Influence of LID and LETID on Damp Heat and Thermal Cycling Test Results

Esther Fokuhl[1], Georg Mülhöfer[1], Daniel Philipp[1], Viktor Wesselak[2], Thomas Mikolajick[3], Paul Gebhardt[1]

[1]Fraunhofer ISE, Freiburg, Germany; [2]University of Applied Sciences Nordhausen, Nordhausen, Germany; [3]TU Dresden, Dresden, Germany

3DO.19.5

Influence of Production Processes on PID-s Sensitivity of c-Si Modules and Novel Mitigation Strategies

Alexander Stauffenberg[1;2;3], Bengt Jäckel[1;2], Matthias Pander[1;2], Jens Fröbel[1;2], Christof Erban[4]

[1]Fraunhofer CSP, Halle (Saale), Germany; [2]Fraunhofer IMWS, Halle (Saale), Germany; [3]Martin Luther University, Halle (Saale), Germany; [4]SUNOVATION, Elsenfeld, Germany

3DO.19.6

Hail Impact Test on PV Modules: Improving the Test Setup to 100mm Hail Class

Mauro Caccivio[1], Moreno Ronchi[1], Mattia Ceretti[1], Falvio Valoti[1], Giovanni Bellenda[1]

[1]SUPSI, Mendrisio, Switzerland

Oral Presentations 3EO.1

08:30- 10:00 Lifetime and Degradation/ System Components and Performance

Chairpersons:

Jens MOSCHNER *(i)*
KU Leuven, *Belgium*

Angela DE ROSE *(i)*
Fraunhofer ISE, Freiburg, *Germany*

3EO.1.1

LeTID in Real Life: Incoming Cell Qualification for Module Manufacturers

Alison Ciesla[1], Arastoo Teymouri[1], LI Wang[1], Moonyong Kim[1], Catherine Chan[1], Ran Chen[1], Petra Manshanden[2], Bas Van Aken[2], Jakob Jan Dijksterhuis[3], Brett Hallam[1], Gianluca Coletti[1;2]

[1]UNSW, Australia; [2]TNO, The Netherlands; [3]Elsun, The Netherlands

3EO.1.2

Towards Standardization of Accelerated Stress Testing Protocols for Metal-Halide Perovskite Photovoltaic Modules

Michael Owen-Bellini[1], Timothy J Silverman[1], Michael G. Deceglie[1], Paul Ndione[1], Nikos Kopidakis[1], Ingrid Repins[1], Mickey Wilson[1], Dana Sulas-Kern[1], Kirsten Perry[1], Robert White[1], Colin Sillerud[2], Prem Rana[3], Jinsong Huang[3], Zhaoning Song[4], Michael Heben[4], Yanfa Yan[4], Tanka Rana[5], Devin Mackenzie[5], Bruce King[6], Joshua S. Stein[6], Joseph Berry[1], Laura Schelhas[1]

[1]NREL, Denver, United States; [2]CFV Labs, Albuquerque, United States; [3]University of North Carolina, United States; [4]University of Toledo, Toledo, United States; [5]University of Washington, Seattle, United States; [6]Sandia National Laboratories, Albuquerque, United States

3EO.1.3

Worldwide Moisture Ingress Evaluation Using Finite Element Simulations and Machine Learning

Stefan Mitterhofer[1], Julián Ascencio-Vásquez[2;3], Xiaohong Gu[1]

[1]NIST, Gaithersburg, MD, United States; [2]Envision Digital, Redwood City, CA, United States; [3]ASVA Consulting, Santa Cruz de Tenerife, Spain

3EO.1.4

Quantifying the Energy Impact of Soiling thanks to the Tool SoilRatio

Eric Pilat[1], Hervè Colin[1], Remi Monna[1], Mohamed Amhal[1]

[1]CEA, Bourget du lac, France

3EO.1.5

Interaction of PV-Modules and Tracker Structure

Benjamin Sauer[1], Fabian Gross[1], Thomas Moschner[2], Markus Balz[1]

[1]sbp sonne, Stuttgart, Germany; [2]sbp, Stuttgart, Germany

3EO.1.6

High Coupling Efficiency in directly coupled PV-battery Systems under Variable Irradiance, Temperature and Load

Sergey Shcherbachenko[1], Oleksandr Astakhov[1], Ugochi Kaosisochukwu Chime[1], LI-Chung Kin[1], Egbert Figgemeier[1;4], Kaining Ding[1], Bart E. Pieters[1], Uwe Rau[1;4], Tsvetelina Merdzhanova[1]

[1]Forschungszentrum Jülich, Jülich, Germany; [2]RWTH Aachen University, Aachen, Germany

Oral Presentations 4EO.2

08:30- 10:00 PV System Design / Power Electronics

Chairpersons:

Giovanna ADINOLFI *(i)*
ENEA, Portici, *Italy*

Clifford HANSEN *(i)*
Sandia National Laboratories, Albuquerque, *United States*

4EO.2.1

The Hybridisation of Wave and Solar Energy to Provide Consistent Power to Islanded Loads

Macauley Versey[1]

[1]University of Edinburgh, Edinburgh, United Kingdom

4EO.2.2

A Model Correcting the Effect of Sub-Hourly Irradiance Fluctuations on Overload Clipping Losses in Hourly Simulations

Adrien Villoz[1], Bruno Wittmer[1], André Mermoud[1], Michele Oliosi[1]

[1]Pysyst, Satigny, Switzerland

4EO.2.3

A General PV Plant Digital Twin Concept to Support the Complete Project Lifecycle

Imre T. Horvath[1], Joris Lemmens[2], Brett Birnie[3], Thomas M. Hall[3], Guillermo Oviedo-Hernandez[4], Olivier Dupon[2], Arttu Tuomiranta[2], Virginijus Vasylius[1], Will Hitchcock[3], Ivan Gordon[2]

[1]PVcase, Vilnius, Lithuania; [2]imec, Genk, Belgium; [3]Above Surveying, Colchester, United Kingdom; [4]BayWa, Rome, Italy

4EO.2.4

GaN based Panel-Integrated, High-Efficiency DC/DC Optimizer for Maximizing the Yield of the Large Photovoltaic Power Plant

Stephane Catellani[1], Van-Sang Nguyen[1], Anthony Bier[1], Tony Delaplagne[1], Patrick Merhej[2], Carlotta Greco[2], Fabrizio Bizzarri[2]

[1]CEA, Le Bourget-du-Lac, France; [2]ENEL Green Power, Milano, Italy

4EO.2.5

Data-Driven PV System Engineering: Comprehensive Modelling and Simulation of a Grid-Connected Three-Phase Inverter

Valeriya Titova[1], Leon Lahrmann[1], Frerk Haase[2], Zouhair Khadiri-Yazami[3], Martin Lapke[1]

[1]Hamburg University of Applied Sciences, Hamburg, Germany; [2]Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology, Hamburg, Germany; [3]SMA Solar Technology, Niestetal, Germany

4EO.2.6

Microinverter PV Systems: Formula for Energy Yield Assessment for any PV Panel Size at Different Microinverter Types

Stefan Krauter[1], Jörg Bendfeld[1]

[1]University of Paderborn, Paderborn, Germany

Oral Presentations 5EO.3

08:30- 10:00 Global, Regional and National Scenarios

Chairpersons:

Maria GETSIOU *(i)*
European Commission, Brussels, *Belgium*

Philippe MALBRANCHE *(i)*
International Solar Alliance, Chambéry, *France*

5EO.3.1

Estimates of Material Consumption for PV Towards Net-Zero Emissions by 2050

Robert Underwood[1], Moonyong Kim[1], Yuchao Zhang[1], LI Wang[1], Storm Drury[1], Pablo Dias[1], Pietro P. Altermatt[2], Brett Hallam[1]

[1]UNSW, Kensington, Australia; [2]Trina Solar, ChangZhou, China

5EO.3.2

Sector-Coupled Energy Model for the European Electricity, Heat, and Transport Sectors - Results

Alexander Blinn[1], Henrik Te Heesen[2]

[1]Toyota, Hoppstädten-Weiersbach, Germany; [2]Trier University of Applied Sciences, Hoppstädten-Weiersbach, Germany

5EO.3.3

Australian Photovoltaic Potential in Different Climate Change Scenarios: Future Projections and Associated Costs

Alejandra Isaza[1], Merlinde Kay[1], Jason Evans[1], Stephen Bremner[1], Abhnil Prasad[1]

[1]UNSW, Sydney, Australia

5EO.3.4

Rapid Solar Photovoltaic Adoption by the United Nations with Evolving Smart Contracts and Demand Response

Manojit Ray[1]

[1]IIT Kharagpur, India

5EO.3.5

The Status of Photovoltaics in Italy and the Prospects for Contributing to the Goal of Energy Decarbonisation

Salvatore Guastella[1], Ezio Terzini[2]

[1]RSE, Milano, Italy; [2]ENEA, Portici, Italy

5EO.3.6

Screening of Potential Sites Adapted for hybrid PV+CSP Systems in Marrakesh-Safi-Morocco Using a GIS-AHP Analysis

Ouafae Jbaihi[1;2], Fatima-Zahra Ouchani[1;2], Ahmed Alami Merrouni[3], Mohamed Maaroufi[1], Abdellatif Ghennioui[2], Zakaria Naimi[2], Mohamed Cherkaoui[1]

[1]Mohammadia School of Engineers, Rabat, Morocco; [2]Green Energy Park, Ben Guerir, Morocco; [3]Mohammed First University, Oujda, Morocco

Plenary Presentations 5EP.1

10:30- 12:00 PV in the TW Era – Scenarios for Sustainable Energy Future

Chairpersons:

Stefan NOWAK *(i)*
NET Nowak Energy & Technology, St. Ursen, *Switzerland*

Keiichi KOMOTO *(i)*
Mizuho Research & Technologies, Tokyo, *Japan*

Annick ANCTIL *(i)*
Michigan State University, Michigan, *United States*

5EP.1.1

A Critical Review of Circular Economy for Photovoltaic Modules – Status, Challenges, and Opportunities

Garvin Heath[1;2], Dwarakanath Ravikumar[1], Brianna Hansen[1;2], Elaine Kupets[1]

[1]NREL, golden, United States

5EP.1.2

Invited

5EP.1.3

Reflecting the Energy Transition from a European Perspective and in the Global Context – Relevance of Solar Photovoltaics Benchmarking Two Ambitious Scenarios

Christian Breyer[1], Dmitrii Bogdanov[1], Manish Ram[1], Siavash Khalili[1], Eero Vartiainen[2], David Moser[3], Eduardo Román Medina[4], Gaëtan Masson[5], Arman Aghahosseini[1], Theophilus Mensah[1], Michael Schmela[6], Raffaele Rossi[6], Walburga Hemetsberger[6], Arnulf Jäger-Waldau[7]

[1]LUT University, Finland; [2]Fortum Growth, Finland; [3]Eurac Research, Italy; [4]Tecnalia, Spain; [5]Becquerel Institute, Belgium; [6]SolarPower Europe, Belgium; [7]European Commission JRC, Italy

5EP.1.4

SocialRES: Social Innovations as the Pathway Towards Energy Democracy and as Sustainable Solution for the Mitigation of the Global Warming

Silvia Caneva[1], Sonja Wilhelm[1], Iban Lizarralde[2], Mikhail Hamwi[2], Audrey Abi Akle[2], Basma Samir[2], Volker Kromrey[3], Dimitri Vedel[3], Jung Lin[3], Andreas Schneller[4], Jakob Hoffmann[4], Kathrin Kohl[4], Lisa Richter[4], Elisabeth Schmid[5], Alice De Ferrari[5], Claudia Crippa[5], Eleanor Denny[6], Ivan Petrov[6], Sofia Mulero[7], Alejandro Hernández Serrano[7], Patxi Bergara[8], Iban Lacoste[8], Maria Regidor[9], Rodrigo Ruiz[9], Santiago Campos[9], Eva Otero[9], Nuno Brito Jorge[10], Inês Branco[10], Karl Harder[11], Velimir Segon[12], Tijana Šimek[12], Alexandru Costeniuc[13]

[1]WIP Renewable Energies, München, Germany; [2]ESTIA, Bidart, France; [3]Bodensee-Stiftung, Radolfzell am Bodensee, Germany; [4]adelphi, Berlin, Germany; [5]ICONS, Lodi, Italy; [6]Trinity College Dublin, Ireland; [7]CARTIF Technology Center, Boecillo, Spain; [8]I-ENER, Saint-Jean-le-Vieux, France; [9]Energética, Valladolid, Spain; [10]GoParity - Impact Investing, Lisboa, Portugal; [11]Abundance, United Kingdom; [12]Regea, Zagreb, Croatia; [13]Tractebel Engineering , Germany

5EP.1.5

Invited

12:10- 13:45 Closing Session

.

VISUAL PRESENTATIONS

MONDAY, 26 SEPTEMBER 2022

Visual Presentations 2AV.1

13:30- 15:00 Perovskite Photovoltaics **Poster Area**

2AV.1.1

Light-Soaking, Photo-Damage and Self-Healing in Halide Perovskites

Davide Raffaele Ceratti[1], David Cahen[2], Gary Hodes[2], Philip Schulz[1], Jean-Francois Guillemoles[1]

[1]IPVF, Palaiseau, France; [2]Weizmann Institute of Science, Rehovot, Israel

2AV.1.2

Chemical Bath Deposition: Developing Large-Scale Fabrication of SnO2 as Electron Transport Layer for NIP Perovskite-Based Solar Cells

Marion Provost[1], Iwan Zimmermann[1], Stephanie Gbegnon[1], Alexandre Blaizot[1], Aurelien Duchatelet[2], Jean Rousset[2]

[1]IPVF, Palaiseau, France; [2]EDF R&D, Palaiseau, France

2AV.1.3

Quantifying Energy Losses Due to Light Soaking Effect in Perovskite Solar Cells under Outdoor Conditions

Marko Remec[1;2], Spela Tomsic[2], Mark Khenkin[1], Quiterie Emery[1], Jinzhao Ll[1], Eva Unger[1], Rutger Schlatmann[1], Marko Topic[2], Carolin Ulbrich[1]

[1]HZB, Berlin, Germany; [2]University of Ljubljana, Ljubljana, Slovenia

2AV.1.4

Evaluation of Performance Measurements of Different Type Perovskite Devices at Different Measurement Conditions

Vasiliki Paraskeva[1], Maria Hadjipanayi[1], Matthew S.H. Norton[1], Aranzazu Aguirre[2], Afshin Hadipour[2], George Elias Georghiou[1]

[1]University of Cyprus , Nicosia, Cyprus; [2]IMEC, Leuven, Belgium

2AV.1.5

Enhanced Electronic Properties and Stability in Tin-Lead Mixed Halides Perovskite Solar Cells via Additive Engineering

Shahrir Razey Sahamir[1], Muhammad Akmal Kamarudin[1], Gaurav Kapil[1], Qing Shen[1], Shuzi Hayase[1]

[1]The University of Electro-Communications, Japan

2AV.1.6

Using the Addition of Ethyl Acetate Anti-solvent to Enhance the Efficiency of Blade-coated Perovskite Solar Cells

Rui Yun Hsu[1], Tsung Chieh Cheng[2], Yu Chen Lin[2], Han Ting Sun[2], Yung-Liang Tung[1]

[1]ITRI, Tainan, Taiwan; [2]NKUST, Kaohsiung, Taiwan

2AV.1.7

Quantification of Spatially Resolved Electrical Properties of Laser Patterned, Interconnected Perovskite Solar Cells based on Hyperspectral Imaging

Christof Schultz[1], Markus Fenske[1], Guillaume Gélinas[2], Stéphane Marcet[2], Laura-Isabelle Dion-Bertrand[2], Janardan Dagar[3], Andreas Bartelt[1], Rutger Schlatmann[4], Eva Unger[3], Bert Stegemann[5]

[1]Berlin University of Applied Sciences, Berlin, Germany; [2]Photon etc, Montréal, QC, Canada; [3]HZB, Berlin, Germany

2AV.1.8

Universal Homologous Bromides Passivation for High Performance Perovskite Solar Cells

Yong LI[1;2]

[1]CSIRO Energy, Newcastle, Australia; [2]UNSW, Australia

2AV.1.9

Influence of the Anion Choice on the Passivation with Ionic Liquids in Wide-Bandgap Inverted Perovskite Solar Cells

Florian Scheler[1], Silvia Mariotti[1;2], Daniele Pane Mantione[3], Artem Musiienko[4], Kari Sveinbjoernsson[1], David Mecerreyes[3], Steve Albrecht[1]

[1]HZB, Berlin, Germany; [2]OIST, Okinawa , Japan; [3]UPV/EHU, Donostia-San Sebastián, Spain

2AV.1.10

Exploration of Sub-Bandgap States in 2D Halide 1 Perovskite Single-Crystal Photodetector

Eunyoung Choi[1], Yurou Zhang[2], Arman Mahboubi Soufiani[1], Minwoo Lee[1], Richard Webster[1;4], Michael E. Pollard[1], Peter Reece[1], Jongchul Lim[6], Wonjong Lee[6], Jan Seidel[1;4], Jung-Ho Yun[2], Jaesung Yun[1;8]

[1]UNSW, Sydney, Australia; [2]University of Queensland, Queensland, Australia; [3]Chungnam National University, Daejeon, Korea, Dem. People's Rep. of; [4]University of Surrey, Guildford, United Kingdom

2AV.1.11

First-Principles Prediction of the Current-Voltage Curve in Perovskite Solar Cells

Juan A. Anta[1], Gerko Oskam[1], Antonio J Riquelme[1], Karen L. Valadez-Villalobos[1], Renan Escalante-Quijano[1]

[1]University Pablo de Olavide, Sevilla, Spain

2AV.1.12

Perovskite Based Solar Ink for Different Fabrication Processes

Anjusree Shyla[1], Deepak Thrithamarassery Gangadharan[2], Erin Moloney[2], Sahar Sam[1], Sonal Prajapati[1], Makhsud Saidaminov[2]

[1]Solaires Entreprises, Victoria, Canada; [2]University of Victoria, Victoria, Canada

2AV.1.13

Analysis on Long-term Stability of Perovskite Solar Cells Using SCAPS-1D Simulation

Seongtak Kim[1], Younghun Jeong[1], Dong-Woon Han[1], Chan Bin Mo[1]

[1]KITECH, Wonju, Korea, Rep. of South

2AV.1.14

New Photoactive Lead-free Perovskite Absorber: Process and Preliminary Characterization

Alexandre Py[1], Yifeng Zhong[1], Pallavi Singh[2], David Cahen[2], Géraud Delport[1], Davide Raffaele Ceratti[1], Javid Hajhemati[1], Claire Darin Bapaume[1], Paul-Alexis Pavard[1], Nathanaelle Schneider[1], Jean-Francois Guillemoles[1], Philip Schulz[1]

[1]IPVF, Palaiseau, France; [2]Weizmann Institute of Science, Rehovot, Israel

2AV.1.15

Size/Location-Dependent Effects of the Plasmonic AU Nanoparticles on the Performance of Perovskite Solar Cells

Oleksii Omelianovych[1], Nikolai Tsvetkov[2], Liudmila Larina[1], Kwanghyeon Jo[3], BA Thong Trinh[3], Ilsun Yoon[3], Ho-Suk Choi[1]

[1]Chungnam National University, Daejeon, Korea, Rep. of South; [2]KAIST, Daejeon, Korea, Rep. of South

2AV.1.16

Testing EVA, PMMA and PVDF Encapsulated Perovskite Solar Cells in a Climatic Chamber by Following the International Summit on Organic Photovoltaic Stability (ISOS-T) Protocols.

Luis Ocaña[1;2], Carlos Montes[1;2], Sara González-Pérez[3], Benjamin González-Diaz[2], Elena Llarena[1]

[1]ITER, Granadilla, Spain; [2]ULL, San Cristóbal de La Laguna, Spain

2AV.1.17

Effect of Passivation of the Nanostructured Electron Transport Layer on the Overall Solar Cell Efficiency

Ivana Panzic[1], Arijeta Bafti[1], Floren Radovanovic-Peric[1], Thomas Rath[2], Vilko Mandić[1]

[1]University of Zagreb, Zagreb, Croatia; [2]Graz University of Technology, Graz, Austria

2AV.1.18

Influence of the Electron Transport Layer Pre-treatment on the Efficiency of Perovskite Solar Cells

Arijeta Bafti[1], Ivana Panžić[1], Luka Pavić[2], Maja Mičetić[3], Vilko Mandić[1]

[1]University of Zagreb, Zagreb, Croatia; [2]Ruđer Bošković Institute, Zagreb, Croatia

2AV.1.19

The Effect of Different PH Level Towards Control of the Size, Composition and Surface Area of NIO as HTL for Inverted Perovskite Solar Cells

Zul Atfyi Fauzan Mohammed Napiah[1], Subathra Muniandy[1], Muhammad Idzdihar Idris[1], Nurbahirah Norddin[2], Marzaini Rashid[3], Luke Bradley[4]

[1]UTeM, Malacca, Malaysia; [2]USM, Penang, Malaysia; [3]Newcastle University, Newcastle, United Kingdom

2AV.1.20

Optimization of Coating Parameters for Enabling High-Performance Triple Cation Perovskite Solar Cell via Upscalable Hybrid Dry-Wet Deposition Route

Van Son Nguyen[1], Elisa Grépin[1], Iwan Zimmermann[1], Elise Bruhat[2], Olivier Dupré[2], Solenn Berson[2], Matthieu Manceau[2], Jean Rousset[3]

[1]IPVF, France; [2]CEA, France; [3]EDF R&D, France

2AV.1.21

Optimization of Physical Treatments of HTL for Perovskite Solar Cells

Eleonora Quadrivi[1], Gianluigi Marra[2], Rosamaria Marrazzo[2], Alberto Savoini[2], Paolo Biagini[1], Gianni Corso[1], Sergio Fanutti[2], Camilla Marchini[1], Riccardo Po[2], Mario Salvalaggio[2], Fiorenza Simone[1]

[1]eni, Novara, Italy

2AV.1.22

Interface Design of Perovskite Solar Cells: Application of Molecular Additives to Improve the Stability and the Performance

Claire Darin Bapaume[1], Mathieu Frégnaux[2], Baptiste Bérenguier[1], Muriel Bouttemy[2], Philip Schulz[1]

[1]IPVF, Palaiseau, France; [2]ILV, Versailles, France

2AV.1.23

Large Scale Characterization of Perovskite Mini-Modules (25 cm²) by Wide-Field Hyperspectral Luminescence Imaging

Alexandra Levtchenko[1], Emilie Raoult[2], Sebastien Jutteau[2], Jean Rousset[2], Daniel Ory[2]

[1]IPVF, Palaiseau, France; [2]EDF R&D, Palaiseau, France

2AV.1.24

Effect of ETL, and MAPbBrI3 Quantum Dots at HTL/Absorber Interface on the Performance of (SN,GE) Based Perovskite Solar Cells

Vivek Garg[1], Ravula V. N. Sai[1], Swarna S. R. Reddy[1], Anjali Mantri[1], Gaurav Siddharth[1]

[1]SVNIT, Surat, India

2AV.1.25

Numerical Modeling and Performance Enhancement of Carbon-Based Monolithic Perovskite Solar Cell Using Cesium Based Triple Cation Composition

Zubair Ahmad[1], Ehsan Raza[1]

[1]Qatar University, Doha, Qatar

2AV.1.26

Simulation of Ecofriendly Photovoltaic Device for Indoor Application by Using SCAPS 1-D

Km Neeraj[1], Brajendra Sengar[2], Saurabh Mishra[1]

[1]Centre for Advanced Studies, Lucknow, India; [2]National Institute of Technology, Sri Nagar, India

2AV.1.27

H2020 Viperlab Knowledge Exchange Platform

Francesco Roca[1], David Casaburi[1]

[1]ENEA, Portici, Italy

2AV.1.28

Insight to Perovskite p-n Homojunction

Meicheng LI[1], Peng Cui[1], Jun Ji[1], Hao Huang[1], Luyao Yan[1], Xinxin Wang[1], Shuxian Du[1], Benyu Liu[1], Shujie Qu[1], Qiang Zhang[1], Zhineng Lan[1], Yingying Yang[1]

[1]North China Electric Power University, Beijing, China

2AV.1.29

Surface Passivation Layer Using S-Based Aprotic Organic Cation for Efficient and Stable PSCs

Sanjay Sandhu[1], Bommaramoni Yadagiri[1], Senthilkumar Muthu[1], Ashok Kumar[1], Jae-Joon Lee[1]

[1]Dongguk University, Seoul, Korea, Rep. of South

2AV.1.30

Performance Improvement of Carbon-Based Perovskite Solar Cells by Modification of the Cell Architecture

Dena Pourjafari[1], Wendy Padron[1], Diecenia Peralta[1], Nidia García[1], Simone Meroni[2], Carys Worsley[3], Becky Bolton[2], Trystan Watson[2], Geonel Rodríguez[4], Gerko Oskam[4;5]

[1]CINVESTAV, MERIDA, Mexico; [2]Swansea University, Swansea, United Kingdom; [3]UPO, Sevilla, Spain

2AV.1.31

Efficient Low Bandgap Perovskite Mid-cells Via Hybrid Evaporation-Solution Method for Triple Junction Solar Cells

Mohammad Reza Golobostanfard[1], Xin Yu Chin[1], Kerem Artuk[1], Daniel Anthony Jacobs[1], Quentin Jeangros[2], Christian Wolff[1], Christophe Ballif[1;2]

[1]EPFL, Neuchatel, Switzerland; [2]CSEM, Neuchatel, Switzerland

2AV.1.32

Modeling the Optical Properties of a Perovskite Solar Cell Film Stack

Maria Fernanda Villa Bracamonte[1], Jose Raul Montes Bojorquez[1], Arturo Ayon[1]

[1]The University of Texas at San Antonio, San Antonio, United States

2AV.1.33

Iodine-Induced Phase Segregation in Mixed-Halide Perovskites

Jakub Holovsky[1;2], Katarína Ridzoňová[2], Amalraj Peter Amalathas[1;3], Branislav Dzurňák[1], Lucie Landová[1;2], Petr Jiříček[2], Oleksandr Romanyuk[2]

[1]ASCR, Prague, Czech Republic; [2]University of Jaffna, Jaffna, Sri Lanka

2AV.1.34

Characterization and Degradation of Perovskite Mini-Modules

Rita Ebner[1], Gusztáv Újvári[1], Ankit Mittal[1], Maria Hadjipanayi[2], Vasiliki Paraskeva[2], George Elias Georghiou[2], Aranzazu Aguirre[3], Afshin Hadipour[3]

[1]AIT, Vienna, Austria; [2]University of Cyprus, Nicosia, Cyprus; [3]imec, Genk, Belgium

2AV.1.35

Perovskite Solar Cells Prepared in a Hybrid Process that Makes Use of Ambient and Moisture-Free Conditions to Produce HTM-free Architectures with Back Contact Based on Carbon and MAI in PVDF Compounds

Carlos Montes[1;2], Luis Ocaña[1;2], Sara González-Pérez[3], Benjamin González-Diaz[2], Elena Llarena[1]

[1]ITER, Granadilla de Abona, Spain; [2]ULL, San Cristóbal de La Laguna, Spain

2AV.1.36

Optimization of Pb(SCN)2 Composition for Enhancing PSCs Long-Terms Stability

Karim Medjoubi[1], Jean Castillon[1], Thomas Guillemot[1], Dounya Barrit[1;2], Camille Bainier[1;2], Jean Rousset[1;3], Jorge Posada[1;3]

[1]IPVF, Palaiseau, France; [2]TotalEnergies, Paris La Défense, France; [3]EDF R&D, Palaiseau, France

2AV.1.37

Ageing of Perovskite Solar Cells: Indoor Stress Tests and Their Relevance for Outdoor Stability

Ulas Erdil[1], Mark Khenkin[1], Quiterie Emery[1], Hans Köbler[1], Antonio Abate[1], Eugene Katz[3], Rutger Schlatmann[1], Carolin Ulbrich[1]

[1]HZB, Berlin, Germany; [2]BGU, Midreshet Ben-Gurion, Israel

2AV.1.38

Environmental and Health Safety Risk Assessment for Perovskite Solar Cells and Modules

Christa Torrence[1], Cara Libby[2], Joshua S. Stein[1]

[1]Sandia National Laboratories, United States; [2]Electric Power Research Institute, United States

2AV.1.39

Sputtering of NiOx for HTL in Perovskite Tandem or Single Junction Applications

René Köhler[1], Martin Fischer[1], Sebastian Gatz[1]

[1]VON ARDENNE, Dresden, Germany

2AV.1.40

Safe and Scalable Solar Inks: Inkjet Printable Perovskite Absorber Layer Solutions for Solar Cells

Josh Turner[1], Amanda Hughes[1], Laurie Phillips[2], Abhinav Singh[1]

[1]University of Liverpool, Liverpool, United Kingdom; [2]Stephenson Institute for Renewable Energy, Liverpool, United Kingdom

2AV.1.41

Light and Heat Induced Degradation of Encapsulated Carbon-Based Perovskite Solar Cells

Nikoleta Kyranaki[1], Cynthia Farha[2], Lara Perrin[2], Lionel Flandin[2], Emilie Planès[2], Lukas Wagner[3], Karima Saddedine[3], David Martineau[4], Stéphane Cros[1]

[1]CEA, Le Bourget-du-Lac, France; [2]Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, Grenoble INP, LEPMI, Grenoble, France; [3]Fraunhofer ISE, Freiburg, Germany; [4]Solaronix, Aubonne, Switzerland

2AV.1.42

Revealing the Dynamics of Thermal Reaction Between Cu and Mixed Halide Perovskite Solar Cells

Jihoo Lim[1], Eunyoung Choi[1], Moonyong Kim[1], Minwoo Lee[1], Daniel Chen[1;2], Martin A. Green[1], Jan Seidel[1], Jongsung Park[4], Xiaojing Hao[1], Jae Sung Yun[1;5]

[1]UNSW, Sydney, Australia; [2]Sundrive Solar, Kirrawee, Australia; [3]Gyeongsang National University, Jinju, Korea, Rep. of South; [4]University Of Surrey, United Kingdom

2AV.1.43

Surface Engineering of ZnO Thin Film for the Growth of MAPbI3 Perovskite Layer

Muhammad Idzdihar Idris[1], Subathra Muniandy[1], Zul Atfyi Fauzan Mohammed Napiah[1], Zarina Baharudin Zamani[1], Marzaini Rashid[2], Luke Bradley[3]

[1]UTeM, Durian Tunggal, Malaysia; [2]USM, Gelugor, Malaysia; [3]Newcastle University, United Kingdom

2AV.1.44

Investigation of Perovskite Solar Cells Stability through Impedance Spectroscopy and Dark Current-voltage Characterizations

Ilaria Matacena[1], Laura Lancellotti[2], Pierluigi Guerriero[1], Brigida Alfano[2], Eugenia Bobeico[2], Antonella De Maria[2], Vera La Ferrara[2], Lucia V. Mercaldo[2], Mara Miglietta[2], Tiziana Polichetti[2], Gabriella Rametta[2], Gennaro V. Sannino[2], Paola Delli Veneri[2], Santolo Daliento[1]

[1]University of Naples Federico II, Naples, Italy; [2]ENEA, Portici, Italy

2AV.1.45

Slow Shallow Energy States as the Origin of Hysteresis in Perovskite Solar Cells

Paul A. Procel Moya[1], Rik van Heerden[1], Luana Mazzarella[1], Rudi Santbergen[1], Olindo Isabella[1]

[1]Delft University of Technology, Delft, The Netherlands

2AV.1.46

Relevance of EQE for Perovskite Solar Cells Characterization

Lucia V. Mercaldo[1], Eugenia Bobeico[1], Antonella De Maria[1], Marco Della Noce[1], Manuela Ferrara[1], Vera La Ferrara[1], Laura Lancellotti[1], Gabriella Rametta[1], Gennaro V. Sannino[1], Iurie Usatii[1], Paola Delli Veneri[1]

[1]ENEA, Portici (NA), Italy

2AV.1.47

Energy Harvesting from a Single Lab-Scale Perovskite Solar Cells for Self-Powered Indoor IoT Applications

Darjo Ursic[1], Matija Pirc[1], Marko Jošt[1], Marko Topic[1], Marko Jankovec[1]

[1]University of Ljubljana, Ljubljana, Slovenia

Visual Presentations 2AV.2

15:15- 16:45 CIGS, CdTe, Organic, DSC and Novel Concept Solar Cells and Materials **Poster Area**

2AV.2.1

The Effect of Defect Type, Density, and Position in Ultra-Thin CIGSe Solar Cell Simulations with COMSOL Multiphysics

Jan Lucaßen[1], Setareh Sedaghat[1], Martina Schmid[1]

[1]University of Duisburg-Essen, Duisburg, Germany

2AV.2.2

Growth of ZnO f+Films by Plasma Assisted Reactive Evaporation with Improved Thickness Homogeneity

Julian C Peña[1], Juan Piña[1], Gerardo Gordillo[1]

[1]National University of Colombia, Bogotá, Colombia

2AV.2.3

Alkali PDT on Sb2Se3 Thin Film Solar Cells

Pedro Vidal-Fuentes[1], Ivan Caño Prades[2], Claudia Malerba[3], Matteo Valentini[3], Xavier Alcobe[4], Alejandro Pérez-Rodríguez[1], Edgardo Saucedo[2], V. Izquierdo-Roca[1]

[1]IREC, Barcelona, Spain; [2]UPC, Barcelona, Spain; [3]ENEA, Rome, Italy; [4]UAK, Barcelona, Spain

2AV.2.4

A Walkthrough of Fabricating CuIn(Ga)Se2 Absorbers Using Solid Selenium in the Sequential Technique

Sarallah Hamtaei[1;2;3], Guy Brammertz[1;3;4], Jozef (Jef) Poortmans[1;2;3;5], Tom Aernouts[1;3], Bart Vermang[1;2;3]

[1]imec, Genk, Belgium; [2]Hasselt University, Diepenbeek, Belgium; [3]EnergyVille, Genk, Belgium; [4]Federal University of Alagoas, Diepenbeek, Belgium; [5]KU Leuven, Leuven, Belgium

2AV.2.5

Interface and Window Optimization Studies for Wide Band Gap CIGSe Solar Cells in the Tandem Perspective

Jackson Lontchi[1], Alexandre Crossay[2], Amelle Rebai[2], Damien Coutancier[2], Nathanaelle Schneider[3], Baptiste Bérenguier[2], Polyxeni Tsoulka[4], Nicolas Barreau[4], Jean-Francois Guillemoles[3], Negar Naghavi[2], Daniel Lincot[2]

[1]IPVF, Palaiseau, France; [2]CNRS, Palaiseau, France; [3]University of Nantes, Nantes, France

2AV.2.6

Elaboration of Highly Transparent Luminescent Solar Concentrators for Agrivoltaics: Opportunities for Agriculture and Energy Transition

Othmane Essahili[1], Mouad Ouafi[1], Omar Moudam[1]

[1]Mohammed VI Polytechnic University, Benguerir, Morocco

2AV.2.7

Effect of the Sb/Se Ratio on the Structural, Morphological and Electrical Properties of SbxSey Films

Bobur Ergashev[1], Takhir Razykov[2], Kudrat Kuchkarov[2], Stefano Pasini[3], Alessio Bosio[3], Ramozan Khurramov[2], Diyorbek Isakov[2], Alessandro Romeo[4], Nicola Romeo[5], Mirzavqiy Makhmudov[2], Abdurashid Mavlonov[6]

[1]Uzbekistan Academy of Sciences, Tashkent, Uzbekistan; [2]University of Parma, Parma, Italy; [3]University of Verona, Verona, Italy; [4]Ritsumeikan University, Kusatsu, Japan

2AV.2.8

CPEPh-Na/MoO3 Bi-stack Hole Interfacial Layers for Enhancing the Performance of Nonfullerene Organic Photovoltaics

Enas Moustafa[1], Josep Pallarès Marzal[1], Lluís F. Marsal Garví[1]

[1]University of Rovira i Virgili , Tarragona , Spain

2AV.2.9

Impact of Charge Separation on Solar Cell Performance in PBDB-T-SF and PBDB-T-2Cl:NFA Photoactive Blends

Jafar Khan[1], Neha Chaturvedi[1], George T. Harrison[1], Yuliar Firdaus[1], Dalaver Anjum[2], Thomas Anthopoulos[1], Stefaan De Wolf[1], Frédéric Laquai[2]

[1]KAUST Solar Center, Saudi Arabia; [2]KAUST, Saudi Arabia

2AV.2.10

Metastabilities in Devices Suffering From Potential Induced Degradation Extracted From a Commercial CIGS Module

Remi Aninat[1], Pelin Yilmaz[1], Thomas Weber[2], Mirjam Theelen[1]

[1]TNO, Eindhoven, The Netherlands; [2]PI Berlin, Berlin, Germany

2AV.2.11

Rare-Earth-Based Luminescent Solar Concentrators for Agri-Photovoltaics Technology: Synthesis, Processing and Photophysical Proprieties

Mouad Ouafi[1], Othmane Essahili[2], Omar Moudam[3]

[1]Mohammed VI Polytechnic University, BENGUERIR , Morocco

2AV.2.12

Evolution of Structural and Optoelctronic Properties in Fluorine-Metallic Atoms Co-Doped Zinc Oxide Thin Films and their Application in Cu2ZnSn(S,Se)4 Thin Film Solar Cells

Jang Suyoung[1], Jin Hyeok Kim[1], Eunae Jo[1]

[1]Chonnam National University, Gwangju, Korea, Rep. of South

2AV.2.13

Tunable Bandgap in Kesterite Thin-Films Absorbers Deposited by Sol-Gel Techniques and their Photovoltaic Applications

Giorgio Tseberlidis[1], Vanira Trifiletti[1], Amin Hasan Husien[1], Maurizio Acciarri[1], Simona Binetti[1]

[1]University of Milano-Bicocca, Milano, Italy

2AV.2.14

The Role of Solvent Selection and Post Processing Treatment in Controling Morphology of Bulk Heterojunction Squaraine Organic Solar Cells

Floren Radovanović-Perić[1], Ivana Panzic[1], Arijeta Bafti[1], Vilko Mandić[1], Dragana Vuk[1], Thomas Rath[3]

[1]University of Zagreb, Zagreb, Croatia; [2]Graz University of Technology, Graz, Austria

2AV.2.15

Fabrication of Dye-Sensitized Solar Cell with Improved Electron Transport Properties by Titania Nanostructures

Govindaraj Rajamanickam[1], Vasanth Babu[1], Ramasamy Perumalsamy[1]

[1]SSN Research Centre, Chennai, India

2AV.2.16

Back Contact Engineering in Ultralight Kesterite Solar Cells Made by a Photonic Lift-off Process

Michael Jones[1], Stephen Campbell[1], Udari Wijesinghe[1], Oliver S. Hutter[1], Ahmed Javed[2], Giulia Longo[1], Matthew C. Naylor[1], Guillaume Zoppi[1], Husnu Emrah Unalan[2], Rasit Turan[2], Selçuk Yerci[2], Vincent Barrioz[1], Linzi Dodd[1], Neil S. Beattie[1], Yongtao Qu[1]

[1]Northumbria University, United Kingdom; [2]METU, Turkey

2AV.2.17

Analysis of Selenization Temperature for the Performance Improvement of Spin Coated CZTSSe Solar Cells

Prabeesh Punathil[1], Solidea Zanetti[1], Elisa Artegiani[1], Narges Torabi[1], Alessandro Romeo[1]

[1]University of Verona, Verona, Italy

2AV.2.18

Synthesis of Earth Abundant Chalcogenide Cu2MnSnS4 (CMTS) and its Application in Solar Devices

Luigi Frioni[1], Vanira Trifiletti[1], Giorgio Tseberlidis[1], Riccardo Sorrill[1], Stefano Marchionna[2], Simona Binetti[3]

[1]University of Milano-Bicocca, Milano, Italy; [2]RSE, Milano, Italy; [3]TÜV Rheinland, Milano, Italy

2AV.2.19

Modelling of Thin Film Solar Cell Using Sb2Se3 and Sb2S3: a Novel Approach Towards the Sustainable Energy Conversion

Divyanshi Daksh[1], Brajendra Sengar[2], Saurabh Mishra[3]

[1]Centre for Advanced Studies, Lucknow, India; [2]National Institute of Technology, Sri Nagar, India

2AV.2.20

Development of Large Area Bifacial Dye-Sensitized Solar Cells with Transparency of Above 45 %

Senthilkumar Muthu[1], Kicheon Yoo[1], Heyong Cheol Kang[1], Jae Joon Lee[1]

[1]Dongguk University, Seoul, Korea, Rep. of South

2AV.2.21

Back Contact Engineering in CZTSSe Thin-Film Solar Cells: Strategies to Reduce the Open-circuit Voltage Loss

Baek Myeongcheol[1], Jin Hyeok Kim[1]

[1], Korea, Rep. of South

2AV.2.22

Inkjet-printed Indium Sulfide Buffer Layer for Cu(In,Ga)(S,Se)2: Is it Necessary to Pre-Form the In-S Bond in Solution?

Alice Debot[1], Jérôme Guillot[2], Damilola Adeleye[1], Phillip Dale[1]

[1]University of Luxembourg, Belvaux, Luxembourg; [2]LIST, Belvaux, Luxembourg

Visual Presentations 2AV.3

17:00- 18:30 Tandem Solar Cells / III-V and Related Compound Semiconductors **Poster Area**

2AV.3.1

Investigation of the Perovskite-silicon Tandems based on Industrially Relevant PERC

Yong LI[1], Bruno Vicari-Stefani[1], Christopher Fell[1], Gregory Wilson[1]

[1]CSIRO Energy, Newcastle, Australia

2AV.3.2

Investigation of Zr-doped Indium Oxide Film with High Transmittance in a Wide Wavelength Region for Tandem Solar Cells

Tappei Nishihara[1], Hyunju Lee[1;2], Yoshio Ohshita[3], Atsushi Ogura[1;2]

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2AV.3.3

High Near-Infrared Transmittance IWO Layer for a Rear Side of Bottom Cell in Tandem Solar Cells

Shiyu Zhang[1], Tappei Nishihara[1], Hyunju Lee[2;3], Yoshio Ohshita[2], Atsushi Ogura[1;3]

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2AV.3.4

Pressure-aided Growth Approach of Highly Efficient Tandem Perovskite Solar Cell via Sandwich Evaporation Technique

Ching-Fuh Lin[1], Jia-CI Jhou[1], Chung-Han Chang[1], Ashish Gaurav[1]

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2AV.3.5

Upscaling of Perovskite-Silicon Tandem Solar Cells

Oliver Schultz-Wittmann[1], Patricia Schulze[1], Oussama Er-Raji[1;2], Minasadat Heydarian[1;2], Özde S. Kabakli[1], Raphael Efinger[1], Martin C. Schubert[1], Alexander Bett[1], Oliver Fischer[1;2], Denis Erath[1], Sebastian Pingel[1], Ulrike Heitmann[1], Zohreh Kiaee[1], Markus Kohlstädt[1], Martin Bivour[1], Jan Christoph Goldschmidt[3], Martin Hermle[1], Stefan W. Glunz[1;2]

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2AV.3.6

n++ Gas Immersion Laser Doping of p++ Emitters in POCl3 Atmosphere: Tuning Semiconductor Dopant Concentration and Formation of Crystalline Silicon Tunnel Junction

Filipe Serra[1], Guilherme Gaspar[1], Ana Viana[2], Ivo Costa[1], David M. Pera[1], José Almeida Silva[1], Giso Hahn[3], L. Vines[4], João M. Serra[1], Killian Lobato[1]

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2AV.3.7

Plasma Enhanced Physical Vapor Deposition of Epitaxial III V Materials (GaN)

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2AV.3.8

III-V on Si Tandem Solar Cells Glued by Hybrid Conductive Layers

Phuong-Linh Nguyen[1;2;3], Jerónimo Buencuerpo[2;3], Philippe Baranek[1;2], Oliver Höhn[4], David Lackner[4], Frank Dimroth[4], Marco Faustini[5], Stephane Collin[2;3], Andrea Cattoni[2;3]

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2AV.3.9

Bifacial ZEBRA IBC Silicon Solar Cells for Three and Four Terminal Perovskite Tandem Devices

Valentin Dan Mihailetchi[1], Razvan Roescu[1], Haifeng Chu[1], Radovan Kopecek[1]

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2AV.3.10

Towards Indium Free TCO-Based Recombination Layers in Perovskite on Silicon Tandem Solar Cells

Elise Bruhat[1], Perrine Carroy[1], Saad Makhladi[1], Caroline Bal[1], Olivier Dupré[1], Elsa Parrat[2], Florian Dupont[2]

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2AV.3.11

Optical Effects of Laser-Reduced Graphene Oxide Layers in Tandem Perovskite/CIGS Solar Cells studied by Numerical Simulations

Milan Kovacic[1], Janez Krc[1], Stella Maragkaki[2], Emmanuel Stratakis[2], Mudasar Rashid[3;4;5], Merve Tutundzic[3;4;5], Yinghuan Kuang[3;4;5], Jessica de Wild[3;4;5], Tom Aernouts[3;4;5], Bart Vermang[3;4;5], Marko Topic[1]

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2AV.3.12

Modelling and Optimization of Perovskite-Silicon Tandem Devices for Enhanced Field Energy Production

Spela Tomsic[1], Marko Jošt[1], Kristijan Brecl[1], Benjamin Lipovsek[1], Marko Topic[1]

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2AV.3.13

Development of Electron Selective Tin Oxide Via Vacuum Based Deposition for Manufacturable Perovskite on Silicon Tandem Solar Cells

Elise Bruhat[1], Perrine Carroy[1], Félix Gayot[1], Caroline Bal[1], Nathalie Nguyen[1]

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2AV.3.14

Application of Advanced Hydrogenation Process on SiGe/Si Solar Cells

Zhenyu Sun[1], Fukun Lei[1], Brett Hallam[1], Xiaodan Zhang[2], LI Wang[1]

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2AV.3.15

High Efficiency 3-Terminal Perovskite/Silicon Tandems Based on Tunnel Junction IBC

Laurie-Lou Senaud[1], Brett Kamino[1], Jonas Geissbühler[1], Gabriel Christmann[1], Gizem Nogay[1], Jun Zhao[1], Florent Sahli[1], Patrick Wyss[1], Derk L. Bätzner[2], Damien Lachenal[2], Quentin Jeangros[1], Christophe Ballif[1], Bertrand Paviet-Salomon[1]

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2AV.3.16

Optimization and Characterization of Indium Zinc Oxide TCOs for Perovskite-Silicon Tandem Solar Cell Applications

Volker Sittinger[1], Hunter King[1], Özde S. Kabakli[2], Patricia Schulze[2], Jan Christoph Goldschmidt[3]

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2AV.3.17

Monolithic Perovskite-Carrier Selective Contact Silicon Tandem Solar Cells Using MoOx as a Hole Selective Layer

Hoyoung Song[1], Changhyun Lee[1], Ji Yeon Hyun[1], Sang-Won Lee[1], Dongjin Choi[2], Dowon Pyun[1], Nam Jiyeon[1], Jeong Seokhyun[1], Jiryang Kim[1], Soohyun Hyun Bae[3], Hyunju Lee[4], Yoonmook Kang[5], Donghwan Kim[1], Hae-Seok Lee[5]

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2AV.3.18

Si-based Tunnel Recombination Junction for Perovskite / Silicon Tandem Solar Cells

Baptiste Marteau[1], Thibaut Desrues[1], Quentin Rafhay[2], Anne Kaminski[2], Sébastien Dubois[1]

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2AV.3.19

Opto-Electrical Simulations and Optimization of Two Terminal Perovskite / CIGS Tandem Solar Cells

Paul A. Procel Moya[1], Jelle Knobbe[1], Nasim Rezaei[2], Valerio Zardetto[3], Nga Phung[4], Mike MA[5], Marcel Simor[3], Adriana Creatore[4], Sjoerd Veenstra[3], Rudi Santbergen[1], Olindo Isabella[1]

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2AV.3.20

How to Design Silicon Surfaces for Efficient Si/Perovskite Tandem?

Gurleen Kaur[1], Marion Provost[1], Alexandre Blaizot[1], Antonio de Jesus Olivares-Vargas[2], Dmitri Daineka[2], Jean Rousset[3], Pere Roca I Cabarrocas[1;2]

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2AV.3.21

Impact of Post-annealing on the Performance of Low-Bandgap CIGS Bottom-Cell for 2-Terminal Perovskite/CIGS Tandem Solar Cells

Mudasar Rashid[1;2;3], Jessica de Wild[1;2;3], Guy Brammertz[1;2;3], Sarallah Hamtaei[1;2;3], Yinghuan Kuang[1;2;3], Tom Aernouts[1;2;3], Bart Vermang[1;2;3]

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2AV.3.22

Design and Realization of Low-Temperature Perovskite Solar Cell for 2T Tandem Application with Bifacial Silicon Bottom Cells

Antonio Agresti[1], Sara Pescetelli[1], Erica Magliano[1], Paolo Mariani[1], Giuseppe Bengasi[2], Marcello Sciuto[2], Adriana Isabel Yanez Ladino[2], Carmelo Connelli[2], Cosimo Gerardi[2], Fabrizio Bizzarri[2], Marina Foti[2], Aldo DI Carlo[3]

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2AV.3.23

Bandgap and Temperature Dependent Modelling of Perovskite/Silicon Tandem Solar Cells

Thomas Allen[1], Waseem Raja[1], Erkan Aydin[1], Ahmed Ali Said[1], Michele De Bastiani[1], Stefaan De Wolf[1]

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2AV.3.40

AlGaAs/InGaP Heterojunction Solar Cell Based on Temperature-graded Growth

Gan LI[1], Hassanet Sodabanlu[2], Kentaroh Watanabe[2], Masakazu Sugiyama[1;2], Yoshiaki Nakano[1]

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2AV.3.41

Miniaturization of High Efficiency InGaP/InGaAs/Ge Solar Cells and Pathways for Further Improvements

Thomas Bidaud[1;2], Corentin Jouanneau[1;2], Pierre Albert[1;2;3], Mathieu De Lafontaine[1;2], Abdelatif Jaouad[1;2], Artur Turala[1;2], Gwenaëlle Hamon[1;2], Maxime Darnon[1;2]

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2AV.3.42

Applying Ultra-High Phosphorous Composition GaAsP to InGaAs/GaAsP Strain-Balanced Quantum Structure Solar Cells Aiming for High Efficiency Multi-junction Solar Cells

Meita Asami[1], Kentaroh Watanabe[2], Yoshiaki Nakano[1], Masakazu Sugiyama[1;2]

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2AV.3.43

Epitaxy and Characterization of InP/InGaAs Tandem Solar Cells grown by MOVPE on InP and Si Substrate

Stefano Soresi[1], Mattia Da Lisca[2], Claire Besancon[1], Nicolas Vaissiere[1], Alexandre Larrue[1], Cosimo Calo[1], Josè Alvarez[3], Christophe Longeaud[3], Ludovic Largeau[4], Pablo Garcia-Linares[5], Eric Tournie[6], Jean-Paul Kleider[3], Jean Decobert[1]

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2AV.3.44

Improvement of InGaP Solar Cells Grown with TBP in Planetary MOVPE Reactor

Hassanet Sodabanlu[1], Gan LI[2], Kentaroh Watanabe[1], Yoshiaki Nakano[2], Masakazu Sugiyama[1;2]

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2AV.3.45

Flexible Solar Cell Assemblies- Testing in Harsh Conditions

Roberta Campesato[1], Mariacristina Casale[1], Giuseppe Gabetta[1], Emilio Fernández Lisbona[2]

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2AV.3.46

Study of Sputtered GaN, Nb2O5 and Ta2O5 Anti-Reflection Coating for III/V-based Multi-junction Solar Cells

Filippo Annoni[1], Marina Cornelli[1], Elisabetta Achilli[1], Nicola Armani[1], Nicola Castagnetti[1], Emanuele Malvisi[1], Franco Trespidi[1], Maddalena Patrini[2], Lucio Claudio Andreani[2], Gianluca Timò[1]

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2AV.3.47

Fast External Quantum Efficiency Measurements Using a Fourier Transform-Based Spectroscopy Approach for the Investigation of InGaP/InGaAs/Ge Microcells

Herinirina Fanevamampiandra[1;2;3], Christophe Longeaud[3], Josè Alvarez[3], Alexandre Jaffre[3], Mattia Da Lisca[3], Corentin Jouanneau[1], Thomas Bidaud[1;4], Jean-Paul Kleider[3], Abdelatif Jaouad[4], Marie-Estelle Gueunier-Farret[3], Vincent Aimez[1;4], Gwenaëlle Hamon[1;4], Maxime Darnon[1;4]

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2AV.3.48

Epitaxial Growth and Characterization of 1.0 eV Bandgap GaAsBi - InGaAs Heterojunction Solar Cells

Tadas Paulauskas[1], Jan Devenson[1], Vaidas Pačebutas[1], Arūnas Krotkus[1]

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2AV.3.49

Determination of Soldering Parameters for Triple Junction GaAs Solar Cells

Sebastian Neven-du Mont[1], Torsten Roessler[1], Martin Heinrich[1], Holger Neuhaus[1], Tim Kubera[2]

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2AV.3.50

Optical Characterization of the InGaAsP Solar Cells with Absolute Electroluminescence Observation

Kentaroh Watanabe[1], Riko Yokota[2], Hassanet Sodabanlu[1], Yoshiaki Nakano[2], Masakazu Sugiyama[1;2]

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2AV.3.51

High-Current Output Bifacial Perovskite/Silicon Tandem Solar Cells

Esma Ugur[1], Erkan Aydin[1], Michele De Bastiani[1], George T. Harrison[1], Bumin Yildirim[1], Thomas Allen[1], Sam Teale[2], Bin Chen[2], Philip Schulz[3], Maxime Babics[1], Randi Azmi[1], Akmaral Seitkhan[1], Mingcong Wang[1], Jiang Liu[1], Anand Selvin Subbiah[1], Atteq Ur Rehman[1], Edward H. Sargent[2], Frédéric Laquai[1], Stefaan De Wolf[1]

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Visual Presentations 4BV.1

08:30- 10:00 PV Integrated in the Built Environment Demonstratrion and Performances of Different Technologies / Infrastructure-integrated PV (VIPV, Agri-PV, Floating PV) **Poster Area**

4BV.1.1

Influence of Rear Side Ventilation and Insulation on the Module Performance of PV Facades as Ventilated Curtain Wall

Niklas Albinius[1], Björn Rau[1], Maximilian Riedel[1], Carolin Ulbrich[1], Rutger Schlatmann[1]

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4BV.1.2

Optimising Free-Space Luminescent Solar Concentrator Facades for Solar Roads and Solar Car Parking Sheds

Shweta Pal[1], Rebecca Saive[1]

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4BV.1.3

Development from a Small to Large Scale Luminescent Downshift Layer Fabrication on Silicon Solar Cells

Bill Cass[1], Sarah Mccormack[1], Subhash Chandra[1], Anita Ortega[1]

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4BV.1.4

Performance Assessment of an Hybrid Photovoltaic/Thermal Installation: the IDEAS Project Experience

Paolo Bernardoni[1], Giulio Mangherini[2], Alfredo Andreoli[2], Valentina Diolaiti[2], Mohamed Amine Ouelhazi[2], Donato Vincenzi[2], Eleonora Baccega[3], Silvia Cesari[3], Giuseppe Emmi[3], Michele Bottarelli[3], Anita Ortega[4], Bill Cass[4], Sarah MC Cormack[4]

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4BV.1.5

Critical Issues and Novel Concepts of Cooling BIPVT and its Integration with Low-Temperature Heating

George Aspetakis[1], Cong Wang[1], Stefan Larsson-Mastonstråle[2], Annika Gram[1], Qian Wang[1]

[1]KTH Royal Institute of Technology, Stockholm, Sweden; [2]Maston Group, Sweden

4BV.1.6

Thermal Influences of Rooftop Photovoltaic Panels on Building Performance: a Meta-Analysis

Delia Dagostino[1], Danny Parker[2]

[1]European Commission JRC, Ispra, Italy; [2]Florida Solar Energy Center, United States

4BV.1.7

Glass BIPVs for Commercial Building Integration in Cyprus

Maria Hadjipanayi[1], Yerasimos Yerasimou[1], Matthew S.H. Norton[1], George Elias Georghiou[1], Valia Miltiadous[2], Annita Karantoni[2], Fanos Karantonis[2], Rafaela Nikolaidou[3], Eliza Loucaidou[3]

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4BV.1.8

Demonstration of Colored BIPV Façades: Installation and First Results

Ya-Brigitte Assoa[1], Ioannis (John) Tsanakas[1], Rémi Sanson[1], Romain Joubert[1], Philippe Thony[1], Paul Messaoudi[1], Fabien Chabuel[1], Sean Erik Foss[2], Tine Uberg Nærland[2], Gaute Otnes[2], Nathan Rooslot[2], Christoph Seiffert[2], Laure-Emmanuelle Perret[3], Andy Hoque[4], Sebastien La Fontaine[5], Grégory Bugnon[6], Rayan Hammoud[7]

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4BV.1.9

Demonstration of a Passively Tracked Rooftop Compatible Hybrid Thermal CPV Module

Stephen Askins[1], Guido Vallerotto[1], David Marti[2], Javier Van Herpt[2], Jaime Caselles[2], Ignacio Anton[1]

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4BV.1.10

A Solar Hybrid PVT Driven Heat Pump System Real Performance Techno-Economic Analysis

Asier Sanz Martinez[1], Raquel Fuente Dacal[2], Antonio Jesús Martin Miranda[3]

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4BV.1.11

Smart Windows: Device Efficiency Characterization

Rosamaria Marrazzo[1], Stefano Zanardi[1], Fabio Melchiorre[2], Luciano Caccianotti[1], Mario Salvalaggio[1]

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4BV.1.12

Inspiring BIPV in UAE, a Jury Experience in Solar Decathlon Middle East (SDME21) Contest

Cristina S. Polo López[1], Francesco Frontini[2], Edwin Rodriguez-Ubinas[3]

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4BV.1.13

Maximum Temperature of BIPV Components: Proposal of a New Testing Procedure to Evaluate the Thermal Behaviour of BIPV Products in Non-Conventional Shading Scenarios

Giovanni Bellenda[1], Mauro Caccivio[1], Fabio Parolini[1], Pierluigi Bonomo[1], Francesco Frontini[1]

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4BV.1.14

Experience and Results from the SOLARISE Living Labs

Bert Herteleer[1], Cas Lavaert[1], Bert Uytterhaegen[1], Anastasios Kladas[1], Jan Cappelle[1], Victor Becerra[2], Ahmed Rachid[3]

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4BV.1.30

Technical Aspects for Road Integrated Photovoltaics Towards A More Sustainable Mobility Sector

Jonas D. Huyeng[1], Jacob Forster[1], Felix Basler[1], Pascal Romer[1], Andreas J. Beinert[1], Christian Schill[1], Martin Heinrich[1], Holger Neuhaus[1], Harry Wirth[1]

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4BV.1.31

On-Board Photovoltaic Kit for Existing Vehicles

Benjamin Commault[1], Bertrand Chambion[1], Lionel Serra[1], Fathia Karoui[1], Shehrazade Nassibi[1]

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4BV.1.32

Development of Shade Tolerant PV Road Elements for a PV-Walkway Demonstrator

Bart E. Pieters[1], Baris Dai[2], Aldo Kingma[2], Dorrit Roosen-Melsen[2], Andreas Gerber[1]

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4BV.1.33

Design and Characterization of Semitransparent Patterned PV Modules for Greenhouse Applications

Carlos Alberto Toledo Arias[1], Alessandra Scognamiglio[1], Francesco Frontini[2]

[1]ENEA, Portici (NA), Italy; [2]SUPSI, Switzerland

4BV.1.34

Energy Yield Gain of Various Electrical Layouts for a Curved VIPV Module

Apostolos Bakovasilis[1;2;3], Arttu Tuomiranta[1;2;3], Loïc Tous[1;2;3], Ivan Gordon[1;2;3], Jozef (Jef) Poortmans[1;2;3]

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4BV.1.35

Validation of a Bifacial Simulation Software against Measured Energy Yield from a Utility-Scale Vertical Fixed-Tilt Agrophotovoltaic Plant

Oliver Pfeiffer[1], Jorit Hanneforth[1], Christopher Marks[1], Eva-Maria Grommes[1], Ulf Blieske[1]

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4BV.1.36

Impact of Additional VIPV System Weight on the Energy Balance of Passenger Electric Vehicles

Neel Patel[1], Karsten Bittkau[1], Evgenii Sovetkin[1], Bart E. Pieters[1], Angèle Reinders[2], Kaining Ding[1]

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4BV.1.37

Implementing Smart Panels to Mitigate Mismatch Conditions for a Dynamic Off-Shore Floating PV System

Sara Mirbagheri Golroodbari[1], Wilfried G.J.H.M. van Sark[1]

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4BV.1.38

Design Rules Based on Ground Solar Irradiation to Maintain Soil Quality in Solar Parks

Ilkay Cesar[1], Bas Van Aken[1], Luuk Scholten[2], Ron de Goede[2], Alex Schotman[2]

[1]TNO, Petten, The Netherlands; [2]Wageningen University & Research, Wageningen, The Netherlands

4BV.1.39

A Novel Combined Model for Solar Garden Roof with Bifacial Technology

Antonino Rollo[1], Piero Bevilacqua[2], Roberto Bruno[2], Vittorio Ferraro[2]

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4BV.1.40

Evaluation of Edge Sealants for Floating PV Applications

Nathan Roosloot[1;2], Dag Lindholm[1], Mike Dallaway[4], Guillaume Kegelart[5], Bjørn Hervold Riise[5], Josefine Helene Selj[1;2], Gaute Otnes[1]

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4BV.1.41

Agrivoltaics as a Technological Option for Ecosystem Recovery: a Case Study for the Mar Menor Coastal Lagoon in South East Spain

Carlos Alberto Toledo Arias[1], Adela Ramos[2], Lucía Serrano[3], Antonio Urbina[4]

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4BV.1.42

Prediction of PPFD (Photosynthetic Photon Flux Density) under Transparent CPV Modules

Teruya Toyoda[1], Daisuke Yajima[2], Masaaki Kirimura[2], Kensuke Nishioka[2], Kenji Araki[2], Yasuyuki Ota[2]

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4BV.1.43

Agrivoltaics in a Blackberry Production Test Case

Lisa Bunge[1], Luis Fialho[1;2], Pedro André Dos Santos Ribeiro Horta[1;2]

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4BV.1.44

Multi-scale Analysis of different PV Technologies for Greenhouses

Alessandra Scognamiglio[1], Carlos Alberto Toledo Arias[1], Lucia V. Mercaldo[1], Marco Della Noce[1], Manuela Ferrara[1], Fabrizio Cartenì[2], Maurizio Zotti[2], Stefano Mazzoleni[2], Paola Delli Veneri[1]

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4BV.1.45

A Sustainable Agrivoltaic Experience in a dry Mediterranean Area: Co-Rxistence of Agricultural Activities in Utility-scale Plants of EGP for Multiple Land Use

Miriam DI Blasi[1], Maria Genovese[1], Gian Maria Baldi[2], Michele Falce[2]

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4BV.1.46

Sharing Global Expertise on Agrivoltaics with AiDO: Agrivoltaics International Discussion Group

Mike Van Iseghem[1;2], Özal Emre Özdemir[3], Frank de Ruijter[4], Christoph Mayr[5;6], Alessandra Scognamiglio[7], Damien Fumey[1], Matthew Berwind[3], Josephine Schwenke[3]

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4BV.1.47

Dual Use of Land: Integrating PV Systems with Dykes

Maarten Dörenkämper[1], Jan Rinze Van Der Schoot[2], Simone Loohuizen[3], Corry de Keizer[1]

[1]TNO, Eindhoven, The Netherlands; [2]Wageningen University & Research, Lelystad, The Netherlands; [3]Arcadis, 's-Hertogenbosch, The Netherlands

4BV.1.48

How Agrivoltaics and Floating Photovoltaics Influence Evapo-Transpi-Ration?

Baptiste Amiot[1;2], Sylvain Edouard[1;3], Rémi Le Berre[1], Mike Van Iseghem[1], Martin Ferrand[4;5], Javier Vidal-Hurtado[4], Stéphanie Giroux--Julien[2], Didier Combes[3]

[1]EDF R&D, Moret sur Loing - Orvanne,, France; [2]University of Lyon, Villeurbanne, France; [3]INL, Lusignan, France; [4]EDF R&D, Chatou, France; [5]CEREA, Chatou, France

4BV.1.49

Solar Resource Evaluation in Dynamic and Static through Solar Tracking System at 1 Hz for VIPV Applications

Shehrazade Nassibi[1], Bertrand Chambion[1], Loic Lonardoni[1], Lionel Serra[1], Benjamin Commault[1], Fabien Chabuel[1], Jérémie Aimé[1]

[1]CEA, Le Bourget-du-Lac, France

4BV.1.50

Survey of the Floating Photovoltaic Potential of Portugal

Dorivaldo Duarte[1;2], Luis Fialho[1;2], Pedro André Dos Santos Ribeiro Horta[2;3], Manuel Pedro Ivens Collares-Pereira[2;3]

[1]University of Évora, Nossa Senhora da Tourega, Portugal, Portugal; [2]University of Évora, Evora, Portugal

4BV.1.51

On the Performance of Photovoltaics on Car Roofs: Case Study Under Different Static Scenarios

Javier Macías Rodríguez[1], Rebeca Herrero[1], Rubén Núñez[1], Ignacio Antón[1]

[1]UPM, Madrid, Spain

4BV.1.52

Development of a Modeling Tool for the Design and Optimization of Vehicle-Integrated Photovoltaic Systems

Patricia Seoane Da Silva[1], Simone Regondi[1], Emanuele Cornagliotti[1], Maikel van Hest[1], Arjo van der Ham[1]

[1]Lightyear, Helmond, The Netherlands

4BV.1.53

Agrivoltaic Perovskite Tandem LCA LCOE

Amaury Martin[1;2], Lars Oberbeck[3], Pierre Philippe Grand[4], Jean-Baptiste Puel[4], Jean Rousset[5]

[1]IPVF, Orsay, France; [2]TotalEnergies, Orsay, France; [3]EDF R&D, Palaiseau, France; [4]EDF R&D, MONTREUIIL, France

4BV.1.54

Floating Photovoltaics for Covering Rainwater Basins of Greenhouses: Evaluation of Energy Yield Models

Arttu Tuomiranta[1], Hariharsudan Sivaramakrishnan Radhakrishan[1], Georgi H. Yordanov[2], Jens Dirk Moschner[2], Marco Morelli[3], Michiel Voglar[3], Jean Reusens[4], Joris Lemmens[1], Loïc Tous[1], Michaël Daenen[3], Hedwig Van Roy[4], Ivan Gordon[1]

[1]imec, Genk, Belgium; [2]KU Leuven, Leuven, Belgium; [3]Hasselt University, Hasselt, Belgium; [4]Connectum, Wuustwezel, Belgium

4BV.1.55

A Concrete Based Floating Solar Solution with Integrated Photovoltaics for Marine Applications

Asier Sanz Martinez[1], Esteban Camacho[2], Francesco Boscolo[1], Eneko Setien[1]

[1]TECNALIA, Derio, Spain; [2]Research and Development Concretes, València, Spain

4BV.1.56

Design of a Flexible Agrivoltaic Research Facility Based on a Parameter Analysis

Brecht Willockx[1], Bert Herteleer[1], Jan Cappelle[1]

[1]KU Leuven, Gent, Belgium

4BV.1.57

3D-Printed Walkable Solar Tiles

Marica (Mariaconcetta) Canino[1], Shima Fasahat[1;2], Virginia Boldrini[1], Emanuele Centurioni[1], Laura Ferlauto[2], Rita Rizzoli[1], Cesare Sangiorgi[2], Daniela Cavalcoli[2]

[1]CNR, Bologna, Italy; [2]University of Bologna, Bologna, Italy

4BV.1.58

Design and Evaluation of an Automated Monitoring and Sensor Network System for Photovoltaic Greenhouses

Houria Assem[1]

[1]CDER, Alger, Algeria

4BV.1.59

Designing the Most Optimal Floating Single-Axis Azimuthal Tracking System

Maarten Dörenkämper[1], Minne M. de Jong[1], Jan M. Kroon[1]

[1]TNO, The Netherlands

4BV.1.60

Mechanical Stress in PV Panels on Floating PV Systems

Christoph Seiffert[1], Josefine Helene Selj[1;2], Dag Lindholm[3], Hallvard Fjær[3], Sigurd Brattheim[1], Gaute Otnes[1], Nathan Roosloot[1;2]

[1]Institute for Energy Technology, Kjeller, Norway; [2]University of Oslo, Kjeller, Norway

Visual Presentations 2BV.2

10:30- 12:00 Emerging and Novel Approaches for Photovoltaics / Advanced Modelling and Characterization **Poster Area**

2BV.2.1

Kesterite-Based Mongrain Photovoltaics: the Ideal Solution for Sustainable Power Supply

Dieter Meissner[1], Kaia Ernits[2], Stefan Gahr[1], Martin Vetter[1], Christoph Glatz[1], Rumman Syed[1]

[1]crystalsol, Austria; [2]crystalsol, Tallinn, Estonia

2BV.2.2

Opto-electrical Properties of Group IV Alloys: the Inherent Challenges of Processing Ge:H

Thierry de Vrijer[1], Bilal Bouazzata[1], Ashwath Ravichandran[1], Julian van Dingen[1], Paul Roelandschap[1], Koos Roodenburg[1], Steven Roerink[1], Federica Saitta[1], Thijs Blackstone[1], Arno Smets[1]

[1]Delft University of Technology, The Netherlands

2BV.2.3

High Absorptivity of Intraband Transition Occurring at Heterointerface in Two-Step Photon Up-Conversion Solar Cells

Shigeo Asahi[1], Hambalee Mahamu[1], Takashi Kita[1]

[1]Kobe University, Kobe, Japan

2BV.2.4

Simulation and Experimental Study for a Micro-Striped Colour Neutral Semi-transparent Mini-Module

Shilpi Shital[1], Pedro Santos[2], Ricardo Poeira[1], Himanshu Phirke[1], Pedro Anacleto[2], Sascha Sadewasser[2], Phillip Dale[1]

[1]University of Luxembourg, Belvaux, Luxembourg; [2]INL, Braga, Portugal

2BV.2.5

Electronic Properties of Doped Anatase TiO2: a First-Principles Modelling and Experimental Demonstration

MD. Anower Hossain[1], Borong Sang[1], Bram Hoex[1]

[1]UNSW, Kensington, NSW, Australia

2BV.2.6

Improvement of Passivation Performance of Silicon Nano-crystal/Silicon Oxide Compound Layer by Hydrogen Plasma Treatment

Masashi Matsumi[1], Kazuhiro Gotoh[1], Markus Wilde[2], Yasuyoshi Kurokawa[1], Katsuyuki Fukutani[2], Noritaka Usami[1]

[1]Nagoya University, Japan; [2]University of Tokyo, Japan

2BV.2.7

Zr-doped Indium Oxide as Transparent Electrodes for Photovoltaics

Melanie Micali[1;2], Marco Leonardi[1;3], S. Lombardo[3], Giuseppe Bengasi[4], Claudio Colletti[4], Virginia Boldrini[5], Esther Alarcon-Llado[6], Antonio Terrasi[1;2]

[1]University of Catania, Catania, Italy; [2]CNR, Catania, Italy; [3]ENEL Green Power, Catania, Italy; [4]CNR, Bologna, Italy; [5]AMOLF, Amsterdam, The Netherlands

2BV.2.8

How Different Window Layers Influence the Performance of Sb2Se3-based Solar Cells

Alessio Bosio[1], Stefano Marchionna[2], Stefano Pasini[1]

[1]University of Parma, Parma, Italy; [2]RSE, Milan, Italy

2BV.2.9

Enhanced Photodetection Effect in Nanoscale MoS2 Van der Waals Heterostructure

Ayman Rizk[1], Ammar Nayfeh[1]

[1], United Arab Emirates

2BV.2.10

Fabrication and Evaluation of Polycrystalline BaSi2 Films on Si Substrates by Co-Sputtering of BaSi2 and Ba Targets

Kazuki Kido[1], Ryota Koitabashi[1], Hayato Hasebe[1], Sho Aonuki[1], Masami Mesuda[2], Kaoru Toko[1], Takashi Suemasu[1]

[1]University of Tsukuba, Tsukuba-shi, Ibaraki-pref., Japan; [2]TOMATO-GSL, Ayase-shi, Kanagawa-pref, Japan

2BV.2.11

Thermodynamic Interfaces Instabilities in Sb2Se3 Based Solar Cells in Substrate Configuration

Maykel Jimenez Guerra[1], Yudenia Sánchez[2], Lorenzo Calvo-Barrio[3;4], Alejandro Navarro Güell[1], Ivan Caño Prades[1], Axel Gon Medaille[2], Zacharie Jehl[1], Edgardo Saucedo[1]

[1]UPC, Barcelona, Spain; [2]IREC, Barcelona, Spain; [3]University of Barcelona, Barcelona, Spain

2BV.2.12

Interfacing Nanostructured Layers in Solar Cells by Ferroelectric Thin-Films for Better Electron Transport

Vilko Mandić[1], Ivana Panzic[1], Arijeta Bafti[1], Luka Pavić[2]

[1]University of Zagreb, Zagreb, Croatia; [2]Ruđer Bošković Institute, Zagreb, Croatia

2BV.2.13

Highly Crystalline In2S3 Thin Films Epitaxially Grown on Sapphire Substrates: A Potential Candidate for Intermediate Band Solar Cell Application

Tanja Jawinski[1], Roland Clausing[2], Heiko Kempa[2], Roland Scheer[2], Marius Grundmann[1], Holger von Wenckstern[1]

[1]University of Leipzig, Leipzig, Germany; [2]Martin Luther University, Halle (Saale), Germany

2BV.2.14

Comparison of CdS and TiO2 Buffer Layers for Antimony Selenide (Sb2Se3) Solar Cells by Vacuum Evaporation

Narges Torabi[1], Solidea Zanetti[1], Elisa Artegiani[1], Prabeesh Punathil[1], Alessandro Romeo[1]

[1]University of Verona, Verona, Italy

2BV.2.15

Evaluation of HNO3 Doping in Graphene/Silicon Solar Cells by Means of Capacitance - Voltage Curves and Impedance Spectroscopy

Ilaria Matacena[1], Laura Lancellotti[1], Eugenia Bobeico[1], Nicola Lisi[2], Paola Delli Veneri[1]

[1]ENEA, Portici, Italy; [2]ENEA, Roma, Italy

2BV.2.16

Light Separation for the Lateral System of Luminescent Solar Concentrators

Mykola R. Kulish[1], Anatoly Sachenko[1], Vitaliy P. Kostylyov[1], Igor O. Sokolovskyi[1], Anatoli Shkrebtii[2]

[1]ISP NASU, Kyiv, Ukraine; [2]Ontario Tech University, Oshawa,

2BV.2.17

Solder Paste Printing Optimization for Interconnecting Back Contact Cells

Narahari Pujari[1]

[1]MacdermidAlpha Electronics Solutions, Bengaluru, India

2BV.2.18

Pre-thermalizational Impact of Hot Carriers on Photovoltage Formation in a Single Junction Solar Cell

Jonas Gradauskas[1;2], Steponas Ašmontas[1], Oleksandr Masalskyi[2], Algirdas Sužiedelis[1], Aldis Šilenas[1], Aurimas Cerškus[1;2], Aleksej Rodin[1], Ihor Zharchenko[1]

[1]Center for Physical Sciences and Technology, Lithuania; [2]VGTU, Lithuania

2BV.2.19

Overview of Materials' Hot Carrier Temperature Under Concentrated Natural Sunlight

Igor Konovalov[1]

[1]University of Applied Sciences Jena, Jena, Germany

2BV.2.20

Defect Passivation through Spiro[Fluorene-9,9′-Xanthene] Based Additives for an Efficient Perovskite Solar Cells

Bommaramoni Yadagiri[1], Sanjay Sandhu[1], Senthilkumar Muthu[1], Jae-Joon Lee[1]

[1]Dongguk University, Seoul, Korea, Rep. of South

2BV.2.21

Enabling Transparent Conductive Oxide and Doped Amorphous Silicon Free Efficient Silicon Heterojunction Solar Cells by Flexibly Using Dopant-free Contact

Jian He[1], Pingqi Gao[1]

[1]Sun Yat-sen University, Guangzhou, China

2BV.2.22

Plasmonic Luminescent Solar Devices

Subhash Chandra[1], Aaron Glenn[1], Bill Cass[1], Mojtaba Nasiri[1], Anita Ortega[1], Sarah Mccormack[1]

[1]Trinity College Dublin, Dublin , Ireland

2BV.2.23

Efficient Light-Harvesting Employing Size-Gradient Quantum Dot Films

Jose Raul Montes Bojorquez[1], Maria Fernanda Villa Bracamonte[1], Arturo Ayon[1]

[1]University of Texas at San Antonio, San Antonio, United States

2BV.2.39

A Self-consistent Hybrid Model Connects Empirical and Optical Models for fast, Non-destructive Inline Characterization of Thin, Porous Silicon Layers

Alexandra Wörnhör[1], Matthias Demant[1], Henri Vahlman[1], Stefan Rein[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany

2BV.2.40

Assessing the Effectiveness of Encapsulation Schemes for Perovskite Devices Using Photoluminescence Imaging

George Koutsourakis[1], Simone Meroni[2], James Blakesley[1], Ross DIX Peek[3], Richard Dixon[4], Ernest van Dyk[3], Pufinji Obene[5], Ian Arnold[5], Tateos Tvapanyan[5], Jacqueline Crozier Mccleland[3], Roelof Roodt[3], Freddie (Frederik) Vorster[3], Alexander Howe[4], Trystan Watson[2], Fernando Castro[1]

[1]National Physical Laboratory, Teddington, United Kingdom; [2]Swansea University, Swansea, United Kingdom; [3]Nelson Mandela University, Gqeberha, South Africa; [4]Dycotec Materials, United Kingdom; [5]Precision Varionic International, United Kingdom

2BV.2.41

Efficient Charge Carrier Extraction in Perovskite-Silicon Tandem Solar Cells Investigated by a Full Opto-Electrical Simulation Model in Sentaurus TCAD

Christoph Messmer[1;2], Jonas Schön[1;2], Uli Würfel[2;3], Patricia Schulze[2], Martin C. Schubert[2], Martin Bivour[2], Stefan W. Glunz[1;2], Martin Hermle[2]

[1]University of Freiburg, Freiburg im Breisgau, Germany; [2]Fraunhofer ISE, Freiburg im Breisgau, Germany; [3]FMF, Freiburg im Breisgau, Germany

2BV.2.42

The Direct Measurement of Positive Feedback Loop-Gain During Hot-Spot Formation in Thin-Film Solar Cells

Suheir Nofal[1;2], Bart E. Pieters[1]

[1]Forschungszentrum Jülich , Jülich, Germany; [2]RWTH Aachen University, Aachen, Germany

2BV.2.43

Optoelectronic Parameters Prediction Using Combinatorial Spectroscopic Techniques and Machine Learning

Enric Grau-Luque[1], Andreas Zimmermann[2], Stefan Paetel[3], Sergio Giraldo[1], Fabien Atlan[1], Robert Fonoll-Rubio[1], Ignacio Becerril-Romero[1], Alejandro Pérez-Rodríguez[1;4], Maxim Guc[1], V. Izquierdo-Roca[1]

[1]IREC, Sant Adrià de Besòs, Spain; [2]Sunplugged, Wildermieming, Austria; [3]ZSW, Stuttgart, Germany; [4]University of Barcelona, Barcelona, Spain

2BV.2.44

Identifying Defects on Solar Cells Using Magnetic Field Measurements and Artificial Intelligence Trained by a Finite-Element-Model

Kjell Buehler[1], Kai Kaufmann[2;3], Markus Patzold[2], Mawe Sprenger[2], Stephan Schoenfelder[1]

[1]Leipzig University of Applied Science, Leipzig, Germany; [2]DENKweit, Halle, Germany; [3]Anhalt University of Applied Sciences, Köthen, Germany

2BV.2.45

Finite Element Method Simulation of Tunneling in Perovskite Based Solar Cells

Habtamu Tsegaye Gebrewold[1;2], Karsten Bittkau[1], Thomas Kirchartz[1;3], Uwe Rau[1;2], Kaining Ding[1]

[1]Forschungszentrum Jülich, Jülich, Germany; [2]RWTH Aachen University , Aachen, Germany; [3]University of Duisburg-Essen, Duisburg, Germany

2BV.2.46

Evaluation Indoor Lighting Simulator for Emerging PV

Yean-San Long[1], Min-An Tsai[1], Teng-Chun Wu[1]

[1]ITRI, Hsinchu, Taiwan

2BV.2.47

Enabling Tandem Solar Cell Measurements Using Common LED Based Solar Simulators – A Robust Spectral Adjustment Method

David Chojniak[1], Jochen Hohl-Ebinger[1], S. Kasimir Reichmuth[1], Michael Schachtner[1], Alexandra Schmid[1], Gerald Siefer[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany

2BV.2.48

Electroluminescence Radiance Maps based on Multiple Exposure Images from InGaAs Cameras

Claire Mantel[1], Sergiu V. Spataru[2], Rodrigo Del Prado Santamaria[2], Peter Behrensdorff Poulsen[2], Søren Forchhammer[1]

[1]DTU Fotonik, Kgs. Lyngby, Denmark; [2]DTU Fotonik, Roskilde, Denmark

2BV.2.49

A New Explicit Five-Parameter Solar Cell Model

Andreea Sabadus[1], Marius Paulescu[2]

[1]UVT, Timișoara, Romania; [2]West University of Timisoara, Timisoara, Romania

2BV.2.50

In-Depth Chemical and Optoelectronic Analysis of Triple-cation Perovskite Thin Films by Combining XPS Profiling and PL Imaging

Pia Dally[1], Stefania Cacovich[2], Guillaume Vidon[1], Marie Legrand[3], Jean-Baptiste Puel[3], Jean-Francois Guillemoles[2], Philip Schulz[2], Muriel Bouttemy[4], A. Etcheberry[4]

[1]IPVF, France; [2]CNRS, France; [3]EDF R&D, France; [4]UVSQ, France

2BV.2.51

A Lateral Heterojunction Device as a Tool to Study and Optimize Perovskite-Based Solar Cells

Davide Regaldo[1;2;3], Pilar Lopez-Varo[1], Jean-Baptiste Puel[1;4], Josè Alvarez[1;2;5], Philip Schulz[1;6], Jean-Paul Kleider[1;2;5]

[1]IPVF, Palaiseau, France; [2]University of Paris-Saclay, Gif-sur-Yvette, France; [3]IPVF, Paris, France; [4]EDF R&D, Palaiseau, France; [5]GeePs, Paris, France; [6]CNRS, Palaiseau, France

2BV.2.52

Online Implementation of a Multiple Linear Regression Model for CIGS Photovoltaic Module Performance

Paolo Graniero[1;2], Guillermo Antonio Farias Basulto[2], Rutger Schlatmann[2], Reiner Klenk[2], Carolin Ulbrich[2]

[1]Free University of Berlin, Berlin, Germany; [2]HZB, Berlin, Germany

2BV.2.53

Dolphin's Method for Fast In-Situ/Line Modulated Photoluminescence

Mateusz Poplawski[1;2], François Silva[2], Jean-Charles Vanel[2], Pere Roca I Cabarrocas[1;2]

[1]IPVF, Palaiseau, France; [2]École Polytechnique, Palaiseau, France

2BV.2.54

Validation of Plasmonic Luminescent Solar Concentrator Modelling Software

Aaron Glenn[1], Sarah Mccormack[1], Subhash Chandra[1], Mojtaba Nasiri[1], Anita Ortega[1]

[1]Trinity College Dublin, Dublin, Ireland

2BV.2.55

Characterizing the Absorption of Perovskites at the Microscale through Photoluminescence Multidimensional Imaging

Marie Legrand[1], Baptiste Bérenguier[2], Guillaume Vidon[3], Jean-Francois Guillemoles[2], Daniel Ory[1]

[1]EDF R&D, Palaiseau, France; [2]CNRS, Palaiseau, France; [3]IPVF, Palaiseau, France

2BV.2.56

Optical Process Control for the Synthesis of CU(In,GA)Se2 Basedmicro-Solar Cells

Ricardo Poeira[1], Daniel Siopa[1], Pedro Anacleto[2], Sascha Sadewasser[2], Phillip Dale[1]

[1]University of Luxembourg, Belvaux, Luxembourg; [2]INL, Braga, Portugal

2BV.2.57

TLM Method Applied on Wires for CIGS

Busra Sesli[1;2], Marc Meuris[1;2], Michaël Daenen[1;2], Bart Vermang[1;2]

[1]Hasselt University, Hasselt, Belgium; [2]imec, Genk, Belgium

2BV.2.58

Inorganic Perovskite Solar Cells Based on Double Perovskite Oxides La2NiMnO6 and La2Ni0.8Fe0.2MnO6

Anna B. Nikolskaia[1], Olga Alexeeva[1], Oksana Almjasheva[2], Liudmila Larina[1], Sergey Kozlov[1], Oleg Shevaleevskiy[1]

[1]RAS, Russian Federation; [2]Saint Petersburg Electrotechnical University, Russian Federation

2BV.2.59

Effect of Thermal Radiation Entropy on the Outdoor Efficiency Limit of Single Junction Solar Cells

Hesan Ziar[1]

[1]Delft University of Technology, The Netherlands

Visual Presentations 3BV.3

13:30- 15:00 PV Characterization, Modelling and Energy Rating Poster Area

3BV.3.1

Improving Spectral Responsivity Measurements by Correcting for Filter Bandwidth

Clara Edmonds[1], Harald Müllejans[1]

[1]European Commission JRC, Ispra (VA), Italy

3BV.3.2

Analysis of Encapsulant Discoloration Effect on the Temperature of Photovoltaic Module

Arti Pareek[1], Roopmati Meena[1], Rajesh Gupta[1]

[1]IIT Bombay, India

3BV.3.3

Optimal Methodology for Forecasting Performance Loss Rate of Fielded Photovoltaic Systems Using Robust Principal Component Analysis and Auto Regressive Integrated Moving Average

Anna Michail[1], Andreas Livera[1], Andreas Kyprianou[1], George Elias Georghiou[1]

[1]University of Cyprus, Nicosia, Cyprus

3BV.3.4

Estimating Solar Cell Operating Temperature via Deep Neural Networks

Theodoros Katsaounis[1;2], Georgios Papadomichelakis[2], Konstantinos Kotsovos[3], Issam Gereige[3], Marwan Abdullah[3], Athanasios Tzavaras[4]

[1]FORTH, Heraklion, Greece; [2]University of Crete, Heraklion, Greece; [3]SAUDI ARAMCO, Thuwal, Saudi Arabia; [4]KAUST, Thuwal, Saudi Arabia

3BV.3.5

Characterisation of Soiling on PV Module by Microscopic Image Processing With New Parametrics

Sébastien Arbaretaz[1], Christophe Ménézo[2], Emilie Planès[3], Eric Pilat[1]

[1]INES, Le Bourget-du-Lac, France; [2]Savoy Mont Blanc University, Le Bourget-du-Lac, France; [3]Grenoble INP, Le Bourget-du-Lac, France

3BV.3.6

Decoupling Performance Gains of Silicon Hetero-Junction Bifacial Modules

Hugo Quest[1;2], Alessandro Virtuani[1], Luca Gnocchi[1], Alejandro Borja Block[1], Nicolas Wyrsch[1], Christophe Ballif[1;3]

[1]EPFL, Neuchâtel, Switzerland; [2]3S Solar Plus, Thun, Switzerland; [3]CSEM, Neuchâtel, Switzerland

3BV.3.7

Advantages of n-Type Bi-Facial TOPCon Solar Modules in Low Irradiance Performance and Energy Yield

Kuang-Chieh (Jay) Lai[1], Chi-Chun LI[1], Chien-Chun Hsieh[2], Ming-Tsun Kuo[2], Liang-Tang Wang[1], Hsing-Wang Tsai[1], An-Heng Cheng[1], H. S. Lin[1]

[1]Motech Industries, Tainan City, Taiwan; [2]ITRI, Tainan City, Taiwan

3BV.3.8

Tools and Techniques for Spectral Irradiance Processing and Mismatch Estimation

Anton Driesse[1], Marios Theristis[2], Josh Gallon[3], Joshua S. Stein[2]

[1]PV Performance Labs, Freiburg, Germany; [2]Sandia National Laboratories, Albuquerque, United States; [3]NREL, Golden, United States

3BV.3.9

Simplified Angular Responsivity Measurements of c-Si Modules

Blago Mihaylov[1], Harald Müllejans[1], Tony Sample[1], Ewan Dunlop[1]

[1]European Commission JRC, Italy

3BV.3.10

Study of Optical Transmission Losses of Satinated PV Glass

Markus Babin[1], Sune Thorsteinsson[1], Michael Jakobsen[1], Sergiu V. Spataru[1]

[1]Technical University of Denmark, Roskilde, Denmark

3BV.3.11

Application of Electroluminescence Current-Intensity Relation for Estimation of PID Impact in Crystalline Silicon Photovoltaic Module

Ravi Kumar[1], Vishal Puranik[1], Rajesh Gupta[1]

[1]IIT Bombay, India

3BV.3.12

Proposal for an Indoor Test Procedure to Determine the Operational Temperature of PV Modules

Paul Gebhardt[1], Kumara Vamsi Krishna Vandanapu[1], Jochen Markert[1], Georg Mülhöfer[1], Daniel Philipp[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany

3BV.3.13

Performance Calculation of n-PERT Solar Cell and 1-Cell Mini Module in the Atacama Desert

Pablo Ferrada[1], Sebastián Rodríguez[2], Aitor Marzo[1], Edward Fuentealba[2], Valeria del Campo[3], Miriam R. Ferrández[4;5], Benjamin Ivorra[4], Emilio Ruiz Reina[7]

[1]University of Antofagasta, Antofagasta, Chile; [2], Valparaíso, Chile; [3]UPM, Madrid, Spain; [4]University of Almería, La Cañada, Spain; [5]University of Malaga, Málaga, Spain

3BV.3.14

Adding the MLFM to PVPMC/PVLIB

Steve Ransome[1;2], Juergen Sutterlueti[3]

[1]Steve Ransome Consulting, Kingston Upon Thames, United Kingdom; [2]Gantner Instruments, Schruns, Austria

3BV.3.15

Outdoor Energy Performances for Standard and Bi-Facial Modules as well on the Failure Modes Observed in Outdoor Conditions

Alessandra Ottanà[1;2], Francesco Rametta[1], Walter Gangemi[1], Claudio Colletti[1], Agnese DI Stefano[1], Andrea Canino[1], Marina Foti[1], Cosimo Gerardi[1], Fabrizio Bizzarri[2]

[1]ENEL Green Power, Italy

3BV.3.16

Dynamic Simulation Model of an Air-Based BIPVT Roof Tile System

Lionel Clasing[1], Pak Hin Yam[1], Claudia Ziller[1], Ulf Blieske[1]

[1]Cologne University of Applied Sciences, Cologne, Germany

3BV.3.17

Photovoltaic Performance Metrics and Data Processing in Nordic Climate Conditions

Aapo Poskela[1;2], Lauri Karttunen[1], Heikki Palonen[1], Hugo Huerta Medina[3], Samuli Ranta[3], Kati Miettunen[1]

[1]University of Turku, Turku, Finland; [2]Solar Finland, Salo, Finland; [3]TUAS, Turku, Finland

3BV.3.18

Uniform and Non-Uniform Soiling of PV Modules: a Comprehensive Study of Performance and Temperature Effects

Daniel Braga[1], Antonia Sonia A.C. Diniz[2], Suellen Caroline Silva Costa[1], Vinícius Augusto Camatta Santana[2], Lawrence Kazmerski[3]

[1]PUC Minas, Belo Horizonte, Brazil; [2]Pontifical Catholic University of Minas Gerais, Belo Horizonte, Brazil; [3]University of Colorado Boulder, Boulder, United States

3BV.3.19

Very Accurate Outdoor Estimation of Voc's Temperature Coefficient from Equivalent Cell Temperature Sensitivity Analysis

Georgi H. Yordanov[1], Stan Herthogs[1]

[1]Catholic University of Leuven, Leuven-Heverlee, Belgium

3BV.3.20

A Study on Using Micro-Computed Tomography for PV Interconnection Technology Development

Rik Van Dyck[1;2;3;4], Alexandros Prapavesis[1], Tom Borgers[2;3;4], Jonathan Govaerts[2;3;4], Loïc Tous[2;3;4], Jozef (Jef) Poortmans[2;3;4;5], Aart Willem Van Vuure[1]

[1]KU Leuven, Leuven, Belgium; [2]Hasselt University, Hasselt, Belgium; [3]imec, Genk, Belgium

3BV.3.21

Experimental Validation of the Simulation of the Impact of Moving Objects, Partial Shading or Penumbra on Shading Losses Affecting Photovoltaic Modules

João M. Serra[1], Rita Coelho[1], Dmitri Boutov[1], Jesus Robledo Bueno[2], Jonathan Leloux[2]

[1]University of Lisbon, Portugal; [2]Lucisun, Belgium

3BV.3.22

Field Monitoring of Water in PV Modules by Near-Infrared Spectroscopy

Oleksandr Stroyuk[1], Claudia Buerhop-Lutz[1], Lewin Leihkamm[1], Jens Hauch[1], Marius Peters[1]

[1]Forschungszentrum Jülich, Erlangen, Germany

3BV.3.23

Outdoor NMOT Test Stand with Adjustable Wind Field

Michael Schrempf[1], Stefan Riechelmann[1], Laura Stenzig[1], Stefan Winter[1]

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3BV.3.24

Bifacial IV Tracer. Bifacial Performance Assessment on Outdoor Sunlight Conditions

Sergio Suarez[1], Eneko Ortega[2], Sofia Rodríguez-Conde[1], Ignacio Fernandez[1], Juan Carlos Jimeno[2], Jose Ruben Gutierrez[2], Vanesa Fano[2]

[1]Enertis Applus, Spain; [2]UPV/EHU, Gasteiz, Spain

3BV.3.25

Experimental Study of Shading Effect on PV Cells by Reverse Electrical Polarization

Imed Derbali[1], Aurélien Raddenzati[1], Bertrand Chambion[1], Lionel Serra[1], Loic Lonardoni[1], Fabien Chabuel[1]

[1]INES, Le Bourget-du-Lac, France

3BV.3.26

Thermal Modelling of PV Systems Based on Indoor and Outdoor PV Modules Testing

Oume Lgheit Rhazi[1], Julien Dupuis[1], Emmanuel Boyère[1], Geoffrey Rachinel[2], Daline Nap[2], Floriane Gay[3]

[1]EDF R&D, Écuelles, France; [2]EDF Renewables, Colombiers, France; [3]EDF Renewables, Paris La Défense, France

3BV.3.27

Module Quality Control Using very Low-Cost Mobile Near-Infrared Spectroscopy Device: Application to Backsheet Type Indentification

Julien Dupuis[1], Christine Abdel Nour[1], Romain Bodeux[2], Paul Lefillastre[3], Axel Becker[3]

[1]EDF R&D, MORET LOING ET ORVANNE, France; [2]IPVF, PALAISEAU, France; [3]EDF Renewables, PARIS LA DEFENSE, France

3BV.3.28

Performance Evaluation and Comparison of Solar Cell Technologies Based on Historical Data

Yiannis Pantazis[1], Evangelia Kalligiannaki[1], Yiannis Kamarianakis[1], Konstantinos Kotsovos[2], Issam Gereige[2], Marwan Abdullah[2], Athanasios Tzavaras[3], Theodoros Katsaounis[1;4]

[1]FORTH, Heraklion, Greece; [2]ARAMCO, Thuwal, Saudi Arabia; [3]KAUST, Thuwal, Saudi Arabia; [4]University of Crete, Heraklion, Greece

3BV.3.29

Linearity Measurements of Photovoltaic Modules with Attenuance of Photovoltaic Modules with Attenuating Irradiance Filter Technique

Özcan Bazkir[1], Seval Meric[1]

[1]TUBITAK-NMI, KOACELI, Turkey

3BV.3.30

Effect of Weather Environment and Partial Shading on Power Generation Performance of Flexible CIGS-PV Modules

Hyun Jin Cha[1], Seokhee Lee[1], Juna Kim[1], Jung Hwan Park[1], Donghyun Hwang[2], Chang Sik Son[3]

[1]Pusan National University, Busan, Korea, Rep. of South; [2]SHU-SOEN's R&D Lab, Busan, Korea, Rep. of South; [3]Silla University, Busan, Korea, Rep. of South

3BV.3.31

Effects of Different Shading Scenarios on the Performance of PV Modules

Seval Merİç[1], Özcan Bazkir[2]

[1]TUBITAK-NMI, KOCAELI, Turkey; [2]TUBITAK-NMI, Kocaeli, Turkey

3BV.3.32

Computation of Faulty IV Curves Based on a Distributed Solar Cell Algorithm

Carlos Cárdenas-Bravo[1;2], Denys Dutykh[1], Duy Long Ha[2]

[1]Savoy Mont Blanc University, Chambéry, France; [2]CEA, Chambéry, France

3BV.3.33

Step by Step Current-Voltage Curve Division Method for the Estimation of Degraded Photovoltaic Cell Parameters

Vishal Puranik[1], Ravi Kumar[1], Rajesh Gupta[1]

[1]IIT Bombay, India

3BV.3.34

Evaluation of Anti-Soiling Coating Solution for Monocrystalline Half-Cut Cells PV Modules [T1] in the Outdoor Conditions of Benguerir, Morocco

Tijani Khalil[1], Benazzouz Aboubakr[1], Said Elhamaoui[1], Naimi Zakaria[1], Ikken Badr[1], Ghennioui Abdellatif[1]

[1]Green Energy Park, Ben Guerir, Morocco

3BV.3.35

A Fuzzy Logic Approach for a Quantitative Evaluation of PV Modules EL Images

Miguel Guada[1], David Pérez[1], César Hidalgo[1]

[1]DNV, Madrid, Spain

3BV.3.36

Accurate Measurement of the Angular Dependence of PV Module Performance Using a Dual Axis Solar Tracker

Arvid van der Heide[1], Arttu Tuomiranta[1], Michiel Daniels[2], Niels Capiot[2], Michaël Daenen[3], Stefan Wendlandt[4], Loïc Tous[1]

[1]imec, Genk, Belgium; [2]Hasselt University, Hasselt, Belgium; [3]Hasselt University, Belgium; [4]PI Berlin, Berlin, Germany

3BV.3.37

Impact of Technological Trends in Crystalline Silicon PV Modules on the Energy Yield Performance: Preliminary Result of the 14th SUPSI Outdoor Measurement Campaign

Gabi Friesen[1], Mauro Caccivio[1], Ebrar Özkalay[1], Falvio Valoti[1]

[1]SUPSI, Mendrisio, Switzerland

3BV.3.38

Development and Validation of a Performance Simulation Model of an Air-Based BIPVT Roof Tile Using Open-Source Libraries

Marius Bartkowski[1], Lionel Clasing[1], Hamza Rehman Saleemi[1], Christian Brosig[1], Eberhard Waffenschmidt[1], Ulf Blieske[1]

[1]Cologne University of Applied Sciences, Cologne, Germany

3BV.3.39

Calibrated Model for the Yield Assessment of PV Modules with Coloured Front Glass

Martina Pelle[1;2], Francesco Causone[1], David Moser[2]

[1]Polytechnic University of Milano, Milano, Italy; [2]Eurac Research, Bozen, Italy

3BV.3.40

Experimental Assessment of Nanoimprinted Micro-Textured Frontsheets for PV Modules

Lionel Clasing[1], Daniel Werner-Meier[1], Leon Willem Veldhuizen[2], Ulf Blieske[1]

[1]Cologne University of Applied Sciences, Cologne, Germany; [2]Morphotonics, Veldhoven, The Netherlands

3BV.3.41

Proposal for the Extension of the Energy Rating Standard Series IEC 61853 to Bifacial Modules

Robert P. Kenny[1], Ana Maria Gracia Amillo[1], Teodora Lyubenova[1], Diego Pavanello[1]

[1]European Commission JRC, Ispra, Italy

3BV.3.42

Improvement of A LED Bias Light System for the Double Sided Characterization of Bifacial Devices

Teodora Lyubenova[1], Robert P. Kenny[1], David Shaw[1], Diego Pavanello[1]

[1]European Commission JRC, Ispra, Italy

3BV.3.43

Applicability of the Analytical Five-Point Method for the Degraded Silicon PV Modules Under Hot and Humid Conditions

Firoz Khan[1], Jae Hyun Kim[2]

[1]KFUPM, Dhahran, Saudi Arabia; [2]DGIST, Korea, Rep. of South

3BV.3.44

Outdoor Performances of Opaque and Semi-Transparent Perovskite Solar Modules

Karim Medjoubi[1], Anne Migan-Dubois[2], Thomas Guillemot[1], Johan Parra[3], Jean Rousset[1;4], Camille Bainier[1;5], Dounya Barrit[1;5], Jordi Badosa[3], Jorge Posada[1;4]

[1]IPVF, Palaiseau, France; [2]GeePs, Gif-sur-Yvette, France; [3]LMD, IPSL, École Polytechnique, Université Paris-Saclay, ENS, CNRS, Palaiseau, France; [4]EDF R&D, Palaiseau, France; [5]TotalEnergies, Paris La Défense, France

3BV.3.45

PV DC Yield Determined by Deep Neural Networks: the Case of Building Integrated PV

Elham Shirazi[1], Ebrar Özkalay[2], Angèle Reinders[1;3]

[1]University of Twente, Enschede, The Netherlands; [2]SUPSI, Manno, Switzerland; [3]Eindhoven University of Technology, Eindhoven, The Netherlands

Visual Presentations 4BV.4

15:15- 16:45 Solar Resource and Forecasting **Poster Area**

4BV.4.1

Day-ahead Forecasting of Solar Power Outputs: KNN-based Ensembles

Yiannis Kamarianakis[1], Evangelia Kalligiannaki[1], Yiannis Pantazis[1], Konstantinos Kotsovos[2], Issam Gereige[2], Marwan Abdullah[2], Athanasios Tzavaras[3], Theodoros Katsaounis[1;4]

[1]FORTH, Heraklion, Greece; [2]Saudi Aramco, Thuwal, Saudi Arabia; [3]KAUST, Thuwal, Saudi Arabia; [4]University of Crete, Heraklion, Greece

4BV.4.2

Improved Adaptive Neuro-Fuzzy Inference Model for Photovoltaic Power Forecast

Mustapha Habib[1], Annika Gram[1], Qian Wang[1]

[1]KTH Royal Institute of Technology, Stockholm,, Sweden

4BV.4.3

A Robust Data-Driven Model for the Reconstruction of Irradiance Measurements

Gerardo Guerra[1], Pau Mercade Ruiz[2], Gaetana Anamiati[2], Lars Landberg[3]

[1]DNV, Bristol, United Kingdom; [2]GreenPowerMonitor, Barcelona, Spain; [3]DNV, Hellerup, Denmark

4BV.4.4

Evaluation of Solar Radiation Potential at the Shooting Point by Identifying the Sky Area of Sky Image Using U-Net

Akito Sago[1], Yuzuru Ueda[2]

[1]Tokyo University of Science , Katsushika City, Japan

4BV.4.5

Solar Irradiance Classification for Improved PV Performance Assessments

Hugo Quest[1;2], Andrew Fairbrother[1], Christophe Ballif[1;3], Alessandro Virtuani[1]

[1]EPFL, Neuchâtel, Switzerland; [2]3S Solar Plus, Thun, Switzerland; [3]CSEM, Neuchâtel, Switzerland

4BV.4.6

Photovoltaic Yield Forecasting Using Extreme Gradient Boosting

Daniel Grzebyk[1;2], Alba Alcañiz[1], Jaap Donker[2], Miro Zeman[1], Olindo Isabella[1], Hesan Ziar[1]

[1]Delft University of Technology, Delft, The Netherlands; [2]Solar Monkey, Den Haag, The Netherlands

4BV.4.7

A Transferable Turbidity Estimation Method for High Fidelity Clear-sky Solar Irradiance Computation

Shanlin Chen[1], Mengying LI[1]

[1]The Hong Kong Polytechnic University, Kowloon, Hong Kong

4BV.4.8

The Simple Sky-Dome Projector

Bart E. Pieters[1], Evgenii Sovetkin[1], Andreas Gerber[1]

[1]Forschungszentrum Jülich, Juelich, Germany

4BV.4.9

Deep Learning Methods for Solar Power Plants nowcasting Systems for Grid-stability and Energy Market Operations

Fabrizio Ruffini[1], Antonio Piazzi[1], Ciro Lanzetta[1]

[1]i-EM, Livorno, Italy

4BV.4.10

Improved Models for Nowcasting Sunshine Number

Marius Paulescu[1], Nicoleta Stefu[1], Ciprian Dughir[2], Andreea Sabadus[3]

[1]West University of Timisoara, Timisoara, Romania; [2]Politehnica University of Timisoara, Timisoara, Romania; [3]UVT, Timisoara, Romania

4BV.4.11

A Computationally Light Data-driven Alternative to Cloud-Motion Prediction for PV Forecasting

Rafael Eduardo Carrillo Rangel[1], Pierre-Jean Alet[1], Stefan C. Müller[2], Jan Remund[2]

[1]CSEM, Neuchâtel, Switzerland; [2]Meteotest, Switzerland

4BV.4.12

PV very Short-Term Power Forecasting Method based on Cloud Monitoring Data

Joao Esteves[1], Rui Pestana[2], Yang Cao[1], Nuno Pinho Da Silva[1], Zheng Wang[3]

[1]R&D Nester, Sacavém, Portugal; [2]Rede Elétrica Nacional, Lisbon, Portugal; [3]EPRI, Beijing, China

4BV.4.13

A Study of the Impact of Multiple Irradiance Measurements on the Performance of Data-Driven Models

Gerardo Guerra[1], Pau Mercade Ruiz[2], Gaetana Anamiati[2], Lars Landberg[3]

[1]DNV, Bristol, United Kingdom; [2]GreenPowerMonitor, Barcelona, Spain; [3]DNV, Hellerup, Denmark

4BV.4.14

3D Cloud Information and Detection for Solar Nowcasting Based on All-Sky Imagers

Khadija Barhmi[1], Sara Mirbagheri Golroodbari[1], Wilfried G.J.H.M. van Sark[1]

[1]Utrecht University, Utrecht, The Netherlands

4BV.4.15

A Physics-Based DNI Model for Advancing Solar Resource Assessment and Forecasting

Yu Xie[1], Jaemo Yang[1], Manajit Sengupta[1], Yangang Liu[2]

[1]NREL, United States; [2]Brookhaven National Laboratory, United States

4BV.4.16

The SMART-G Code to Compute the Solar Resource Parameters. Validation in Clear-Sky Conditions in North of France

Thierry Elias[1], Nicolas Ferlay[2], Gabriel Chesnoiu[2], Isabelle Chiapello[2], Mustapha Moulana[1]

[1]HYGEOS, Lille, France; [2]University of Lille, Villeneuve d'Ascq, France

4BV.4.17

Helping Prosumers with Location-Specific Solar Radiation and PV Performance Data

Nigel Taylor[1], Ana Martinez Fernandez[1], Nikos Alexandris[1], Gianpiero Arcaro[2], Anatoli Chatzipanagi[1], Fernando Fahl[3]

[1]European Commission JRC, Ispra, Italy; [2]Piksel, Milano, Italy; [3]GFT Italia, Italy

4BV.4.18

A Hybrid Numerical Method and Comparative Study for Solar Irradiance Forecasting

Jayesh Thaker[1], Robert Höller[2]

[1]University of Oldenburg, Oldenburg, Germany; [2]FH OOE, Wels, Austria

4BV.4.19

How Does the Use of Satellite-Derived Insolation Data Impact the Accuracy of Performance Ratio Estimates?

Ebrar Özkalay[1;2], Alessandro Virtuani[2], Andrew Fairbrother[2], Artur Skoczek[3], Gabi Friesen[1], Christophe Ballif[2;4]

[1]SUPSI, Mendrisio, Switzerland; [2]EPFL, Neuchâtel, Switzerland; [3]Solargis, Bratislava, Slovakia; [4]CSEM, Neuchâtel, Switzerland

4BV.4.20

Day-ahead Photovoltaic Production Forecasting Using XGBoost and Post-Calibration Modeling

Spyros Theocharides[1], Javier Lopez Lorente[1], George Makrides[1], George Elias Georghiou[1]

[1]University of Cyprus, Nicosia, Cyprus

4BV.4.21

Development of a Sky Image Based Modelfor Prediction of Irradiance in a Minute-Range Horizon

Victor Arturo Martinez Lopez[1], Pim Doodkorte[1], Hesan Ziar[1], Miro Zeman[1], Olindo Isabella[1]

[1]Delft University of Technology, Delft, The Netherlands

4BV.4.22

Evaluation of Irradiance Decomposition and Transposition Models for a Nordic Climate

Dina Martinsen[1], Heine Nygard Riise[2], Magnus Moe Nygård[2], Marie Syre Wiig[2], Erik Stensrud Marstein[2]

[1]NTNU, Trondheim, Norway; [2]Institute for Energy Technology, Kjeller, Norway

4BV.4.23

Improving Site Shading Assessment from Digital Surface Models with Onsite LiDAR Measurements

Daniel Alvarez Mira[1], Sebastian Poessl[1], Martin Bartholomäus[1], Thøger Kari Hass[1], Peter Behrensdorff Poulsen[1], Sergiu V. Spataru[1]

[1]Technical University of Denmark, Lyngby, Denmark

4BV.4.24

Impact of Data Quality on the Performance Evaluation of Large-Scale PV Plants

Giuliano Luchetta Martins[1;2], Elena Koumpli[1], Sarah Southern[1], Anastasia Panoui[1], Jan Muller[1]

[1]Statkraft UK, London, United Kingdom; [2]Anhalt University of Applied Sciences, Köthen, Germany

4BV.4.25

Recovering Missing Data Using Low Quality Sensors and Machine Learing

Atse Louwen[1], Sascha Lindig[1], Alexander Astigarraga[1], David Moser[1]

[1]Eurac Research, Bolzano, Italy

4BV.4.26

Cloud Dynamics Probed by Narrow and Broadband Solar Irradiance Probability Densities

Nick Anderson[1], Viktar Tatsiankou[2], Karin Hinzer[1], Richard Beal[2], Henry Schriemer[1]

[1]University of Ottawa, Ottawa, Canada; [2]Spectrafy, Ottawa, Canada

4BV.4.27

Estimating Global Horizontal Irradiance at the Urban Level: a Sensitivity Analysis Using Different Digital Surface Models

Rodrigo Amaro e Silva[1], Philippe Blanc[1]

[1]MINES ParisTech, Sophia Antipolis, France

4BV.4.28

Evaluation of the Duration of Albedo Measurement Campaigns

Stefan Mau[1], Christian Gertig[2], Adam Sharpe[3], Christophe Campistron[2], Nicolas Chouleur[2]

[1]Everoze, Spain; [2]Everoze, France; [3]Everoze, United Kingdom

4BV.4.29

Time Series Forecasting of Solar Irradiance Based on Numerical Data

Bireswar Paul[1], Palash Chhabra[1], Hrituparna Paul[1]

[1], India

4BV.4.30

A Novel Approach Based on the Integration of Numeric Weather Prediction and Deep Learning for Short-term Solar Irradiance Forecasting

Navid Shirzadi[1], Fuzhan Nasiri[1], Ramanunniparakkal Manon[1], Ursula Eicker[1]

[1]Concordia University, Montréal, Canada

4BV.4.46

Outdoor Characterisation for Small Scale Compound Parabolic Concentration for Two Locations: Ferrara-Italy and Mayo-Ireland

Anita Ortega[1], Subhash Chandra[1], Sarah Mccormack[1]

[1]Trinity College Dublin, Dublin, Ireland

4BV.4.47

Effects of Temperature Variation on Concentrated Photovoltaic (CPV) Cells with Different Sizes

Elsen Aydin[1;2], Gence Bektaş[1;2], Ahmet Emin Keçecİ[1;2], Hasan Hüseyin Canar[1;2], Hasan Asav[1;2], Sümeyye Koçak[1], Rasit Turan[1;2;4], Bulent Gultekin Akinoglu[1;2;4]

[1]ODTÜ - GÜNAM, ANKARA, Turkey; [2]METU, ANKARA, Turkey

Visual Presentations 4BV.5

17:00- 18:30 Performance and Monitorisation of PV Systems **Poster Area**

4BV.5.1

Energy Management System for Hybrid DC-AC Microgrid Including PV Installations and Storage

Mohamed Amhal[1], Grégory Pais[2], Anthony Bier[1]

[1]CEA, Le Bourget-du-Lac, France; [2]CEA, France

4BV.5.2

PV Module Thermography: Long-term Study of Defect Visibility under Varying Environmental Conditions

Victoria Lofstad-Lie[1], Erik Stensrud Marstein[1;2], Aleksander Simonsen[3], Torbjørn Skauli[1;3]

[1]University of Oslo, Kjeller, Norway; [2]Institute for Energy Technology, Kjeller, Norway; [3]Norwegian Defence Research Establishment, Kjeller, Norway

4BV.5.3

Cloud-based Decision Support System for Operation and Maintenance in Photovoltaic Systems

Andreas Livera[1], Panagiotis Goumenos[1], Jose G. Franquelo[2], Ruben Gonzalez Bernal[2], George Elias Georghiou[1]

[1]University of Cyprus, NICOSIA, Cyprus; [2]Isotrol , Sevilla, Spain

4BV.5.4

Soiling Detection on Photovoltaic Modules Using Hyperspectral Imaging and Machine Learning Algorithms

Marko Turek[1]

[1]Fraunhofer CSP, Halle (Saale), Germany

4BV.5.5

Deep-Learning based Photovoltaic Panel Performance Monitoring Applied to Real Data

Peigen Xie[1], Sebastien Gourvenec[1], Gilles Poulain[1], Sara Aid[2], Daniel-Paul Dondera[1]

[1]TotalEnergies, Courbevoie, France; [2]Tosoh, Courbevoie, France

4BV.5.6

The Influente of System Layout and Operating Conditions on PV System Degradation

Aline Kirsten Vidal de Oliveira[1], Claudia Buerhop-Lutz[2], Marius Peters[2], Ricardo Rüther[1]

[1]UFSC, Florianópolis, Brazil; [2]HI ERN, Erlangen, Germany

4BV.5.7

Design and Operation of the First Large Linear Vertical Bifacial PV Plant in France

Hervè Colin[1], Astrig Benefice[2]

[1]CEA, Le bourget-du-lac, France; [2]CNR, lyon, France

4BV.5.8

Experimental Observations about the Cloud Enhancement Phenomenon on PV Strings

Kari Lappalainen[1], Seppo Valkealahti[1]

[1]Tampere University, Tampere, Finland

4BV.5.9

One year performance assessment of HTJ modules on Horizontal Single Axis Tracker (HSAT)

Giosué Maugeri[1], Asier Sanz Martinez[2], Eneko Setien[2], Lorenzo Todaro[3], Alexandre Mignonac[4], Giuseppe Demofonti[5], Salvatore Guastella[1], Alessandro Virtuani[6], Stéphane Guillerez[4]

[1]RSE, Milano, Italy; [2]TECNALIA, Donostia, Spain; [3]Enel Green Power, Catania, Italy; [4]CEA, Saint-Paul-lez-Durance, France; [5]Convert Italia, Roma, Italy; [6]EPFL, Lausanne, Switzerland

4BV.5.10

A Facility Test to Generate Data from Real PV Systems Affected by Faults

Giosué Maugeri[1], Salvatore Guastella[1]

[1]RSE, Milano, Italy

4BV.5.11

Performance Evaluation and Operational Faults Analysis for PV System Protection and Safety Standard Improvement

Tarikua Mekashaw Zenebe[1], Lemu Kebede[2], Ole-Morten Midtgård[1], Steve Völler[1]

[1]NTNU, Norway; [2]Private, Germany

4BV.5.12

A fast Software Check for PV Systems

Markus Rinio[1], Clifford Hansen[2]

[1]Karlstad University, Karlstad, Sweden; [2]Sandia National Laboratories, Albuquerque, United States

4BV.5.13

Impact of Large Format Solar Panels on the Balance of System Costs of Photovoltaic Power Plants

Djaber Berrian[1],

[1]BELECTRIC Solar & Battery, Kolitzheim, Germany

4BV.5.14

Thermal PV Defects Degradation Monitoring Using a Mounted Thermal Camera

Dhiaeddine Melliti[1], Duy Long Ha[1], Mohamed Amhal[2],

[1]INES, Le Bourget-du-Lac, France; [2]CEA, Le Bourget-du-Lac, France

4BV.5.15

Outdoor Performance Analysis of Five Different Technologies in Palaiseau, France

Moira Itzel Torres Aguilar[1], Jordi Badosa[1], Vincent Bourdin[2], Anne Migan-Dubois[3]

[1]École Polytechnique, Palaiseau, France; [2]LIMSI, Orsay, France; [3]University of Paris-Saclay, Gif-sur-Yvette, France

4BV.5.16

Comparison of Soiling Measurement Approaches in Solar PV Plants

Paula Rodriguez[1], Jose Antonio Bolivar Munoz[2], Shilpee Sinha[3], Imke Meyer[3]

[1], Colombia; [2], Spain; [3], United Kingdom

4BV.5.17

Analysis of Performance Enhancement of PV Systems after the Cleaning Event

Latifa El Boujdaini[1], Christof Bucher[1], Ahmed Mezrhab[2], Matthias Burri[1]

[1]BUAS, Burgdorf, Switzerland; [2]Mohammed First University, Oujda, Morocco

4BV.5.18

Monitoring of Photovoltaic Soiling and Assessment of Soiling Losses Characterization Strategies

Ruben Vardanyan[1], Narek K. Badalyan[1]

[1], Armenia

4BV.5.19

Modelling Soiling Losses in Different Sites in the Mediterranean Region

João Gabriel Bessa[1], Leonardo Micheli[1], Eduardo F. Fernández[1], Florencia Almonacid-Cruz[1]

[1]University of Jaén, Jaén, Spain

4BV.5.20

1 MW PV System at Munich Trade Fair Centre - 25 Years of Successful Operation

Gerd Becker[1]

[1]Bavarian Association for the Promotion of Solar Energy, Munich, Germany

4BV.5.21

Analysis of Non-linear Long-term Degradation of PV Systems

Latifa El Boujdaini[1], Christof Bucher[1], Ahmed Mezrhab[2], Matthias Burri[1], Ebrar Özkalay[3], Mauro Caccivio[3], Gabi Friesen[3]

[1]BUAS, Burgdorf, Switzerland; [2]Mohammed First University, Oujda, Morocco; [3]SUPSI, Lugano, Switzerland

4BV.5.22

Digital Twin Modelling of PV Modules Using IoT Enabled Module Monitoring

Pranav Maheshwari[1], Shubham Sharma[1], Utkarsh Kushwah[1]

[1]PV Diagnostics, Indore, India

4BV.5.23

Mitigating the Influence of Clipping Variability on Performance Ratio Calculations of PV Systems

Elena Koumpli[1], George Koutsourakis[2], James Blakesley[2], Christopher West[1], Jan Muller[1]

[1]Statkraft UK, London, United Kingdom; [2]National Physical Laboratory, United Kingdom

4BV.5.24

Fault Diagnosis of Grid-Connected Photovoltaic Systems Based on Unsupervised Sample Clustering and Multilayer Perceptron Model

Mohsen Zargarani[1], Sara Zermani[1], Chabakata Mahamat[1], Laurent Linguet[1]

[1]University of French Guiana, French Guiana

4BV.5.25

Cleaning Operations Planning Induced by Monitoring and Modelling of Soiling on Photovoltaic Modules

Jean Catry[1;2], Thomas Carriere[1], Marianne Marot[1], Alexandre Boilley[1]

[1]Solaïs, Valbonne, France; [2]Mines ParisTech, Paris, France

4BV.5.26

Soiling Persistence Model as Benchmark for Soiling Forecasts of Solar Collectors

Fernanda Norde Santos[1], Natalie Hanrieder[1], Stefan Wilbert[1], Jesús Polo[2], Carmen Alonso-García[2], Luis F. Zarzalejo[2], Mounir Abraim[4;5], Abdellatif Ghennioui[4], Robert Pitz-Paal[6]

[1]DLR- German Aerospace Center, Almería, Spain; [2]CIEMAT, Madrid, Spain; [3]Green Energy Park, Ben Guérir, Morocco; [4]USMBA, Fez, Morocco; [5]DLR-German Aerospace Center, Cologne, Germany

4BV.5.27

Data Analytics and the Performance Ratio of PV Plant with Bifacial Solar Monocrystalline Modules

Rodrigues Luis[1]

[1]Lightsource bp, London, United Kingdom

4BV.5.28

Distributed Detection Algorithm for Photo-Voltaic Solar Arrays Based on Least Significant Difference Test

Luis Diego Murillo-Soto[1], Carlos Meza[2]

[1]Costa Rica Institute of Technology, Costa Rica; [2]Anhalt University of Applied Sciences, Germany

4BV.5.29

An Automated Flexible Data-Driven Ensemble Approach for Estimating PV Module Degradation and Comparing against Warranty Levels

Julián Ascencio-Vásquez[1], Haohui Lui[2], Zoe Defreitas[1]

[1]Envision Digital, Redwood City, United States; [2]Envision Digital International, Singapore

4BV.5.30

PV Performance Loss and Snow Shedding at Low Tilt Angle: a Utility-Scale Case Study

Jennifer Braid[1], Laurie Burnham[1]

[1]Sandia National Laboratories, Albuquerque, United States

4BV.5.31

Choosing the Optimal Initial Position of a UAV for Infrared Inspection of Photovoltaic Power Plants

Tor Solend[1], Hans Jonas Fossum Moen[1], Anders Rødningsby[1]

[1]University of Oslo, Kjeller, Norway

4BV.5.32

Effects of the Soil and Washing Cycle on the Performance of a PV-Array

Yasuhiro Matsumoto[1], Mario Gerardo Moheyer[1], Marco Antonio Ramos[1], Edgar Roberto Sandoval[2], Nun Pitalúa[3], Jose Antonio Urbano[1], René Asomoza[1]

[1]CINVESTAV, GUSTAVO A MADERO, Mexico; [2]TecNM, Cuautitlán Izcalli,, Mexico; [3]University of Sonora, Hermosillo, Sonora, México, Mexico

4BV.5.33

Detailed Performance Metric Estimation of Solar Modules From Time-Series Monitoring of Solar Power Systems

Yang LI[1], Haohui Lui[1], Kang Jian[1], Haoran Chang[1], Biyun Liu[1], Lu Zhao[1]

[1]Envision Digital International, Singapore

4BV.5.35

Evaluation of the Self-cleaning Effect on the Performance of PV Plants

Latifa El Boujdaini[1], Christof Bucher[1], Ahmed Mezrhab[2], Matthias Burri[1], Ebrar Özkalay[3], Mauro Caccivio[3], Gabi Friesen[3]

[1]BUAS, Burgdorf, Switzerland; [2]Mohammed First University, Oujda, Morocco; [3]SUPSI, Lugano, Switzerland

4BV.5.36

Outdoor Performance Evaluation of CIS PV Plant under the Semi-Aride Climate of Benguerir Morocco

Said Elhamaoui[1]

[1]Green Energy Park, Ben Guerir, Morocco

4BV.5.37

Utilizing System Efficiency Evaluations to Determine DC Output of PV Systems

Bengt Jäckel[1], Matthias Pander[1], David Daßler[1], Stephanie Malik[1], Jens Fröbel[1]

[1]Fraunhofer IMWS, Halle, Germany

Visual Presentations 4CV.1

13:30- 15:00 4CV.1 **Poster Area**

4CV.1.1

Effective Irradiation Estimation of PV Installations: a Performance Analysis of PV Prod Tool

Katherine Alvino[1;2], Boutros Ghannam[2], Maroun Nemer[2]

[1]BBS Slama, Clermont-Ferrand, France; [2]Mines Paris, Palaiseau, France

4CV.1.2

Evaluation of Local Conditions and Their Impact on Bifacial PV Performance at High Latitude

Alexander Granlund[1], Mattias Lindh[2], Josefin Sundström[1], Jimmy Narvesjö[1], Anna Malou Petersson[1]

[1]RISE, Piteå, Sweden; [2]RISE, Umeå, Sweden

4CV.1.3

Optimal Design and Installation of Solar Home Systems for Bottom-up grids: a Comparative Case Study of Kenya and Norway

Ida Fuchs[1], Anja Myhre Waitz[1], Kari Thorset Lervik[1], Steve Völler[1], Ole-Morten Midtgård[1], Jayaprakash Rajasekharan[1]

[1]NTNU, Trondheim, Norway

4CV.1.4

Digital Platform for PV Tracker Technical Information and Benchmarking Tool

Cesar Hidalgo[1]

[1]GL-GH Solar, Barcelona, Spain

4CV.1.5

Opportunities and Limitation for PV-Systems with a Delta East/west Configuration at Higher Latitudes and Sites with low Clearness Index

Hans Georg Beyer[1]

[1]University of the Faroe Islands, Tórshavn, Faroe Islands

4CV.1.6

Experimental and Theoretical Investigation of Fixed and Tracking PV Panel Performance in Tehran through Techno-economic Aspects

Shahab Eslami[1;2], Aryan Tadjik[2], Ramin Pouladian Kari[3], Arman Pouladian Kari[4], Lars Lichner[2]

[1]University of Tehran, Iran; [2]Kirchner Solar Group, Germany; [3]Kirchner Solar Group, United Kingdom; [4]University of Warwick, United Kingdom

4CV.1.7

High Latitude Bifacial Orientation, a Non-Tracking Opportunity to Flatten the Production Curve

Christopher Pike[1], Erin Whitney[1], Michelle Wilber[1]

[1]UAF, Fairbanks, United States

4CV.1.8

Optimal Design of a Semi Grid-Connected PV System for a Site in Lwak, Kenya Using HOMER

Josephine Nakato Kakande[1], Godiana Hagile Philipo[1], Stefan Krauter[1]

[1]University of Paderborn, Paderborn, Germany

4CV.1.9

An Incorporated Geographic Information System and Multi-Criteria Decision-Making Approach for Potential Assessment of Large Photovoltaic Power Plant Sites in Iran

Shahab Eslami[1], Amin Golshanfard[1], Ramin Pouladian Kari[1], Lars Kirchner[1]

[1]Kirchner Solar Group, Germany

4CV.1.10

Solar Photovoltaic Systems for High Power Pumping: a Use Case

Márcia Horta[1], Luis Fialho[1], Pedro André Dos Santos Ribeiro Horta[1], Carlos Marques[2]

[1]University of Évora, Evora, Portugal; [2]ABROXO, Aljustrel, Portugal

4CV.1.11

Comparison of LCOE for Various PV System Configurations and Module Technologies in the South African Climatic Condition

Jacqui Crozier Mccleland[1], Tshepo Serameng[2], Ernest van Dyk[1], Monphias Vumbugwa[1], Freddie (Frederik) Vorster[1], Ross DIX Peek[1], Roelof Roodt[1]

[1]Nelson Mandela University, Gqeberha, South Africa; [2]ESKOM, Johannesburg, South Africa

4CV.1.12

Optimization of PV Array Tilt Angles and Row Spacing to Maximize Energy Yield

Bader Aldalali[1], Raed Bourisli[2], Arttu Tuomiranta[3], Jozef (Jef) Poortmans[3]

[1]Kuwait University, kuwait, Kuwait; [2]Kuwait University, Kuwait; [3]imec , Leuven, Belgium

4CV.1.13

Bifacial Energy Gain of Photovoltaic Arrays Installed on Highly Reflective Rooftops

Jesus Robledo Bueno[1], Babacar Sarr[1], Ibrahim El Boujdaini[1], Roxane Bruhwyler[2], Jonathan Leloux[1], Christian A. Gueymard[3], Frédéric Lebeau[2]

[1]LuciSun, Villers-la-Ville, Belgium; [2]University of Liege, Gembloux, Belgium; [3]Solar Consulting Services, Colebrook, United States

4CV.1.14

Disruptive Innovation for Automated PV Plant Construction Delivers Faster Time-To-Market and Lower Overall Costs for Mid-Size to Multi-MW Solar Farms

Giovanni DI Stefano[1], Francesco Beccarisi[1]

[1]Comau, Grugliasco, Italy

4CV.1.15

Experimental Performance of a PV-powered Center-Pivot Irrigation System

Juan Ignacio Herraiz[1], Rita Hogan Almeida[1], Manuel Castillo-Cagigal[2], Luis Narvarte[1]

[1]UPM, Madrid, Spain; [2]Qualifying Photovoltaics, Madrid, Spain

4CV.1.31

Modelling Efficiency of Multi-input Inverters

Clifford Hansen[1], Jay Johnson[1], Rachid Darbali[1], Nicholas Gurule[1]

[1]Sandia National Laboratories, Albuquerque, United States

4CV.1.32

Analysis of Power Grids with High-Penetration of Photovoltaics: the Case of Honduras

Gustavo A. Gómez-Ramírez[1], Carlos Meza[2], Gonzalo Mora-Jiménez[3], Isaac A. Luévano-Reyes[4], Luis García-Santander[5], José Rodrigo Rojas[6]

[1]Costa Rica Institute of Technology, Costa Rica; [2]Anhalt University of Applied Sciences, Germany; [3], Costa Rica; [4], Mexico; [5]University of Concepción, Concepción, Chile; [6]Costa Rica Institute of Electricity, Costa Rica

Visual Presentations 1CV.2

15:15- 16:45 High Temperature Route for Si Solar Cells **Poster Area**

1CV.2.1

SiNx and AlOx as Alternative Dielectrics in Hole Selective Tunnelling Passivating Contacts

Shona Mcnab[1], Ailish Wratten[2], Edris Khorani[2], Nicholas Grant[2], John Murphy[2], Matthew Wright[1], Peter Wilshaw[1], Sebastian Bonilla[1]

[1]University of Oxford, Oxford, United Kingdom; [2]University of Warwick, Coventry, United Kingdom

1CV.2.2

High-Efficiency PERL Solar Cells Using Simultaneous Laser Local Contact Opening and n+ Doping from POx/Al2O3 Passivation Stacks

Marco Ernst[1], Lachlan Black[1], Roel Theeuwes[2], Daniel Macdonald[1], Erwin Kessels[2]

[1]ANU, Canberra, Australia; [2]Eindhoven University of Technology, Eindhoven, The Netherlands

1CV.2.3

P-Type TOPCon Solar Cells with n-Poly Rear Emitter

Shih-Peng Hsu[1], Chao-Ping Huang[1], Chaihung Tsai[1], Sung-Yu Chen[1]

[1]ITRI, Tainan, Taiwan

1CV.2.4

Fabrication of IBC Solar Cells with Efficiency Higher than 24% Using TOPCon Technology

Han-Chen Chang[1], Bo-Cheng Kung[1], Sung-Yu Chen[1], Ming-Tsun Kuo[1], Chorng-Jye Huang[1]

[1]ITRI, Tainan, Taiwan

1CV.2.5

p- and n-Type Fireable Passivating Tunnel Oxide Contacts for Crystalline Silicon Solar Cells

Franz-Josef Haug[1], Mario Joe Lehmann[1], Sofia Libraro[1], Ezgi Genç[1], Audrey Morisset[1], Christophe Ballif[1]

[1]EPFL, Neuchâtel, Switzerland

1CV.2.6

Edge Passivation for Double Side Poly-Si/SiOx Passivated Contacts Solar Cells

Franck Dhainaut[1;2], Benoit Martel[1], Thibaut Desrues[1], Mickael Albaric[1], Olivier Palais[2], Sébastien Dubois[1]

[1]CEA, Le Bourget-du-Lac, France; [2]CNRS, Marseille, France

1CV.2.7

Industrial Feasible Screen Printed IBC Solar Cell Based on PECVD a-Si (N) Deposition on Large Area p-Type Substrates

Lejo Joseph Koduvelikulathu[1], Jan Lossen[1], A. Adrian[1], Dominik Rudolph[1], Razvan Roescu[1], Andreas Wolf[2], Bernd Steinhauser[2], Melanie Frettloeh[2], Thomas Pernau[3], Helge Haverkamp[3], Radovan Kopecek[1]

[1]ISC Konstanz, Germany; [2]Fraunhofer ISE, Germany; [3]centrotherm international, Germany

1CV.2.8

nc-SiC Layers by PECVD for High Temperature Passivating Contacts

Ezgi Genç[1], Sofia Libraro[1], Mario Joe Lehmann[1], Audrey Morisset[1], Franz-Josef Haug[1], Christophe Ballif[1]

[1]EPFL , Neuchâtel, Switzerland

1CV.2.9

Investigation on the Passivation Quality of Ex-situ Doped p+ and n+ Poly-Si Layers for IBC Solar Cells

Vaibhav Kuruganti[1], Radovan Kopecek[2], Sven Seren[3], Olindo Isabella[4], Valentin Dan Mihailetchi[1]

[1]ISC Konstanz, Konstanz, Germany; [2]SCHMID Group, Freudenstadt, Germany; [3]Delft University of Technology, Delft, The Netherlands

1CV.2.10

Analysis of Passivation Characteristics with Inserting Intrinsic poly-Si Layer on Passivating Contact Solar Cells

Haejung Lee[1], Dongjin Choi[2], Myeongseob Sim[2], Ji Yeon Hyun[2], Heeyeon Lee[2], Hoyoung Song[2], Changhyun Lee[2], Dongkyun Kang[2], Donghwan Kim[2], Yoonmook Kang[1], Hae-Seok Lee[1]

[1]Korea University, Seoul , Korea, Rep. of South; [2]Korea University, Seoul, Korea, Rep. of South

1CV.2.11

Fully Passivating Contact IBC Solar Cells Using Laser Processing

Florian Buchholz[1], Jonathan Linke[1], Christoph Peter[1], Jan Hoß[1], Jan Lossen[1], Radovan Kopecek[1]

[1]ISC Konstanz, Konstanz, Germany

1CV.2.12

Screen-Printed c-Si Solar Cells with poly-SiOx Carrier Selective Passivating Contacts on Ultra-Thin Thermal Tunneling Oxide

Manvika Singh[1], Aswathy Amarnath[1], Guangtao Yang[1], Dong Zhang[2;3], Valerio Zardetto[2], Mehrdad Najafi[2], Adriana Creatore[4], René Janssen[3], Sjoerd Veenstra[2], Gianluca Coletti[2], Luana Mazzarella[1], Arthur W. Weeber[1;2], Miro Zeman[1], Olindo Isabella[1]

[1]Delft University of Technology, Delft, The Netherlands; [2]TNO, Eindhoven, The Netherlands; [3]Eindhoven University of Technology, Eindhoven, The Netherlands

1CV.2.13

Recent Progress of POLO Back Junction Solar Cells

Byungsul Min[1], Lasse Nasebandt[1], Christina Hollemann[1], Dennis Bredemeier[2], Lennart Thiemann[1], Till Brendemühl[1], Karsten Bothe[1], Robby Peibst[1], Rolf Brendel[1;2]

[1]ISFH, Emmerthal, Germany; [2]Leibniz University of Hannover, Hannover, Germany

1CV.2.14

An Al-Doped SiO2 for Passivation of p-Type Surfaces in Silicon Solar Cells

Xinya Niu[1], Matthew Wright[1], Peter Wilshaw[1], Sebastian Bonilla[1]

[1]University of Oxford, Oxford, United Kingdom

1CV.2.15

The Influence of the AlOx Deposition Temperature on the Passivation Mechanism of AlOx/SiNy:H Stacks

Fabian Geml[1], Sarah Sanz Alonso[1], Heiko Plagwitz[1], Giso Hahn[1]

[1]University of Konstanz, Konstanz, Germany

1CV.2.16

LPCVD n-Type Polycrystalline Silicon Passivating Contacts for Industrial Scale Crystalline Silicon Solar Cells

Hisham Nasser[1], Emine Hande Ciftpınar[1], Berkay Uygun[1], Hassan Osman[1], Ahmet Emin Keçeci[1], Hasan Hüseyin Canar[1], Sercan Aslan[1], Salar Habibpur Sedani[1], Ergi Dönerçark[1], Rasit Turan[1]

[1]ODTÜ-GÜNAM, Ankara, Turkey

1CV.2.17

Improving the Efficiency of PERC Solar Cells by Low Temperature Oxidation

Ahmet Emin Keçeci[1;2], Hasan Hüseyin Canar[1;2], Hasan Asav[1;2], Sümeyye Koçak Bütüner[2], Selin Seyrek[1;2], Bülent Arikan[2], Gence Bektas[1;2], Rasit Turan[1;2]

[1]METU, Ankara, Turkey; [2]ODTÜ - GÜNAM, Ankara, Turkey

1CV.2.18

Effect of Laser Contact Opening Fraction and Emitter Doping on n-Si Rear Junction Solar Cells

Ahmet Emin Keçeci[1;2], Gence Bektas[1;2], Hasan Hüseyin Canar[1;2], Hasan Asav[1;2], Sümeyye Koçak Bütüner[1], Selin Seyrek[2], Emine Hande Ciftpınar[1;2], Rasit Turan[1;2]

[1]ODTÜ - GÜNAM, Ankara, Turkey; [2]METU, Ankara, Turkey

1CV.2.34

Impact of Hydrogen Diffusion into ITO Layer on the Electrical Performance of SHJ Solar Cells

Ergi Dönerçark[1], Seda Kılıçkaya[1], Patrick Choulat[2;3;4], Milad Ghasemi[1;5], Arghavan Salimi[1;5], Devika Rajagopal[2;3;4;6], Salar Sedani[1;5], Konstantin Tsoi[1], Emine Hande Ciftpınar[1;5], Hariharsudan Sivaramakrishnan Radhakrishan[2;3;4], Rasit Turan[1;5]

[1]ODTÜ - GÜNAM, Ankara, Turkey; [2]Hasselt University, Hasselt, Belgium; [3]Imec, Genk, Belgium; [4]EnergyVille, Genk, Belgium; [5]METU, Ankara, Turkey; [6]KU Leuven, Heverlee, Belgium

1CV.2.35

Heterojunction Ge Solar Cells with a Record High Efficiency of 8.6%

Makoto Konagai[1], Kimihiko Saito[2], Yukimi Ichikawa[1], Naoki Suyama[1], Kazuyoshi Nakada[1], Ryousuke Ishikawa[1]

[1]Tokyo City University, Tokyo, Japan; [2]Fukushima University, Fukushima, Japan

1CV.2.36

Lithium Fluoride as an Interlayer in Transparent Selective Contacts for Silicon Heterojunction Solar Cells

Francesca Menchini[1;2], Luca Serenelli[1], Luca Martini[1], Enrico Salza[1], Pietro Mangiapane[1], Massimo Izzi[1], Mario Tucci[1]

[1]ENEA, Roma, Italy; [2]University of Rome, Roma, Italy

1CV.2.37

Comparison of Amorphous Silicon Deposition Methods for Heterojunction Solar Cells

Carsten Strobel[1], Sebastian Leszczynski[1], Matthias Albert[1], Johann W. Bartha[1], Thomas Mikolajick[1], Frank Stahr[2], Olaff Steinke[2]

[1]Dresden University of Technology, Dresden, Germany; [2]FAP, Dresden, Germany

1CV.2.38

Evaporated Cu2O as a hole-selective Contact for c-Si Solar Cells

Gabriel Bartholazzi Lugao de Carvalho[1], Daniel Macdonald[1], Lachlan Black[1]

[1]ANU, Canberra, Australia

1CV.2.39

Optimization of High – Mobility Doped Indium Oxide Films and its Transfer to Silicon Solar Cells as Transparent Conductive Electrode

Thomas Tom[1;2], Leonard Tutsch[1], Julian López-Vidrier[2], Jose Miguel Asensi Lopez[2], Martin Hermle[1], Joan Bertomeu[2], Martin Bivour[1]

[1]Fraunhofer ISE, Germany; [2]University of Barcelona, Spain

1CV.2.40

Temperature- and Illumination-Dependent Performance of Silicon Heterojunction Solar Cells with Bulk Resistivities over 1,000 Ω.cm

Anh Huy Tuan Le[1], Apoorva Srinivasa[2], Stuart Bowden[2], Ziv Hameiri[1], André Augusto[2]

[1]UNSW, Sydney, NSW 2052, Australia; [2]Arizona State University, Tempe, AZ 85287, United States

1CV.2.41

High-Mobility IWO Films Deposited in Nonreactive Plasma by RF Sputtering

Francesca Menchini[1;2], Luca Serenelli[1], Luca Martini[1], Enrico Salza[1], Massimo Izzi[1], Mario Tucci[1]

[1]ENEA, Roma, Italy; [2]University of Rome, Roma, Italy

1CV.2.42

Catalytic-CVD Deposited Nanocrystalline Silicon Oxide Thin Films for the Application in Silicon Heterojunction Solar Cells

Yong Liu[1], Miao Yang[1], Xiaoning Ru[1], Minghao Qu[1], Xixiang Xu[1]

[1]LONGi Solar Technology, Xi'an, China

1CV.2.43

Effect of Chemical Polishing on Textured Silicon Surface Conditioning and Impact on Heterojunction Cell Performance

Shrestha Bhattacharya[1], Ashutosh Pandey[1], Sourav Mandal[1], Vamsi Krishna Komarala[1]

[1]IIT Delhi, New Delhi, India

1CV.2.44

Improving Silicon Heterojunction Solar Cell Performance with Double Layer ARC

Milad Ghasemi[1], Ergi Dönerçark[1], Arghavan Salimi[1], Seda Kılıçkaya[1], Mehmet Koç[1], Rasit Turan[1]

[1]ODTÜ- GÜNAM, ANKARA, Turkey

1CV.2.45

Influence of Indium Tin Oxide Electronic Properties on Contact Resistivity with p-Type Amorphous Silicon

Sourav Mandal[1], Shahnawaz Alam[1], Anamika Anamika[1], Shrestha Bhattacharya[1], Ashutosh Pandey[1], Vamsi Krishna Komarala[1]

[1]IIT Delhi, New Delhi, India

1CV.2.46

Hydrogenated SiOy Interlayer Formed by Etching Al2O3 for MoOx Hole-Selective Contact

Mike Ah Sen[1;2], Fatemeh S. Minaye Hashemi[1], Ruben Streekstra[1], Astrid Gutjahr[1], Jimmy Melskens[1], Agnes Mewe[1], Arthur Weeber[1;2]

[1]TNO, Petten, The Netherlands; [2]Delft University of Technology, Delft, The Netherlands

1CV.2.47

Influence of Carrier Transport Barrier on Silicon Heterojunction Cell Performance With the Variation of Intrinsic Hydrogenated Amorphous Layer Thickness

Ashutosh Pandey[1], Shrestha Bhattacharya[1], Sourav Mandal[1], Shahnawaz Alam[1], Vamsi Krishna Komarala[1]

[1]IIT Delhi, New Delhi, India

1CV.2.48

Novel HJT Metallization Processes to Face the Silver Consumption Challenge

Nicola Frasson[1], Marco Galiazzo[1]

[1]Applied Materials, Olmi di San Biagio di Callalta, Italy

1CV.2.49

Characterization of the Crystallinity, Passivation and Conductivity of Nano-Crystalline Silicon Films for Si Heterojunction Solar Cells

Karl Ceulemans[1;2;3;4], Hariharsudan Sivaramakrishnan Radhakrishan[1;2;3], Devika Rajagopal[1;2;3;4], Stefanie Sergeant[5], Thomas Nuytten[5], Jozef (Jef) Poortmans[1;2;3]

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Visual Presentations 1CV.3

17:00- 18:30 Feedstock, Crystallisation, Wafering and Defects in Silicon — **Poster Area**

1CV.3.1

Hydrogen Interactions in Silicon Studied by Temporary LeTID Recovery Experiments

Wolfram Kwapil[1;2], Tim Niewelt[1;2;3], Martin C. Schubert[2]

[1]University of Freiburg, Freiburg, Germany; [2]Fraunhofer ISE, Freiburg, Germany; [3]University of Warwick, Coventry, United Kingdom

1CV.3.2

Pre-Hydrogenation for LeTID Suppression via an Understanding the Hydrogen Distribution in Cz Silicon Wafer

Myeongseob Sim[1], Dongjin Choi[2], Yujin Jung[1], Hyunjung Park[1], Yoonmook Kang[3], Donghwan Kim[1], Hae-Seok Lee[3]

[1]Korea University, Seoul, Korea, Rep. of South; [2]KIMS, Seoul, Korea, Rep. of South

1CV.3.3

Light and Elevated Temperature Induced Degradation in Gallium- and Boron-Doped hpmc-Si Wafers Studied by Hyperspectral Photoluminescence Imaging

Torbjørn Mehl[1], Oda Goa Berge[1], Ingunn Burud[1], Rune Søndenå[2], Espen Olsen[1]

[1]Norwegian University of Life Sciences, Aas, Norway; [2]Institute for Energy Technology, Kjeller, Norway

1CV.3.4

Impact of a Renewed SiNx:H Passivation Layer and/or a Renewed Firing Step on LeTID and Regeneration

Andreas Schmid[1], Annika Zuschlag[1], Giso Hahn[1]

[1]University of Konstanz, Konstanz, Germany

1CV.3.5

Effect of Different AlOx Passivation Layers Deposited by APCVD and ALD on LeTID

Melanie Mehler[1], Fabian Geml[1], Andreas Schmid[1], Annika Zuschlag[1], Giso Hahn[1]

[1]University of Konstanz, Konstanz, Germany

1CV.3.6

The Impact of Bulk Iron Contamination on the Surface Recombination of Silicon Wafers

Tien Le[1], Toni Pasanen[2], Lachlan Black[1], Hele Savin[2], Daniel Macdonald[1], Anyao Liu[1]

[1]ANU, Canberra, Australia; [2]Aalto University, Espoo, Finland

1CV.3.7

Fluorine Passivation of Ring Defects in Czochralski-Grown Silicon

Rabin Basnet[1], Hang Cheong Sio[1], Chang Sun[1], Hieu Nguyen[1], Daniel Macdonald[1]

[1]ANU, Canberra, Australia

1CV.3.8

Modelling of Eddy-Current Measurement for Inhomogeneous Charge Carrier Depth Profile

David Krisztian[1,2], Ferenc Korsós[1], Martin Kovacs[1], Ferenc Ujhelyi[1], Péter Tüttö[1]

[1]Semilab, Budapest, Hungary; [2]BME, Budapest, Hungary

1CV.3.9

Evaluation of the Effect of Surface Structure on Flexibility of Si Wafers for Flexible c-Si Solar Cells

Koki Ide[1], Yutaka Hara[2], Tappei Nishihara[1], Ryo Yokogawa[2;3], Kyotaro Nakamura[4], Yoshio Ohshita[4], Tomoyuki Kawatsu[5], Toshiki Nagai[5], Noboru Yamada[6], Yukio Miyashita[6], Yuma Aoki[6], Hayato Kobayashi[6], Atsushi Ogura[2;3]

[1]Meiji University , Kawasaki, Japan; [2]Meiji University, Kawasaki, Japan; [3]Toyota Technological Institute , Nagoya, Japan; [4]Komatsu NTC, Nanto, Japan; [5]Nagaoka University of Technology, Nagaoka, Japan

1CV.3.10

Mechanical Strength Testing of Mono-Si Wafers with Different Thickness

Nurhayat Yildirim[1], Burak Kaan Cihan[1], Kaan Görgişen[1], Fırat Es[1]

[1]Kalyon PV, Ankara, Turkey

1CV.3.11

Optimization Wafer Thickness for a Large-Scale Module Production

Nurhayat Yildirim[1], Fırat Es[1], Kaan Görgişen[1], Burak Kaan Cihan[1], Ömer Yalçın[1]

[1]Kalyon PV, Ankara, Turkey

1CV.3.12

Study of Diamond Wire Slicing Parameters by the 3D Visualization of a Multicrystalline Silicon Ingot

Sergey M. Karabanov[1], Oleg A. Belyakov[1], Andrey E. Serebryakov[1], Dmitry V. Suvorov[1], Andrey S. Karabanov[1]

[1]RSREU, Russian Federation

1CV.3.13

Impact of Crucible-Coating-Silicon Feedstock System Quality on Electrical Properties of HEM Multicristalline Silicon Ingot

Yassine Chettat[1], Djamel Ouadjaout[1], Bouchehahm Abdelghani[2]

[1]CRTSE, Algiers, Algeria

1CV.3.14

Modelling Seed Joint Grain Boundaries in Cast Monocrystalline Silicon

Shuai Yuan[1], Dongli Hu[2], Xuegong Yu[1], Lei Wang[1], Deren Yang[1]

[1]Zhejiang University, Hangzhou, China; [2]Jiangsu GCL Silicon Material Technology Development, Xuzhou, China

1CV.3.15

Study of the Influence of Electromagnetic Stirring of Silicon Melt on Multicrystalline Silicon Parameters

Sergey M. Karabanov[1], Dmitry V. Suvorov[1], Oleg A. Belyakov[1], Evgeny V. Slivkin[1], Andrey S. Karabanov[1]

[1]RSREU, Russian Federation

1CV.3.16

A New Technological and Environmentally Sustainable Long-Term Supply-Chain Solution for The Mass Production of High Purity Silica from Canada

Doug Mcmillan[1], Brent Bullen[2]

[1]University of Alberta, Edmonton, Canada; [2]Queen's University, Kingston, Canada

1CV.3.17

Understanding the Effect of Ambient Media on Laser Grooving of Silicon

Tushar Ner[1], Pinal Rana[1], Deepak Marla[1]

[1]IIT Bombay, Mumbai, India

1CV.3.33

Influence of the Growth Temperature and RF Power in p-Type nc-SiOx:H Films on the Performance of Silicon Heterojunction (SHJ) Solar Cells

Antonio de Jesus Olivares-Vargas[1], Pere Roca I Cabarrocas[1]

[1]LPICM, CNRS, Ecole Polytechnique, Palaiseau, France

1CV.3.34

Transparent Electrode of ITO/AZO DBR-diffuser Structure to Implement Various and Vivid Colors for BIPV Windows

Jung-Dae Kwon[1], Myunghun Shin[2], Soo-Won Choi[1]

[1]KITECH, 창원시, Korea, Rep. of South; [2]76, Goyang-si, Korea, Rep. of South

Visual Presentations 3DV.1

08:30- 10:00 Module Design and Manufacturing Posters **Poster Area**

3DV.1.1

Fully Black and Reliable PV Modules with a Cost Effective Inkjet Coating of Cell Strings

Christian H. Schiller[1], Stephan Hoffmann[1], Mike Jahn[1], Angela De Rose[1], Martin Heinrich[1], Holger Neuhaus[1]

[1]Fraunhofer ISE, Freiburg, Germany

3DV.1.2

Application of SHJ and TOPCon Shingle Cells in Full-format and Integrated Solar Modules

Veronika Nikitina[1], Dirk Reinwand[1], Tobias Fellmeth[1], Sebastian Neven-du Mont[1], Daniel von Kutzleben[1], Torsten Roessler[1], Holger Neuhaus[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany

3DV.1.3

Photovoltaic Modules Encapsulated in Composite Material with Enhanced Recyclability

Gorka Imbuluzqueta[1], Jon Aizpurua[1], Juan Maria Hernandez[1], Naiara Yurrita[1], Werther Cambarau[1], Francisco J. Cano[1], Oihana Zubillaga[1]

[1]TECNALIA, San Sebastian, Spain

3DV.1.4

Influence of Micro- and Macrostructure of ECA on Contact Resistivity of ECA-Based Interconnects

Ignacia Devoto[1;2], Daniel Tune[1], Stephan Großer[3], Tudor Timofte[1], Andreas Halm[1], Ralph Gottschalg[2;3]

[1]ISC Konstanz, Konstanz, Germany; [2]Anhalt University of Applied Sciences, Köthen (Anhalt), Germany; [3]Fraunhofer CSP, Halle (Saale), Germany

3DV.1.5

Optimizing PV Modules via Functional Pigments in Solar Encapsulants

Daniel Mann[1;2], Ryan van Zandvoort[1;2], Pj Pascal Buskens[1;2;3]

[1]TNO, Eindhoven, The Netherlands; [2]Brightlands Materials Center, Geleen, The Netherlands; [3]Hasselt University, Hasselt, Belgium

3DV.1.6

Interconnection Technology for the Next Generation of (Temperature-Sensitive) Solar Cells such as Heterojunction and C-Si/Perovskite Tandem

Yonas Zemen[1], Stefan Wendlandt[2], Lars Podlowski[1], Bernd Litzenburger[1]

[1]Solyco Technology, Berlin, Germany; [2]PI Berlin, Berlin, Germany

3DV.1.7

Paving the Way for low Breakage Rates in Industrial Production of N.I.C.E.-Wire Modules

Pascal Leibiger[1], Christoph Pönisch[1], Thomas Seifert[1], Daniel Kray[1]

[1]University of Applied Sciences Offenburg, Offenburg, Germany

3DV.1.8

1% Absolute Power Gain of Silicon Heterojunction Metal Wrap Through Laminates Produced in Industrial Pilot Line

Marina Foti[1], Nicolas Guillevin[2], Anna J. Carr[2], Bas Van Aken[2], Francesco Rametta[1], Marcello Sciuto[1], Antonio Spampinato[1], Alfredo DI Matteo[1], Gianluca Coletti[2;3], Cosimo Gerardi[1]

[1]ENEL Green Power, Catania, Italy; [2]TNO, Petten, The Netherlands; [3]UNSW, Sydney, Australia

3DV.1.9

Processing and Demonstration of Pilot Scale Solar Heat Blocking Encapsulants for Increased Power Output and Lifetime of Crystalline Silicon PV

Ryan van Zandvoort[1], Tatjana Vavilkin[2], Nicole Meulendijks[1], Daniel Mann[1], Pj Pascal Buskens[1]

[1]TNO, The Netherlands; [2]Soltech, Tienen, Belgium

3DV.1.10

Novel Photovoltaic Module Design for Desert Climate

Amir A. Abdallah[1], Kamal Mroue[2], Ayman Samara[1], Maulid M. Kivambe[1], Brahim Aissa <[1], Benjamin Figgis[1], Juan Lopez Garcia[1], Stephan Großer[3], Matthias Pander[3], Bengt Jäckel[3;4], Klemens Ilse[3;4], Christian Hagendorf[3], Matthias Ebert[3]

[1]QEERI, Doha, Qatar; [2]Fraunhofer CSP, Halle (Saale), Germany; [3]Fraunhofer IMWS, Halle (Saale), Germany

3DV.1.11

Shade-resistant PV Module Design to Increase Power and Energy Production of PV Modules under Partial Shading Conditions

Hamed Hanifi[1], Waldemar Maier[1], Afshin Bakhtiari[1], Matthias Pander[2], Bengt Jäckel[2]

[1]AE SOLAR, Königsbrunn, Germany; [2]Fraunhofer CSP, Halle, Germany

3DV.1.12

2.5 Minutes Lamination Process and the Influences of the Degree of Cross-Linking and of the Humidity Degradation on PV Modules

Aksel Kaan Öz[1], Christine Wellens[1], Martin Heinrich[1], Holger Neuhaus[1], Martin Wiese[1], Sraisth Sraisth[2], Daniel Klaus[2]

[1]Fraunhofer ISE, Freiburg, Germany; [2]Robert Bürkle, Freudenstadt, Germany

3DV.1.13

Demonstrative BIPV Facades Realized with Novel Glass-free Colored Lightweight PV Modules

Fabiana Lisco[1], Gianluca Cattaneo[2], Alessandro Virtuani[1], Claudio del Pero[3], Fabrizio Leonforte[3], Niccolo Aste[3], Matthieu Despeisse[2], Christophe Ballif[1]

[1]EPFL, Neuchâtel, Switzerland; [2]CSEM, Neuchâtel, Switzerland; [3]Polytechnic University of Milano, Milano, Italy

3DV.1.14

A New Typed Shingled Photovoltaic Module

Han Chang Liu[1], Wen-Kuei Lee[1], Mei-Hsiu Lin[1], Po-Yu Chou[1]

[1]ITRI, Taiwan

3DV.1.15

The Impacts of Different Flux Materials on the Performance of Photovoltaic Solar Modules

Meriç Çaliskan[1], Bedrettin Aydoğan[1], Merve Kaya[1], Nurullah Alper Sütçü[1], Fırat Es[1]

[1]Kalyon PV, Ankara, Turkey

3DV.1.16

Laser Processes for Perovskite Modules: Influence of Pulse Duration and Wave Length Onto the Process Quality to Reduce Production Costs

Stefan Bergfeld[1;2]

[1]FH Aachen University of Applied Sciences, Germany; [2]Bergfeld Lasertech, Aachen, Germany

3DV.1.17

Influence of the Lamination Pressure on the Adhesion, Degree of Cross-Linking, and Bubble Formation of PV Modules

Sraisth Sraisth[1], Aksel Kaan Öz[2], Daniel Klaus[1], Christine Wellens[2], Martin Heinrich[2]

[1]Robert Bürkle, Freudenstadt, Germany; [2]Fraunhofer ISE, Freiburg, Germany

3DV.1.18

Integration of Antenna for IoT Communication in Small Silicon Photovoltaic Module

Lasse Roer Wahlgreen[1], Martin Nordal Petersen[1], Peter Behrensdorff Poulsen[1], Sune Thorsteinsson[1]

[1]Technical University of Denmark, Roskilde, Denmark

3DV.1.19

Achieving Uniform Module Appearance While Increasing Module Efficiency: the Full Gapless Module Concept for Stringed IBC Solar Cells

Andreas Halm[1], Stefan Wendlandt[2], Tudor Timofte[1], Florian Buchholz[1]

[1]isc konstanz, konstantz, Germany; [2]PI Berlin, Berlin, Germany

3DV.1.20

Mitigating Cell Breakage and Shading Losses in Shingled Strings and Modules

Daniel Tune[1], Karl Wienands[1], Ingo Ullmann[1], Andreas Halm[1]

[1]ISC Konstanz, Germany

3DV.1.21

Interconnection Approach for Busbar-Less Bifacial IBC Cells Based on Printed Solder Paste

Tobias Messmer[1], Haifeng Chu[1], Valentin Dan Mihailetchi[1], Razvan Roescu[1], Andreas Halm[1]

[1]ISC Konstanz, Konstanz, Germany

3DV.1.22

Reducing Cut Losses of Interdigitated Back-Contact Solar Cells

Ning Chen[1], Florian Buchholz[1], Daniel Tune[1], Andreas Halm[1], Olindo Isabella[2], Valentin Dan Mihailetchi[1]

[1]ISC Konstanz, Germany, Germany; [2]Delft University of Technology, Delft, The Netherlands

3DV.1.23

Interconnection Technology in PV Modules: Impact of Ribbons, Tab Connectors and Electrically Conductive Backsheet on Module Performance

Ammar Tummalieh[1], Balaramakrishna Paritala[2], Max Mittag[1], Holger Neuhaus[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany; [2]University of Applied Sciences Jena, Jena, Germany

3DV.1.24

Towards the Optimization of the Lamination of Eco-Designed Photovoltaic Modules; First Step : Relevant Thermomechanical Characterization of Polymers

Dylan Habans[1;2], Jean-Luc Bouvard[2], Billon Noëlle[2], Eeva Mofakhami[1], Aude Derrier[1]

[1]CEA, Le Bourget du Lac, France; [2]CEMEF Mines ParisTech - PSL Research University, Sophia Antipolis, France

3DV.1.40

Performance Analysis of Power Optimizers from Different Manufacturers by Indoor Lab Testing and High-resolution Shading Simulation

Cyril Allenspach[1], Arturo Bänziger[1], Andrin Schneider[1], Fabian Carigiet[1], Franz P. Baumgartner[1]

[1]ZHAW, Winterthur, Switzerland

3DV.1.41

LCOE Reduction Approaches for Bifacial PV Plants

Ignacio Ballesteros García[1], Xavier Rodríguez[2], Adrià Ortega[2], Ana Milena Cruz Rodríguez[1], Andrea Ricci[3], Luca Bellini[3]

[1]Leitat, Spain; [2]Convert Italia, Italy

3DV.1.42

Horizontal Single Axis Tracker in Weathering Steel, a Solution with a Low Impact on the LCOE and LCA Index.

Giuseppe Demofonti[1]

[1]*Convert Italia, Rome, Italy*

3DV.1.43

Stand-alone IoT Enabled Bifacial Irradiance Sensor for PV

Urban Barbič[1], Marko Jankovec[1], Marko Topic[1]

[1]*University of Ljubljana, Ljubljana, Slovenia*

3DV.1.44

Multi-Wavelength DUSST: A Novel Concept of Optical Soiling Sensor:

Álvaro Fernández Solas[1], Leonardo Micheli[1], Florencia Almonacid-Cruz[1], Eduardo F. Fernández[1]

[1]*University of Jaén, Jaén, Spain*

3DV.1.45

Fabrication of Flexible and Light-Weight Module with Crystalline Silicon Solar Cells

Tomihisa Tachibana[1], Katsuto Tanahashi[1], Yuji Ino[1], Katsuhiko Shirasawa[1]

[1]*AIST, Koriyama, Japan*

Visual Presentations 5DV.2

10:30- 12:00 Energy System Integration; Storage / Sustainability, Environment, and Circularity of PV / Modelling and Scenarios for Renewables, Policy, Global Challenges / Costs, Economics, Finance and Markets / Regional Experiences; Combatting Energy Poverty / Societal Challenges; Citizens' Participation, Awareness **Poster Area**

5DV.2.1

Solenco Power: Hydrogen Storage for AC and DC Networks

Francisco López[1], Dr. Hugo Vandenborre[1]

[1]*Solenco Power, Turnhout, Belgium*

5DV.2.2

Batteries in Solar-driven Water Splitting System – Synergistic Efficiency Gain

Oleksandr Astakhov[1], LI-Chung Kin[1], Minoh Lee[2], Stefan Haas[1], Uwe Rau[1;3], Tsvetelina Merdzhanova[1]

[1]*Forschungszentrum Jülich, Jülich, Germany;* [2]*University of Toronto, Toronto, Ontario, Canada;* [3]*RWTH Aachen University, Aachen, Germany*

5DV.2.3

KALYON EV-ON Charge

Merve Tunçez[1], Ali Eren Kok[1], Duygu Kuzyaka[1], Fırat Es[1]

[1]Kalyon PV, Ankara, Turkey

5DV.2.4

Transient Response and Non-Linear Capacity Variation Aware Unified Equivalent Circuit Battery Model

Dafang Zhao[1], Ittetsu Taniguchi[1], Francky Catthoor[2], Takao Onoye[1]

[1]University of Osaka, Suita, Japan; [2]KU Leuven, Leuven, Belgium

5DV.2.5

Integrating Perovskite Photovoltaics and Nickel Cobalt Sulfide Catalysts for Efficient Hydrogen Evolution Reaction

Hongjae Shim[1], Jaesung Yun[1]

[1]UNSW, Sydney, Australia

5DV.2.6

Hydrogen Concept in the Commercial Sector with a H_2 Bus for the Use of PV Yield

Hannah Prinz[1], Henrik Te Heesen[1]

[1]Environmental Campus Birkenfeld, Hoppstädten-Weiersbach, Germany

5DV.2.7

Evaluating PV Integration Strategies Considering High Resolution Embedded CO2 Emissions of Grid Electricity

Natasa Vulic[1], Martin Ruedisueli[1]

[1]EMPA, Dübendorf, Switzerland

5DV.2.8

Solar Photovoltaic Floating Systems Assessment Through GIS-Multicriteria Analysis: a Case Study of the Marrakech-Safi Region' Dams in Morocco

Fatima-Zahra Ouchani[1;2], Ouafae Jbaihi[1;2], Ahmed Alami Merrouni[3], Samir Idrissi Kaitouni[1], Abdellatif Ghennioui[1], Zakaria Naimi[1], Mohamed Maaroufi[2]

[1]Green Energy Park, Ben Guerir, Morocco; [2]Mohammadia School of Engineers, Rabat, Morocco; [3]Mohammed First University, Oujda, Morocco

5DV.2.9

Reactive Power Control in PV Systems through (explainable) Artificial Intelligence

Christian Utama[1], Christian Meske[2], Johannes Schneider[3], Rutger Schlatmann[4], Carolin Ulbrich[4]

[1]Free University of Berlin, Berlin, Germany; [2]Ruhr University Bochum, Bochum, Germany; [3]University of Liechtenstein, Vaduz, Liechtenstein; [4]HZB, Berlin, Germany

5DV.2.10

Technical, Business and Regulatory Approaches to Enhance Renewable Energy Capabilities to Take Part Actively in the Electricity and Ancillary Services Markets

Hanna Bartoszewicz-Burczy[1]

[1]Institute of Power Engineering, Warszawa, Poland

5DV.2.11

Six Years of Development and Field Experice in Residential PV Buildings with Maximum Power Self-Consumption and Grid Friendly Operatione

Thomas Nordmann[1], Ralph Lingel[1]

[1]TNC Consulting, Meilen, Switzerland

5DV.2.12

Matching Photovoltaics and Heat Pumps - Against the Peak

Paul Grunow[1]

[1]Trier University of Applied Sciences, Berlin, Germany

5DV.2.13

Highly efficient Indoor Charging of Sodium Ion Battery with Lead Halide Perovskite under LED Lighting

LI-Chung Kin[1], Tsvetelina Merdzhanova[1], Zhifa Liu[1], Hans Kungl[1], Sergey Shcherbachenko[1], Thomas Kirchartz[1], Rüdiger-A. Eichel[1], Uwe Rau[1;3], Oleksandr Astakhov[1]

[1]Forschungszentrum Jülich, Jülich, Germany; [2]RWTH Aachen University, Aachen, Germany

5DV.2.14

Assessment of Non-Isolated Microgrid Potential for Increased Reliability in Medium Voltage Feeders

Pedro Torres[1], João Tavares Pinho[1], Roberto Zilles[1]

[1]University of São Paulo, Sao Paulo, Brazil

5DV.2.15

Impedance, Inertia and Delays of Serbian Energy Transition

Ilija Batas Bjelic[1]

[1]Institute of Technical Sciences of SASA, Beograd, Serbia

5DV.2.16

Leveraging Industry Energy Flexibility to Enable Higher Shares of Renewable Energy in the Power System – an Experimental Case Study

Yahya Kenoussi[1], Jesus S. Da Costa Fernandes[1], Edgar Schmitt[1], Rainer Gasper[1], Niklas Hartmann[1], Michael Schmidt[1]

[1]University of Applied Sciences Offenburg, Offenburg, Germany

5DV.2.17

Analysis of the Spatial and Temporal Variability of Solar Radiation and its Use in the Design of Energy Systems

Jannik Langenecker[1], Edgar Schmitt[1], Michael Schmidt[1]

[1]University of Applied Sciences Offenburg, Offenburg, Germany

5DV.2.18

Improving the Modelling of PV Systems in Grid Optimisation Studies by Using Earth Observation and Remote Sensing Data

Jethro Betcke[1], Susanne Weyand[1], Alaa Alhamwi[1], Annekatrin Metz-Marconcini[2], Thomas Krauß[2], Seyedmajid Azimi[2], Marion Schroedter-Homscheidt[1]

[1]DLR- German Aerospace Center, Oldenburg, Germany; [2]DLR- German Aerospace Center, Wessling, Germany

5DV.2.34

CO2 Emissions of Silicon Photovoltaic Modules – Impact of Module Design and Production Location

Christian Reichel[1], Amelie Müller[1], Lorenz Friedrich[1], Sina Herceg[1], Max Mittag[1], Holger Neuhaus[1]

[1]Fraunhofer ISE, Freiburg, Germany

5DV.2.35

About the Recycling of Various Silicon Waste from Photovoltaics

Wolfram Palitzsch[1], Ingo Röver[2]

[1]LuxChemtech, Freiberg, Germany

5DV.2.36

Photovoltaic Waste Management – Review within the Circular Economy

Asmin Aşkın[1], Şiir Kılkış[2], Bulent Gultekin Akinoglu[1]

[1]ODTÜ - GÜNAM, ANKARA, Turkey; [2]Ilmenau University of Technology, ANKARA, Turkey

5DV.2.37

Innovation, Repowering and Sustainability

Ian Marius Peters[1], Jens Hauch[1], Christoph Brabec[1]

[1]Forschungszentrum Jülich, Erlange, Germany

5DV.2.38

Estimating the Lifetime of Solar Photovoltaic Modules in Australia

Verity Tan[1], Pablo Dias[1], Rong Deng[1], Nathan Chang[1]

[1]UNSW, Sydney, Australia

5DV.2.39

Potential and Risk of PV Waste Management in Europe – PHOTORAMA Circular Model

Claire Agraffeil[1], David Pelletier[2], Karsten Wambach[3], Wolfram Palitzsch[4]

[1]CEA, Le Bourget du Lac, France; [2]bifa Environmental Institute, Augsburg, Germany; [3]LuxChemtech, Freiberg, Germany

5DV.2.40

Characterising the Composition of End-of-Life Solar Panel Materials in Australia

Rong Deng[1], Olivia Bowen[1], Pablo Dias[1], Renate Egan[1]

[1]UNSW, Sydney, Australia

5DV.2.41

A Comparative Life-Cycle Assessment of Renewable Energy from High Efficiency Solar Photovoltaic Technologies

Andrea Danelli[1], Elisabetta Brivio[1]

[1]RSE, Milano, Italy

5DV.2.42

Life Cycle Assessment Analysis of Thin-film, Flexible Solar Panels Produced in The Netherlands

Gianluca Limodio[1], Edward Hamers[2], Arno Smets[1]

[1]Delft University of Technology, The Netherlands; [2]HyET Solar The Netherlands, The Netherlands

5DV.2.43

A Literature Overview: Environmental Assessments of CIGS Thin Film Including its End of Life (EoL) Options

Natasha Witto[1], Mirjam Theelen[2], Ando Kuypers[2], Mitchell van der Hulst[3;4], Arjan Kirkels[1], Mara Hauck[1;3]

[1]Eindhoven University of Technology, Eindhoven, The Netherlands; [2]TNO, Eindhoven, The Netherlands; [3]TNO, Utrecht, The Netherlands; [4]Radboud University, Nijmegen, The Netherlands

5DV.2.44

Energy Transition, Solar PV and Circular Economy: Triple Helix Approach to a Second Life for PV Modules in Chile

Maria José Riquelme[1], Nouha Gazbour[2], Denet Soler[1], Edward Fuentealba[1], Delfina Muñoz[2]

[1]University of Antofagasta, Antofagasta, Chile; [2]CEA, Le Bourget-du-Lac, France

5DV.2.45

Carbon Payback Time for Mainstream PV is too Long for an Increasing Number of Countries, already 8 Years for The Netherlands

Michiel Mensink[1]

[1]Energist, 's-Gravenhage, The Netherlands

5DV.2.46

Life-Cycle Global Warming Impact of Photovoltaic Powered Electrolysis and Hydrogen Import from Africa

Olga Kanz[1], Franka Brüggemann[1], Uwe Rau[1], Kaining Ding[1], Karsten Bittkau[1], Angèle Reinders[2;3]

[1]Forschungszentrum Jülich, Jülich, Germany; [2]Technical University of Darmstadt, Eindhoven, The Netherlands; [3]University of Twente, Enschede, The Netherlands

5DV.2.47

Science Dissemination in Photovoltaics? ... a "Game" for Youngsters

Marica (Mariaconcetta) Canino[1], Mirko Seri[1], Armida Torreggiani[1], Simona Binetti[2], Alessia Le Donne[2]

[1]CNR, Bologna, Italy; [2]University of Milano-Bicocca, Milan, Italy

5DV.2.48

Influence of Factory Locations and Supply Chain on the Environmental Impact of Metallurgical Silicon Production for Solar Cells

Jan-Philipp Mai[1], Steffen Blömeke[2], Jianpeng Yang[1], Robar Arafat[2], Juan Felipe Cerdas[2], Christoph Herrmann[2]

[1]JPM Silicon, Braunschweig, Germany; [2]TU Braunschweig, Germany

5DV.2.49

Combining Circularity and Environmental Metrics to Guide Technology Development in PV

Aistis Rapolas Zubas[1], Estelle Gervais[1], Sina Herceg[1], Sebastian Nold[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany

5DV.2.65

Simulation of the Officially Announced Renewable Expansion Plan for Germany - Potential Problems and Opportunities Illustrated in Exemplary Scenario Weeks

Simon Forster[1]

[1]Rosenheim University of Applied Sciences, Rosenheim, Germany

5DV.2.66

Proposal of an Alternative for Developing a Global Grid Able to Provide 100% Renewable Power to the World

Ralf Leutz[1], Ana Rosa Lagunas[2]

[1]TOMATO-GSL, Munich, Germany; [2]Tokyo University of Science , Munich, Germany

5DV.2.67

Economic Optimisation of Supportive and Protective Policy Mechanisms for Promoting Local PV Manufacturing in the Global Market

Mohammad Dehghanimadvar[1], Nathan Chang[1], Renate Egan[1]

[1]UNSW, Sydney, Australia

5DV.2.68

Updates from the AgroFossilFree Project - Strategies and Technologies to Achieve a European Fossil-Energy-Free Agriculture

Chuan Ma[1], Dominik Rutz[1], Veronika Hofmeier[1], Rainer Janssen[1], Athanasios T. Balafoutis[2], Konstantinos Vaiopoulos[2], Claus Aage Grøn Sørensen[3], Dimitris Manolakos[4], Alex Koutsouris[4], George Papadakis[4], Magdalena Borzecka[5], Daan Creupelandt[6], Julio Román[7], Vanja Bisevac[8], Frank Oudshoorn[9], Daniele Rossi[10], Martyna Próchniak[11], Michail D. Kaminiaris[12], Zisis Tsiropoulos[12], Harm Brinks[13], Barry Caslin[14], Jorge Sneij[15], Mirentxu Asín[16]

[1]WIP Renewable Energies, Germany; [2]CERTH, Greece; [3]Aarhus University, Denmark; [4]Agricultural University of Athens, Greece; [5]IUNG, Poland; [6]REScoop, Belgium; [7]ECAF, Belgium; [8]CEMA - European Agricultural Machinery Industry Association, Belgium; [9]Landbrug & Fodevarer, Denmark; [10]Confagricoltura, Italy; [11]Lublin Agricultural Advisory Center in Konskowola, Poland; [12]AGENSO, Greece; [13]DELPHY, The Netherlands; [14]TEAGASC, Ireland; [15]Trama TecnoAmbiental, Spain; [16]Initiativas Innovadoras, Spain

5DV.2.69

PV Will Shine in the New Clean Energy Transition Partnership

Stefan Nowak[1], Marcel Gutschner[1], Michael Hübner[2], Marko Topic[3]

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5DV.2.70

Mobilisation of Financing Resources for Renewable Investments in Africa, India and South America to Reach the 1.5°C Goal

Winfried Hoffmann[1], Heinz-Werner Binzel[2]

[1]ASE, Hanau, Germany; [2]Private, Langenselbold, Germany

5DV.2.71

Multilateral Industrial Research on Solar Energy – the Success Story of INES.2S

Jens Merten[1], Anis Jouini[2], Frédéric Storck[3], Philippe Raffin[4], Caroline Deforeit[5], Stephane Grazi[6], Gilles Duissard[7], Hervé Druon[2], Philippe Galez[8]

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5DV.2.87

Savings by Net-Metering PV in a Spanish Household

Hugo-José Rodríguez San Segundo[1], Nair López[2]

[1]Edhuna Consulting, Madrid, Spain; [2]UAM, Madrid, Spain

5DV.2.88

The Optimal Azimuth and Tilt Angle of BIPV Panels Considering the Prices at Electricity Spot Market

Iva Batic[1]

[1]University of Belgrade, Belgrade, Serbia

5DV.2.89

The Economics of Photovoltaic Performance and Loss Mitigation in Electricity Spot Markets

Leonardo Micheli[1], Marios Theristis[2], Diego L. Talavera[1], Gustavo Nofuentes[1], Joshua S. Stein[2], Florencia Almonacid-Cruz[1], Eduardo F. Fernandez[1]

[1]University of Jaén, Jaén, Spain; [2]Sandia National Laboratories, United States

5DV.2.90

Economic Feasibility Study of Different Configurations of a High-Power Photovoltaic Irrigation System

Rita Hogan Almeida[1], Celena Lorenzo[1], Luis Narvarte[1]

[1]UPM, Madrid, Spain

5DV.2.91

Evaluating the Economic Performance of an Off-Grid Storage-Less Hybrid Energy System Under the Guidance of Different Solar Forecasts

Fuqiang Zhuang[1;2], Rodrigo Amaro e Silva[1], Thomas Carriere[3], Benoit Gschwind[1], Yves-Marie Saint-Drenan[1], Philippe Blanc[1]

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5DV.2.92

Economic Assessment of Small Scale Electrolysis Powered by Decentralized Rooftop PV in Europe

Joeri De Pauw[1], Michael Kleemann[1], Frank Buysschaert[2]

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5DV.2.93

Competitiveness Perspectives for Vertically Integrated Local PV Manufacturing Until 2025

Philippe Macé[1], Elina Bosch[1], Gaëtan Masson[1], Monica Aleman[1], Adrien van Rechem[1], André Penas[1]

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5DV.2.125

In my Backyard Please! Testing a Co-Design Approach to Increase Local Support for a Multifunctional Solar Park

Merel Enserink[1], Rudi Van Etteger[1], Lianne Polinder[2], Floor Govers[2], Marieke Rietbergen[2], Thijs Sepers[3], Ruben Peuchen[4], Koen Straver[4], Leo Van der Knaap[4], Jan De Jong[4], Ilkay Cesar[4]

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5DV.2.126

Smart Strategies for the Transition in Coal Intensive Regions

Rita Mergner[1], Rainer Janssen[1], Dominik Rutz[1], Charalampos Malamatenios[2], Georgia Veziryianni[2], Dirk Knoche[3], Anne Rademacher[3], Rainer Schlepphorst[3], Liliana Fonseca[4], Rona Michie[4], Angel Nikolaev[5], Christian Doczekal[6], Gregory (Greg) Arrowsmith[7], Nicholas de la Vega[7], Gloria Popescu[8], Jasmina Mandic Lukic[9], Igor Volchyn[10], Dmytro Bondzyk[10], Marcin Pietrzykowski[11], Marcin Chodak[12], Lee Guilfoyle[13], Kenn Palmer[13], Jan Frouz[14], Marketa Hendrychova[15], Sabina Irimie[16]

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5DV.2.127

Simple and Smart Communities for All

Rita Mergner[1], Dominik Rutz[1], Rainer Janssen[1], Angela Holzmann[2], Kerstin Schilcher[3], Altan Sahin[3], Natascha Fenz[4], Ulfert Höhne[4], Angel Nikolaev[5], Mariya Trifonova[5], Thekla Heinel[6], Avigdor Burmeister[6], Benjamin Dannemann[7], Nikoloz Sumbadze[8], Eszter Süle[9], Slavica Robić[10], Tijana Šimek[10], Bence Kovacs[11], Krisztina Szabó[12]

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5DV.2.128

Energy Communities-Challenge and an Opportunities for Energy Decentralization and Efficiency. A Comparison of PV Based Case-Studies with Different Control Strategies

Domenico Vito[1]

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5DV.2.129

Spatially Differentiated Assessment of Solar Park Potential in Germany Respecting Environmental, Socio-Technical and Socioeconomic Restrictions

Elham Fakharizadehshirazi[1], Christine Rösch[1]

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5DV.2.130

Net-Metering Regulations and Sustainable Transition to Solar PV Technology – The Missing Behavioral Change in Pakistan

Iftikhar Shahid[1], Kafait Ullah[2], Clark Miller[3], Muhammad Dawood[4]

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5DV.2.131

Italy 2050: a Pathway Towards 100% Renewables

Alessandro Virtuani[1]

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5DV.2.132

How to Make a Solar PV-Based Energy Community Economically Attractive in Belgium?

Philippe Macé[1], Elina Bosch[1], Monica Aleman[1]

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Visual Presentations 3DV.3

13:30- 15:00 PV Module Reliability **Poster Area**

3DV.3.1

Study of Abrasion Resistance of Structured PV Glass

Cristina Leyre Pinto Fuste[1], Jaione Bengoechea[1], Eugenia Zugasti[1]

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3DV.3.2

PV Module Sand Abrasion Testing

Gerhard Mathiak[1], Jim Joseph John[1], Vivian Alberts[1]

[1]DEWA R&D Center, Dubai, United Arab Emirates

3DV.3.3

An Exploratory Study on the Role of Sand Erosion on the Degradation of wet Insulation Resistance of Photovoltaic Backsheets in a Desert-Like Environment

Umang Desai[1], Aparna Singh[1]

[1]IIT Bombay, Mumbai, India

3DV.3.4

Effect of Degradation Factors on Solar Module Encapsulant Materials

Hsin-Hsin Hsieh[1], Sih-Hong Chen[1], Wei-Lun Yang[1], Chiou-Chu Lai[2], Min-Tsung Kuan[2], Yi-Chun Liu[2]

[1]ITRI, Chutung, Taiwan

3DV.3.5

Identification of Backsheet Type of Silicon PV Modules by Fluorescence Patterns of EVA Encapsulant

Oleksandr Stroyuk[1], Cosima Güttler[1], Claudia Buerhop-Lutz[1], Jens Hauch[1], Marius Peters[1]

[1]Forschungszentrum Jülich, Erlangen, Germany

3DV.3.6

Minimizing Crack Propagation in Cracked PV Backsheets with Repair Coatings

Yuliya Voronko[1], Gabriele C. Eder[1], Wolfgang Mühleisen[2], Lukas Neumaier[2], Christian Breitwieser[3], Sonja Feldbacher[4], Gernot Oreski[4]

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3DV.3.7

Pressure Cooker Test on PV Backsheets: Freestanding vs. Module-Aged

Caroline Biedermann[1], Angelika Beinert[1], Daniel Philipp[1], Paul Gebhardt[1]

[1]Fraunhofer ISE, Freiburg im Breisgau, Germany

3DV.3.8

Challenges for Polycarbonate (PC) and Polymethylmethacrylate (PMMA) for the Use as flexible Front-Sheets in Photovoltaic Modules

Sonja Feldbacher[1], Astrid Macher[1], Gernot Oreski[1]

[1]PCCL, Leoben, Austria

3DV.3.9

Determination of Activation Energy for the Degradation of Encapsulant (EVA/TPO) in C-Si Photovoltaic Modules

Maruthi Avula[1], Baloji Adothu[1;2], Krishan Patel[1], Siddharth Singh[1], Sudhanshu Mallick[1]

[1]IIT Bombay, Mumbai, India; [2]DEWA R&D Center, Dubai, United Arab Emirates

3DV.3.10

Properties of Transparent Backsheets Based on Polypropylene

Eric Helfer[1], Astrid Macher[1], Gernot Oreski[1], Margit Lang[1], Peter Fuchs[1]

[1]PCCL, Leoben, Austria

3DV.3.11

The Fast and Quantitative Measurements of Barrier Properties in PV Polymer Films

Anton Mordvinkin[1]

[1]Fraunhofer CSP, Halle (Saale), Germany

3DV.3.12

Compressive Shear Analysis of Encapsulant Glass Laminates - Comparison of EVA, POE and TPO

Martin Tiefenthaler[1], Robert Pugstaller[1], Gernot M. Wallner[1]

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3DV.3.13

Low Temperature Solar Cell Encapsulation with Novel Silicone Elastomer for Building Integrated PV

Guy Beaucarne[1], Mantas Zelba[2], Emmanuel Jadot[3], Jonathan Curon[3], Frédéric Gubbels[3], Valérie Hayez[3], Beatriz Sanabria Arenas[3], Gregory Chambard[3], Rimvydas Karoblis[2]

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3DV.3.14

Influence of Alternating Potential-Induced Degradation and Recovery on CIGS Thin Film Solar Modules

Lukas Gerstenberg[1], Rohith Krishnan Bala Krishnan[1]

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3DV.3.15

A Screening Protocol to Assess the Stability of Inks used to Mask Metallic Interconnects in BIPV Modules

Alejandro Borja Block[1], Alessandro Virtuani[1], Christophe Ballif[1;2]

[1]EPFL, Neuchâtel, Switzerland; [2]CSEM, Neuchâtel, Switzerland

3DV.3.16

Stability Analysis on Shingled High-Efficiency BAPV Modules

Stefan Wendlandt[1], Carolyn Carrière[2], Luis Eduardo Alanis[3], Veronika Nikitina[3], Dirk Reinwand[3]

[1]PI Berlin, Germany; [2]CEA, France; [3]Fraunhofer ISE, Germany

3DV.3.17

Assessment of ECA to Ribbon Interconnection Stability by Current Path and Power Loss Imaging

Stephan Großer[1], Matthias Schak[1], Tudor Timofte[2], Marko Turek[1]

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3DV.3.18

Assessment Approach of Interconnection Aging in Shingled Cell Modules

Stephan Großer[1], Matthias Schak[1], Matthias Pander[1], Marko Turek[1], Bengt Jäckel[1]

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3DV.3.19

Laser-Weld Qualification Methods for Al Foil Interconnection of Back-Contacted Cells to Predict Module Reliability

Barry Hartweg[1], Kathryn Fisher[1], Zhengshan Jason Yu[1], Zachary Holman[1]

[1]Arizona State University, Tempe, AZ, United States

3DV.3.20

Are Glass-Free C-Si Lightweight PV Modules Resistant to Abrasion?

Fabiana Lisco[1], Farwa Bukhari[2], Adam Law[2], Luke Jones[2], Michael Walls[2], Christophe Ballif[1]

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3DV.3.21

FEM Simulation of Influence of Different Polymeric Encapsulation Materials and Backsheets on Deformations in Strings of Shingled Solar Cells under Mechanical and Thermal Loading

Margit Lang[1], Gernot Oreski[1], Peter Fuchs[1], Eric Helfer[1], Andreas Halm[2], Markus Klenk[3]

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3DV.3.22

Study of Hot Spots in Partially Shaded PV Modules with Large-Area Wafers

Haifeng Chu[1], Constantin Klyk[1], Andreas Halm[1], Valentin Dan Mihailetchi[1]

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3DV.3.23

Corrosion Testing of FPV Materials in Off-shore

Myenggil Gang[1], Dong-Chan Kim[1], Seong Dae Kim[1], Hyun-Jun Kim[2], Hyunsik Jo[2], Seungwook Shin[3], Chang-Sub Won[1]

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3DV.3.24

Effect of UV Preconditioning in a Sequential UV/DH Accelerated Test on Commercial P-Si Photovoltaic Encapsulated Cells

Julia Vincent[1;2], Venkata Ramana Posa[1], Ali Khouzam[1;2], Adrien Gomez[1], Fabien Delaleux[1], Olivier Riou[1], Pierre-Olivier Logerais[1]

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3DV.3.25

Thermo-Mechanical Analysis of Si-based PV Modules and Experimental Validation with In-laminate Sensing Technology

Marta Casasola[1;2;3], Philippe Nivelle[1;2;3], Bin Luo[1;2;3;4], Jonathan Govaerts[1;2;3], Rik Van Dyck[1;2;3;4], Tom Borgers[1;2;3], Jozef (Jef) Poortmans[1;2;3;4], Loïc Tous[1;2;3], Michaël Daenen[1;2;3]

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3DV.3.26

Mechanical Characterization of Glass Transparent Backsheet PV Modules via Modelling and Testing Methods

Meriç Çaliskan[1], Güven Korkmaz[1], Bedrettin Aydoğan[1], Fırat Es[1]

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3DV.3.27

Effects of Wind Load on the Mechanics of a PV Power Plant

Pascal Romer[1], Kishan Pethani[1], Andreas J. Beinert[1], Holger Neuhaus[1]

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3DV.3.28

Lead-Free PV Modules: Industrial Realization and Evaluation of Environmental Impact

Paul Gebhardt[1], Timo Wenzel[1], Stephan Hoffmann[1], Lorenz Friedrich[1], Sina Herceg[1], Dilara Maria Subasi[1], Angela De Rose[1], Andreas Lorenz[1], Daniel Philipp[1]

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3DV.3.29

Moisture Protection of Modules Containing Perovskite Solar Cells

Lori Postak[1], Mark Molinaro[1]

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3DV.3.30

Monitoring of Electrical Performance and Material Stability of PV Modules with Repaired/Coated Backsheets

Anika Gassner[1;2], Karl Knöbl[3], Markus Hilweg[4], Christian Breitwieser[5], Norbert Lenck[6], Gabriele C. Eder[1]

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3DV.3.31

Damp Heat induced Degradation of SHJ Glass/Glass Modules with EVA: Insights into Root-causes and Mitigation Strategies

Luca Gnocchi[1], Olatz Arriaga Arruti[1], Alessandro Virtuani[1], Christophe Ballif[1]

[1]EPFL, Lausanne, Switzerland

3DV.3.32

Which Cell Technologies are more Resistant to LETID?

Andrew Fairbrother[1], Alejandro Borja Block[1], Olatz Arriaga Arruti[1], Christophe Ballif[1], Alessandro Virtuani[1]

[1]EPFL, Switzerland

3DV.3.33

Chemical and Morphological Characterization of PVDF Films used for Photovoltaic Backsheets

Chiara Barretta[1], Eric Helfer[1], Astrid Macher[1], Márton Bredács[1], Abdulkerim Gök[2], Gernot Oreski[1]

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3DV.3.34

Experimental Study of Non-uniform Mechanical Loads and Deformation on Photovoltaic Module

Shu-Tsung (Anderson) Hsu[1]

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3DV.3.35

Measuring and Modeling the Rate of Power Loss in N-PERT Cells Associated with PID-P as a Function of Encapsulant Resistivity and Irradiance

Brian Habersberger[1], Peter Hacke[2]

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Visual Presentations 1DV.4

15:15- 16:45 Characterisation & Simulation of solar cells **Poster Area**

1DV.4.1

Characterization of Highly Efficient Silicon-Based Solar Cells with Flat and Textured Surfaces

Anatoly Sachenko[1], Vitaliy P. Kostylyov[1], Viktor M. Vlasiuk[1], Gowsikan Perinparajah[2], Igor O. Sokolovskyi[1], Mykhaylo Evstigneev[3], Anatoli Shkrebtii[2]

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1DV.4.2

A Simulation Study on IBC Solar Cells for Industrial Manufacturing

Gence Bektas[1;2], Selin Seyrek[1;2], Ahmet Emin Keçeci[1;2], Hasan Hüseyin Canar[1;2], Hasan Asav[1;2], Sümeyye Koçak Bütüner[1;2], Emine Hande Ciftpınar[1;2], Rasit Turan[1;2]

[1]ODTÜ - GÜNAM, Turkey; [2]METU, Turkey

1DV.4.3

Development of Measurement Method for Diffusion Capacitance Characterization

Apostolos Bakovasilis[1;2;3;4], Rik Van Dyck[1;2;3;5], Wilmar Martinez[4;6], Jozef (Jef) Poortmans[1;2;3]

[1]IMEC, Genk, Belgium; [2]Hasselt university, Hasselt, Belgium; [3]EnergyVille, Genk, Belgium; [4]KU Leuven , Leuven, Belgium; [5]KU Leuven , Belgium

1DV.4.4

In-depth Exposure of New Phase in Poly-Silicon of TOPCon Device: is Phosphorus Bonded Oxygen Present?

Zhongquan MA[1], Y.L. Wang[1], Z.X. Lan[2]

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1DV.4.5

Characterization of the Dynamic Behavior of Different Solar Cell Technologies for Application in Visible Light Communication

Mirco Muttillo[1], Patrizio Manganiello[1], Olindo Isabella[1]

[1]Delft University of Technology, Delft, The Netherlands

1DV.4.6

Meta-Light Funnel Arrays for Efficient Wideband Solar Light Harvesting for Photovoltaic Applications

Ashish Prajapati[1], Gil Shalev[1]

[1]BGU, Be'er Sheva, Israel

1DV.4.7

Cut out for Efficiency: A Detailed LBIC Study of Edge Recombination in Cut-Cell Silicon Photovoltaics

Miha Kikelj[1], Benjamin Lipovsek[1], Matevz Bokalic[1], Marko Topic[1]

[1]University of Ljubljana, Ljubljana, Slovenia

1DV.4.8

Extraction of Interface States Density Distribution from the Capacitance Spectra of a-Si:H/c-Si Heterojunction Solar Cell

Jagannath Panigrahi[1], Ashutosh Pandey[1], Shrestha Bhattacharya[1], Sourav Mandal[1], Vamsi Krishna Komarala[1]

[1]IIT Delhi, New Delhi, India

1DV.4.9

Analysis of Recombination Behavior of Polycrystalline on Oxide(POLO) Cells by Formation Conditions

Heeyeon Lee[1], Dongjin Choi[1], Changhyun Lee[1], Hoyoung Song[1], Haejung Lee[1], Yoonmook Kang[1], Hae-Seok Lee[1], Donghwan Kim[1]

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1DV.4.10

Characteristics of PEDOT:PSS/Si Solar Cells with a Flat and Textured Interface

Sergii V. Mamykin[1], Iryna B. Mamontova[1], Tetiana Lunko[1], Olga Kondratenko[1], Natalia V. Kotova[1], V.R. Romanyuk[1]

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1DV.4.11

Determination of Contact Resistivity Components of Poly-Si/SiOx Passivated Contacts by Laser Structuring

Jan Lossen[1], Aditya Chaudhary[1], Mertcan Comak[1], Lejo Joseph Koduvelikulathu[1], Jan Hoß[1], Radovan Kopecek[1]

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1DV.4.12

Enabling Understanding of Hydrogen Passivation and Degradation in Topcon via Atom Probe Tomography

Yifu Shi[1], J.-I. Polzin[2], Matthew Wright[1], Sebastian Bonilla[1], Michael Moody[1]

[1]University of Oxford, United Kingdom; [2]Fraunhofer ISE, Germany

1DV.4.13

Iron Quantification in Crystalline Silicon Solar Cells from Voc Measurements

Axel Herguth[1]

[1]University of Konstanz, Konstanz, Germany

1DV.4.29

Characterization of the Damaging Potential of High Throughput Cell Manufacturing Processes by Sensitive Strength Analysis

Ringo Koepge[1], Stephan Großer[1]

[1]Fraunhofer IMWS, Halle, Germany

1DV.4.30

Investigation of the Front Side Anti-Reflection Coating Layer on M10 PERC Solar Cells

Cheng-Wen Kuo[1], Ta-Ming Kuan[1], Yung-Chih LI[1], Wei-Lo (Chris) Chueh[1], LI-Guo Wu[1], Shih-Chieh Lin[1], Cheng-Yeh Yu[1]

[1], Hsinchu, Taiwan

1DV.4.31

Different Behaviors of LETID in the M6/M10 PERC Silicon Solar Cells

Min-An Tsai[1], Cheng-Wen Kuo[2], Yean-San Long[1], Cho Fan Hsieh[1], Ta-Ming Kuan[3], Cheng-Yeh Yu[2], Teng-Chun Wu[1]

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1DV.4.32

Low-area Laser-doped Selective Contacting Scheme for Industrial Solar Cells

Yuchao Zhang[1], LI Wang[1], Ran Chen[1], Catherine Chan[1], Brett Hallam[1]

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1DV.4.33

Transitioning to Higher Emitter Sheet Resistance for PERC Solar Cell Production

Mehul Raval[1], Mehmet Siddik Memetemin[2], Guru Prasad A[3], Mehmet Ender[2], Peter Fath[1]

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1DV.4.34

Influence of Metallization Screen Parameters on Silver Paste Consumption Reduction for Commercial Mono PERC Solar Cell Production

Emircan Han[1;2], Mehul Raval[3], Fatma Çambay Kuban[1], Sandeep Chandrill[3], Mehmet Ender[1], Fırat Es[1], Peter Fath[3], Ahmet Aktas[2], Serhat Karyeyen[2]

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1DV.4.35

Observation on Etching Chemicals Performance with Time by an Industrial Single Side Etching (SSE) Tool

Sümeyye Koçak Bütüner[1], Ahmet Emin Keçeci[1;2], Hasan Hüseyin Canar[1;2], Hasan Asav[1;2], Gence Bektas[1;2], Bülent Arikan[1], Rasit Turan[1;2]

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1DV.4.36

Every Cell needs a Beautiful Image: On-The-Fly Contacting Measurements for High-Throughput Production

Leslie Kurumundayil[1], Klaus Ramspeck[2], Stefan Rein[1], Matthias Demant[1]

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1DV.4.37

Overview of Wet-Chemical Solutions for Industrial Solar Cells with Efficiencies beyond 23%

Damian Brunner[1], Sufan Xu[1], Weiwei Xie[1], Iron Wang[1], Caroline Scheiwe[1], Tobias Dannenberg[1], Tjark Harders[1], Jan Temmler[1], Mathias Kamp[1], Holger Kühnlein[1], Michael Passig[1], Martin Pretscher[1], Alexis Pediaditakis[1], Markus Sieber[1], Bendikt Straub[1]

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1DV.4.38

Mass Production Vacuum Deposition Equipment for Silicon-Perovskite Tandem Solar Cells

Simon Hübner[1], Torsten Dippell[1], Cheng Xuemei[1]

[1]SINGULUS TECHNOLOGIES, Kahl am Main, Germany

1DV.4.39

Effect of Adding a Second Immiscible Liquid on the Slip and Printing Behavior of Solar Cell Frontside Metallization Pastes

Max Ailinger[1], Karim Abdel Aal[1], Norbert Willenbacher[1]

[1]Karlsruhe Institute of Technology - KIT, Karlsruhe, Germany

1DV.4.40

Single Sided High Throughput Sputter Process Technology for In-Situ Doped n-Type Amorphous Silicon Layers for High Efficiency TOPCon Solar Cells

Eric Schneiderlöchner[1], Uwe Graupner[1], Volker Linss[1], Tina Dietsch[1], Jens Baumann[1], Jan Hoß[2], Jonathan Linke[2], J.-I. Polzin[3], Henning Nagel[3], Martin Bivour[3], Sebastian Mack[3], Jan Lossen[2]

[1], Dresden, Germany; [2], Konstanz, Germany; [3], Freiburg im Breisgau, Germany

1DV.4.41

Processing Response of Air Fired Copper Pastes Printed on Crystaline Silicon PERC Solar Cells

Thad Druffel[1], Ruvini Dharmadasa[1], Krishnamraju Ankireddy[1], Kevin Elmer[1], Apolo Nambo[1], Sandra Huneycutt[2], Abasifreke Ebong[2]

[1]Bert Thin Films, Louisville, United States; [2]University of North Carolina Charlotte, Charlotte, United States

1DV.4.42

Oxygen Related Recombination Centers Induced by RPD ITO Deposition Process in CSC Solar Cells

Toimohiko Hara[1], Iori Oura[1], Yoshio Ohshita[1]

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1DV.4.43

Industrially Feasible Cu-Based Paste for Crystalline Silicon Solar Cells via High-Temperature Contact Formation

Dongjin Choi[1], Soohyun Bae[2], Myeongseob Sim[3], Hyunjung Park[3], Donghwan Kim[3], Yoonmook Kang[3], Hae-Seok Lee[3]

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1DV.4.44

Industrially Feasible Mace Textured PERC Solar Cell Exceeding 20% Conversion Efficiency

Hasan Asav[1;2], Ahmet Emin Keçeci[1;2], Sümeyye Koçak Bütüner[1], Hasan Hüseyin Canar[1;2], Gence Bektas[1;2], Samim Gök[4], Bülent Arikan[1], Rasit Turan[1;2]

[1]ODTÜ - GÜNAM, Turkey; [2]METU, Turkey; [3]Parla Solar, Turkey

1DV.4.45

Fine-Line Screen Printing Enables PERC Front-Side Metallization with only 20mg Silver Laydown

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1DV.4.46

Optimization of Electrical LID Regeneration for PERC Solar Cell Production

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1DV.4.47

Damage-free Laser Patterned Process Route for Cu-Electroplated Contacts on SHJ Solar Cells

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1DV.4.48

Enhancing the Durability of a Solar Cell Screen-Printable Gridlines Through the Addition of Surface-Engineered Carbon Nanotubes (CNTs) to a Commercial Front AG Paste

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1DV.4.49

Model for Contact Formation of Novel TeO2 Containing Pb-Free Silver Paste on n+ and p+ Doped Crystalline Silicon

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1DV.4.50

Why Silver Must be Replaced by Plated Copper for Solar Cells Metallization?

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1DV.4.51

Evaluation of Innovative Glass-Based Printing Forms for Fine Line Metallization Using Stencil Printing and Parallel Dispensing

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