

SYMPOSIUM ES1

Perovskite Solar Cells—Towards Commercialization
April 17 - April 21, 2017

Symposium Organizers

Wei Huang, Nanjing Tech University
Nam-Gyu Park, Sungkyunkwan University
Yabing Qi, Okinawa Institute of Science and Technology
Graduate University
Kai Zhu, National Renewable Energy Laboratory

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Proceedings Statement

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* Invited Paper

SESSION ES1.1: Commercialization, Synthesis, Large Area and Modules
Session Chairs: David Cahen and Yabing Qi
Monday Morning, April 17, 2017
PCC North, 200 Level, Room 224 B

8:00 AM ES1.1.01

Solid-State Ligand-Exchange Fabrication of $\text{CH}_3\text{NH}_3\text{PbI}_3$ Capped PbS Quantum Dot Solar Cells [Ziqi Liang](#); Fudan University, China.

8:15 AM ES1.1.02

Inverted Lead Acetate-Based Perovskite Solar Cells Exceeding 19% Efficiency through Crystallization Optimization and Interfacial Engineering [Baomin Xu](#); South University of Science and Technology of China, China.

8:30 AM *ES1.1.03

(How) Can Halide Perovskites Impact PV [David Cahen](#); Weizmann Inst of Science, Israel.

9:00 AM *ES1.1.04

Advanced Materials and Process for Facilitating Commercialization of Perovskite Solar Cells [Hyun Suk Jung](#); Sungkyunkwan Univ, Korea (the Republic of).

9:30 AM ES1.1.05

In Situ Methylammonium Lead Halide Perovskite Growth—A Novel Approach for Solar Energy Technology [Muge Acik](#); Argonne National Laboratory, United States.

9:45 AM BREAK

10:15 AM *ES1.1.06

Efficient and Stable Perovskite Solar Cells and Modules [Liyuan Han](#); NIMS, Japan.

10:45 AM *ES1.1.07

Fully Evaporated High Efficiency Perovskite Based Solar Cells [Michele Sessolo](#); University of Valencia, Spain.

11:15 AM ES1.1.08

Ligand-Facilitated Formation of Perovskite at Room Temperature—A Guideline from Theoretical and Experimental Study [Wallace C. Choy](#); University of Hong Kong, China.

11:30 AM ES1.1.09

Hybrid Perovskite Thin Film Formation—An In Situ Investigation of Solvent Engineering and Its Implication on Microstructural and Morphological Control [Rahim Munir](#); King Abdullah University of Science and Technology, Saudi Arabia.

11:45 AM ES1.1.10

All Laser Scribed Perovskite Solar Mini-Modules [Stefano Pisoni](#); EMPA, Switzerland.

SESSION ES1.2: Device Stability, Electron and Hole Transport Layers
Session Chairs: Liyuan Han and Hyun Suk Jung
Monday Afternoon, April 17, 2017
PCC North, 200 Level, Room 224 B

1:30 PM *ES1.2.01

Lead Halide and Lead-Free Perovskite Solar Cells by Metal Oxide-Based Low Temperature Processes [Tsutomu Miyasaka](#); Toin University of Yokohama, Japan.

2:00 PM ES1.2.02

Defective TiO_2 with High Photoconductive Gain for Efficient and Stable Planar Heterojunction Perovskite Solar Cells [Yanbo Li](#)^{1,2}; ¹University of Electronic Science and Technology of China, China; ²Lawrence Berkeley National Lab, United States.

2:15 PM ES1.2.03

Roles of Hole Transport Layer Additives in Perovskite Solar Cell [Shen Wang](#); University of California, San Diego, United States.

2:30 PM ES1.2.04

Accelerated Stability Testing of Perovskite Photovoltaic Materials Reveals Dependence on the Halide Composition and Synthesis Details [Iris Visoly-Fisher](#)^{1,2}; ¹Ben-Gurion University of the Negev, Israel; ²Ben-Gurion University of the Negev, Israel.

2:45 PM ES1.2.05

Thermal Degradation of $\text{CH}_3\text{NH}_3\text{PbI}_3$ Perovskite into NH_3 and CH_3I Gases Observed by Coupled Thermogravimetry–Mass Spectrometry Analysis [Emilio J. Juarez-Perez](#); Okinawa Institute of Science and Technology Graduate University (OIST), Japan.

3:00 PM BREAK

3:30 PM *ES1.2.06

Issues on Efficiency and Stability of Perovskite Solar Cells [Shihe Yang](#); Hong Kong University of Science and Technology, Hong Kong.

4:00 PM ES1.2.07

Performance Enhancement of Perovskite Solar Cells with SnO_2 Electron Transport Layer [Guojia Fang](#); Wuhan University, China.

4:15 PM ES1.2.08

Extraordinary Stability of Bromide Based Perovskite Solar Cells Yielding Photovoltage above 1.5 V [M Ibrahim Dar](#); Ecole Polytechnique Federale de Lausanne, Switzerland.

4:30 PM ES1.2.09

Dense Silica Barrier Films for Improved Efficiency and Stability of Perovskite Solar Cells Deposited in Ambient Air [Nicholas Rolston](#); Stanford University, United States.

4:45 PM ES1.2.10

Self-Encapsulating Air-Resilient Semitransparent Perovskite Solar Cells with Superior Thermal Stability beyond 2000 h [Kai O. Brinkmann](#); Bergische Universität Wuppertal, Germany.

SESSION ES1.3: Micro-Structure, Defects and Traps

Session Chair: Nam-Gyu Park
Tuesday Morning, April 18, 2017
PCC North, 200 Level, Room 224 B

SESSION ES1.5: Poster Session I
Session Chairs: Kenjiro Miyano and Yixin Zhao
Tuesday Afternoon, April 18, 2017
8:00 PM - 10:00 PM
Sheraton, Third Level, Phoenix Ballroom

10:30 AM *ES1.3.01

How Much Do We Know about Perovskite [Jinsong Huang](#); University of Nebraska–Lincoln, United States.

11:00 AM *ES1.3.02

Spiro-MeOTAD Hole Transport Layer in Perovskite-Based Solar Cells [Luis K. Ono](#); Okinawa Institute of Science and Technology, Japan.

11:30 AM *ES1.3.03

Controlling Surface Trap Density in Hybrid Perovskite Single Crystals and Thin Films [Maria Antonietta Loi](#); University of Groningen, Netherlands.

SESSION ES1.4: Characterization, Interface and Modeling

Session Chairs: Jinsong Huang and Shihe Yang
Tuesday Afternoon, April 18, 2017
PCC North, 200 Level, Room 224 B

1:30 PM *ES1.4.01

Interface and Intermediate Phases Engineering for Achieving Efficient Perovskite Solar Cells [Yang Yang](#); University of California, Los Angeles, United States.

2:00 PM *ES1.4.02

Electronic Characterizations of Perovskite PVs and Their Interpretation via Numerical Simulations [Kenjiro Miyano](#); NIMS, Japan.

2:30 PM ES1.4.03

Electronic Structure of the Interfaces between the Perovskite Absorber Layer and the Surrounding Transport Layers in Perovskite Solar Cells [Carolin Wittich](#); Technische Universität Darmstadt, Germany.

2:45 PM ES1.4.04

Highly Efficient Perovskite Modules Resulted from Improved Perovskite Layer Formation and Interface Engineering [Weiming Qiu](#); imec, Belgium.

3:00 PM BREAK

3:30 PM ES1.4.05

Measuring Defect Tolerance and Electronic Structure in Hybrid Perovskite Solar Cell Materials [Joseph J. Berry](#); National Renewable Energy Laboratory, United States.

3:45 PM ES1.4.06

Dopable Extracting Layers as a Strategy to Stabilize Interfacial Charge Accumulation and Defect States in Perovskite Solar Cells [Vijay Venugopalan](#)^{1,2}; ¹Italian Inst of Technology, Italy; ²Politecnico di Milano, Italy.

4:00 PM *ES1.4.07

Charge Transport and Junction Nature of the Perovskite Solar Cell [Qingbo Meng](#); Chinese Academy of Sciences, China.

4:30 PM ES1.4.08

Impact of the Interface Charge-Injection on CH₃NH₃PbI₃ Perovskite Solar Cell Performance Investigated by Time-Resolved Photoluminescence and Photocurrent Measurements [Taketo Handa](#); Kyoto University, Japan.

4:45 PM ES1.4.09

Computational I-V Curve of Perovskite Solar Cell with Surface Boundary Induced Capacitance [Satoshi Uchida](#); The University of Tokyo, Japan.

ES1.5.01

Photonic Curing of Inkjet Printed TiO₂ Films for Perovskite Solar Cells [Briley Bourgeois](#); Tulane University, United States.

ES1.5.02

Towards Flexible NiO_x-Based Perovskite Solar Cells [Xingtian Yin](#); Xi'an Jiaotong University, China.

ES1.5.03

Large Size Planar Perovskite Solar Cells Produced from Porous PbI₂(NMP) Complexes [Yimhyun Jo](#); Korea Institute of Energy Research, Korea (the Republic of).

ES1.5.04

Controlling Perovskite Crystal Growth by Thermal Gradient [Karsten Bruening](#)^{2,1}; ¹Stanford University, United States; ²SLAC National Accelerator Laboratory, United States.

ES1.5.05

New Concepts in Reinforced, Segmented Perovskite Solar Cell Design with Polymer Scaffolding [Adam Printz](#); Stanford University, United States.

ES1.5.06

High Efficient Flexible Perovskite Solar Cells Based on Indium-Free Solution-Processed Silver Nanowire Composite Transparent Electrode [Eunsong Lee](#); Yonsei University, Korea (the Republic of).

ES1.5.07

Extent of Methylammonium Lead Iodide Hydration by Atmosphere in Full Devices [Genevieve Hall](#); Arizona State University, United States.

ES1.5.08

Modeling the Growth Mechanism and Morphology of Solution-Processed Monolayers on Perovskite Surfaces for Solar Cell Applications [Aniruddha Dive](#); Washington State University, United States.

ES1.5.09

A Pure and Stable Intermediate Phase is Key to Growing Aligned and Vertically Monolithic Perovskite Crystals for Efficient PIN Planar Perovskite Solar Cells with High Processibility and Stability [Yang Bai](#); Hong Kong University of Science and Technology, Hong Kong.

ES1.5.10

Unveiling a Key Intermediate in Solvent Vapor Post-Annealing to Enlarge Crystalline Domains of Organometal Halide Perovskite Films [Shuang Xiao](#); The Hong Kong University of Science and Technology, China.

ES1.5.11

Risky Business? The Future of Perovskite Solar Cells Market in China [Jie Liu](#); Institute of Chemistry, Chinese Academy of Science, China.

ES1.5.12

Triple-Cation Mixed-Halide Perovskites—Fabrication of Efficient, Annealing-Free, Air-Stable Solar Cells Enabled by Pb(SCN)₂ Additive [Ziqi Liang](#); Fudan University, China.

ES1.5.13

Soft-Cover Deposition of Scaling-Up Uniform Perovskite Thin Films for High Cost-Performance Solar Cells [Chen Han](#); Shanghai Jiaotong University, China.

ES1.5.14

Selective Dissolution of Halide Perovskites as a Step towards Cost-Efficient Recycling Solar Cells [Dongho Kim](#); National Renewable Energy Laboratory, United States.

ES1.5.15

Loading Dependent Electrical Properties of Novel Hybrid Perovskite/Polymer Composite [John P. Murphy](#)^{1,2}; ¹Montana Tech of the University of Montana, United States; ²Montana Tech Nanotechnology Laboratory, United States.

ES1.5.16

Fabrication of Formamidinium Lead Bromide Perovskite Solar Cells Yielding High Open-Circuit Voltage Using New Hole-Transporting Materials [Neha Arora](#); Ecole Polytechnique Federale de Lausanne, Switzerland.

ES1.5.17

Degradation of MAPbI₃—What We Know/What We Don't Know [Angus I. Kingon](#); Brown University, United States.

ES1.5.18

Environmental-Friendly Design of Perovskite Solar Cells—Cooperation between Environmental and Materials Sciences [Carolin Wittich](#); Technische Universität Darmstadt, Germany.

ES1.5.19

Optical Annealing for Improved Photostability of Mixed Halide Perovskites [Wenhao Li](#); Brown University, United States.

ES1.5.20

A New Criteria Helping in Finding Novel Stable Hybrid Halide Perovskites [Chao Zheng](#); McMaster University, Canada.

ES1.5.21

Poly(Methyl Methacrylate) Based Composite Encapsulation for Long-Term Stable Perovskite Solar Cells in Humid Condition [Gill Sang Han](#); University of Pittsburgh, United States.

ES1.5.22

A Surface-Modification Strategy to Prepare Efficient and Stable Perovskite Solar Cells in Ambient Air [Chang Liu](#); South University of Science and Technology, China.

ES1.5.23

Athmospherically Processed and Stable Cs-Pb and Cs-Sn Based Perovskite Solar Cells [Shubhra Bansal](#); University of Nevada, Las Vegas, United States.

ES1.5.24

The Detrimental Effect of Excess Mobile Ions in Planar CH₃NH₃PbI₃ Perovskite Solar Cells [Yuanhang Cheng](#); City University of Hong Kong, Hong Kong.

ES1.5.25

Investigation of Chemical Structure and Physical Properties of Organic-Inorganic Metal Halide Materials for Solid State Solar Cells [Majid Safdari](#); Royal Institute of Technology, Sweden.

ES1.5.26

Light-Induced Degradation of Methylammonium and Formamidinium Lead Iodide Perovskites [Norbert H. Nickel](#); Helmholtz Zentrum Berlin für Materialien und Energie GmbH, Germany.

ES1.5.27

Correlations of Optical Absorption, Charge Trapping and Surface Roughness of TiO₂ Photoanode Layer Loaded with Neat Ag-NPs for Efficient Perovskite Solar Cells [Sung Hyun Kim](#); Wonkwang University, Korea (the Republic of).

SESSION ES1.6: Tandem, Mixed Perovskites, Transistor and Carbon Materials

Session Chairs: Shuzi Hayase and Kai Zhu
Wednesday Morning, April 19, 2017
PCC North, 200 Level, Room 224 B

8:00 AM ES1.6.01

Cu₂O/Al:ZnO as a Tunneling Junction for Perovskite/Si Tandem Solar Cells [Pravakar Rajbhandari](#); Binghamton University, United States.

8:15 AM ES1.6.02

Robust Recombination Contacts for Perovskite on p-Type Silicon Tandem Solar Cells [Ian Marius Peters](#); Massachusetts Institute of Technology, United States.

8:30 AM *ES1.6.03

Opportunities and Challenges of Mixed Sn-Pb Perovskite Solar Cells [Yanfa Yan](#); University of Toledo, United States.

9:00 AM *ES1.6.04

Compositional and Non-Uniformity Requirements for Commercial Scale Silicon Perovskite Tandem Solar Cells [Christopher Case](#)^{1,2}; ¹Oxford PV, United Kingdom; ²University of Oxford, United Kingdom.

9:30 AM ES1.6.05

23.6%-Efficient Monolithic Perovskite/Silicon Tandem Solar Cells with Improved Stability [Kevin Bush](#); Stanford University, United States.

9:45 AM BREAK**10:15 AM *ES1.6.06**

Halide Ion Migration and Charge Carrier Recombination in Mixed Halide Perovskite Films [Prashant Kamat](#); University of Notre Dame, United States.

10:45 AM ES1.6.07

Liquid Water- and Heat-Resistant Hybrid Perovskite PV via an Inverted ALD Oxide Design [Alex Martinson](#); Argonne National Laboratory, United States.

11:00 AM ES1.6.08

Advances in Stacked Cu(In,Ga)Se₂-Perovskite Tandem Solar Cells [Erik Ahlswede](#); ZSW, Germany.

11:15 AM ES1.6.09

Perovskites with Band Gaps Approaching 1.2 eV to Enable Perovskite-Perovskite Tandem Solar Cells [Tomas Leijtens](#); Stanford University, United States.

11:30 AM ES1.6.10

Enhanced Charge Carrier Extraction in Hybrid Organic Metal Halide Perovskite Solar Cells Using Carbon Nanotube Interlayers [Philip Schulz](#); National Renewable Energy Laboratory, United States.

11:45 AM ES1.6.11

Perovskite Solar Cells Based on Mesoscopic Carbon-Electrode Attaining Efficiency 15% with One Step Slow Crystallization Method [Cheng-Min Tsai](#); National Chiao Tung University, Taiwan.

SESSION ES1.7: LED, Luminescence and Photophysics

Session Chairs: Tsutomu Miyasaka and Yanfa Yan
Wednesday Afternoon, April 19, 2017
PCC North, 200 Level, Room 224 B

1:30 PM *ES1.7.01

Luminescent Low Dimensional Organometal Halide Perovskites [Biwu Ma](#)^{1,2,3}; ¹FAMU-FSU College of Engineering, United States; ²Florida State University, United States; ³Florida State University, United States.

2:00 PM ES1.7.02

Excitonic Optical Responses of CH₃NH₃PbCl₃ Single Crystals Revealed by Multi-Photon Excitation Spectroscopy [Takumi Yamada](#); Kyoto University, Japan.

2:15 PM ES1.7.03

Electrical Stress Improves the Efficiency of CH₃NH₃PbI₃ Perovskite Light Emitting Devices [Lianfeng Zhao](#); Princeton University, United States.

2:30 PM BREAK**3:30 PM *ES1.7.04**

NiO Electrode Interlayer and Methylamine/Perovskite Gas-Solid Treatment to Markedly Advance Hybrid Perovskite-Based Light-Emitting Diodes [Tzung-Fang Guo](#); National Cheng Kung Univ, Taiwan.

4:00 PM ES1.7.05

High-Performance Inorganic CsPbBr₃ Perovskite Light-Emitting Diodes by Dual Source Vapor Deposition [Sihan Xie](#); Massachusetts Institute of Technology, United States.

4:15 PM ES1.7.06

Quantitative Correlation of Perovskite Film Morphology to Light Emitting Diodes Efficiency Parameters [Dinesh Kabra](#); IIT Bombay, India.

4:30 PM ES1.7.07

Liquid-Like Screening in Hybrid Perovskites—A Hierarchical Charge Protection Mechanism [Kiyoshi Miyata](#); Columbia University, United States.

SESSION ES1.8: Poster Session II

Session Chair: Ziqi Liang

Wednesday Afternoon, April 19, 2017

8:00 PM - 10:00 PM

Sheraton, Third Level, Phoenix Ballroom

ES1.8.01

Ferroelasticity in MAPbI₃ [Tao Li](#); University of Nebraska–Lincoln, United States.

ES1.8.02

Mobility-Lifetime Products in MAPbI₃ Films [David Cahen](#); Weizmann Inst of Science, Israel.

ES1.8.03

Entropy-Driven Structural Transition and Kinetic Trapping in Formamidinium Lead Iodide Perovskite [Tianran Chen](#); University of Virginia, United States.

ES1.8.04

Influence of Ferroelectric Polarization on Photo-Conversion Efficiency of Hybrid Perovskite Absorber Solar Cells [Hye Ri Jung](#); Ewha Womans University, Korea (the Republic of).

ES1.8.05

Alkali Metal Halide Salts as Interface Additives to Fabricate Hysteresis-Free Hybrid Perovskite-Based Photovoltaic Devices [Lili Wang](#); Michigan State University, United States.

ES1.8.06

Free Excitons and Exciton-Phonon Couplings in Orthorhombic-Phase CH₃NH₃PbI₃ Single Crystals [Yoshihiko Kanemitsu](#); Institute for Chemical Research, Kyoto University, Japan.

ES1.8.07

Origin of Hysteresis in CH₃NH₃PbI₃ Perovskite Materials [Hyunjung Shin](#); Sungkyunkwan University (SKKU), Korea (the Republic of).

ES1.8.08

Photoluminescence Hysteresis in Organometal Halide Perovskite Solar Cells [Zhihua Xu](#); University of Minnesota, United States.

ES1.8.09

Understanding How Nanoscale Variations in Halide Stoichiometry Determine Charge Collection in Mixed-Halide Hybrid Perovskite Solar Cells [Yanqi Luo](#); University of California, San Diego, United States.

ES1.8.10

First-Principles Design of New Electrode Materials in CH₃NH₃PbI₃ Solar Cells [Mao-hua Du](#); Oak Ridge National Laboratory, United States.

ES1.8.11

The Effect of Liq Layer on Inverted Perovskite Solar Cells—Working Mechanism and Stability Analysis [Hyunho Lee](#); Seoul National University, Korea (the Republic of).

ES1.8.12

Interplay between Static vs Dynamic Disorder and Its Influence on Electronic Properties of Hybrid Perovskite Semiconductor CH₃NH₃PbI₃ [Dinesh Kabra](#); IIT Bombay, India.

ES1.8.13

Textured Perovskite Cells [Joop van Deelen](#); TNO, Netherlands.

ES1.8.14

Structural Investigation of Hybrid Perovskite CH₃NH₃PbI_{3-x}Br_x Solid Solution [Frederike Lehmann](#); Helmholtz-Zentrum Berlin für Materialien und Energie, Germany.

ES1.8.15

Crystallographic Texture Control in Hybrid Organic-Inorganic Perovskite Thin Films [Min Chen](#); Brown University, United States.

ES1.8.16

BaTiO₃ Nanoparticles Embedded CH₃NH₃PbI_{3-x}Cl_x Perovskite Solar Cells with Enhanced Open-Circuit Voltage [Sarath Witanachchi](#); University of South Florida, United States.

ES1.8.17

Geometrically Designing Stable Dopant Environments in Perovskite Photovoltaics [Nicole C. Onishi](#); Western Washington University, United States.

ES1.8.18

Thin-Film ‘Metamorphosis’ Behavior in Hybrid Halide Perovskites for High-Performance Solar Cells [Yingxia Zong](#); Brown University, United States.

ES1.8.19

Fundamental Mechanisms Leading to Nucleation and Growth in the Solution Processing of Hybrid Organic Inorganic Perovskites [Blair A. Sorenson](#); Cornell University, United States.

ES1.8.20

Laser Crystallization of Organic-Inorganic Hybrid Perovskite Solar Cells [Jisun Yoon](#); Korea Advanced Institute of Science and Technology, Korea (the Republic of).

ES1.8.21

Interface Modification by Simple Organic Salts Improves Performance of Planar Perovskite Solar Cells [Raja B. Siram](#); Weizmann Institute of Science, Israel.

ES1.8.22

Reflection-Absorption Infrared Spectroscopic Study of Perovskite Bulk and Interlayer Modification [Leo Hamerlynck](#); University of Arizona, United States.

ES1.8.23

Correlating Microscale Luminescent and Photovoltaic Heterogeneity in Perovskite Solar Cells [Giles Eperon](#); University of Washington, United Kingdom.

ES1.8.24

Predicting the Morphology of Perovskite Thin Films via Crystal Growth Dynamic Studies of Sequential Deposition Method [Hyomin Ko](#); Pohang University of Science and Technology (POSTECH), Korea (the Republic of).

ES1.8.25

Enhanced Performance of Perovskite Solar Cells by Employing Plasmonic Au@SiO₂ Core-Shell Nanoparticles [Siva Chandra Sekhar Pakanati](#); Indian Institute of Technology Delhi, India, India.

ES1.8.26

Impact on Optoelectronic Properties and Device Performance of Perovskite Devices Prepared via Annealing in MACI Vapor [Dhruba B. Khadka](#); National Institute of Material Science (NIMS), Japan.

ES1.8.27

Understanding the Role of Halide on the Formation of Mixed Halide and Performance in Lead Halide Solar Cells [Md Abdul Kuddus Sheikh](#); Kookmin University, Korea (the Republic of).

ES1.8.28

Kinetic Monte Carlo Modeling on Organic Solar Cells—Domain Size, Donor-Acceptor Ratio and Thickness [Qiuan Qiao](#); South Dakota State University, United States.

SESSION ES1.9: Structure, Pb-Free, New Materials, Low Dimensional and Transistor

Session Chair: Wei Huang
Thursday Morning, April 20, 2017
PCC North, 200 Level, Room 224 B

8:00 AM ES1.9.01

Amino Acid Crosslinked 2D/3D Perovskite and Ion Exchange Induced 2D-3D Perovskite Conversion Yixin Zhao; Shanghai Jiao Tong University, China.

8:15 AM ES1.9.02

Effect of Perovskite Precursor Solutions on Structure and Properties of PEDOT:PSS and Photovoltaic Performance of Planar Perovskite Solar Cells Jianyong Ouyang; National University of Singapore, Singapore.

8:30 AM *ES1.9.03

Enhancement of Efficiency for Sn-Perovskite Solar Cell from View Point of Hetero-Interface Structure Shuzi Hayase; Kyushu Inst of Technology, Japan.

9:00 AM *ES1.9.04

Development of New Materials for Highly Efficient Perovskite Solar Cells Tingli Ma^{1,2}; ¹Dalian University of Technology, China; ²Kyushu Institute of Technology, Japan.

9:30 AM ES1.9.05

Understanding Field Effect Charge Transport in Room Temperature Operating Lead Halide Perovskite Transistors Satyaprasad P. Senanayak; University of Cambridge, United Kingdom.

9:45 AM BREAK

SESSION ES1.10: Structure, Materials Properties and Low Dimensional

Session Chair: Tingli Ma
Thursday Morning, April 20, 2017
PCC North, 200 Level, Room 224 B

10:15 AM *ES1.10.01

The Key Role of Materials Science in the Advancement of Halide-Perovskite Solar Cells Nitin P. Padture; Brown University, United States.

10:45 AM *ES1.10.02

The Synthesis of Multi-Dimensional Perovskite Crystals and Device Fabrication Huanping Zhou; Peking University, China.

11:15 AM ES1.10.03

Metal to Halide Perovskite, HaP—A Novel Road to HaP Coating Directly from Pb⁽⁰⁾ or Sn⁽⁰⁾ Films Yevgeny Rakita; Weizmann Institute of Science, Israel.

11:30 AM ES1.10.04

Understanding Film Formation Morphology and Orientation in High Member 2D Ruddlesden-Popper Perovskites for High-Efficiency Solar Cells Chan Myae Myae Soe^{1,2}; ¹Northwestern University, United States; ²Los Alamos National Laboratory, United States.

11:45 AM ES1.10.05

Investigation on the Properties of Hybrid CH₃NH₃Sn_{1-x}I₃ (0.9 ≤ x ≤ 1.4) Perovskite Systems Lucangelo Dimesso; Technische Universitaet Darmstadt, Materials Science Dept., Germany.

SESSION ES1.11: Traps, Device Stability, Electron and Hole Transport Layers

Session Chair: Michele Sessolo
Thursday Afternoon, April 20, 2017
PCC North, 200 Level, Room 224 B

1:30 PM *ES1.11.01

Interaction between Halide Perovskite and Other Materials—A Chance to Tailor the Properties and to Boost Performance Ivan Mora-Sero; University Jaume I, Spain.

2:00 PM *ES1.11.02

Understanding Defect Physics in Metal-Halide Perovskites for Optimizing Optoelectronic Devices Annamaria Petrozza; Istituto Italiano di Tecnologia, Italy.

2:30 PM ES1.11.03

Probing Degradation in Perovskite Solar Cells and Progress towards Demonstrating Sufficient Stability Rongrong Cheacharoen; Stanford University, United States.

2:45 PM ES1.11.04

Trap-Limited Charge Transport in MAPbI₃ Solar Cells with Tunability in Trap Concentration Yuan Zhang; Beihang University, China.

3:00 PM BREAK

SESSION ES1.12: Ion Migration, Phase Transition and Hysteresis

Session Chair: Philip Schulz
Thursday Afternoon, April 20, 2017
PCC North, 200 Level, Room 224 B

3:30 PM ES1.12.01

The Impact of Ion Migration on the Stability of Perovskite Solar Cells Antonio Abate; Helmholtz-Zentrum, Germany.

3:45 PM ES1.12.02

Highly Efficient and Stable Perovskite Solar Cells via Suppression of Iodide Ions Migration Jiangzhao Chen; Sungkyunkwan University, Korea (the Republic of).

4:00 PM ES1.12.03

Understanding the Relationship between Ion Migration and the Anomalous Hysteresis in High-Efficiency Perovskite Solar Cells—A Fresh Perspective from Halide Substitution Teng Zhang; The Hong Kong University of Science and Technology, Hong Kong.

4:15 PM ES1.12.04

Monitoring the Cubic-Tetragonal Phase Transition in Working CH₃NH₃PbI₃ Solar Cells Jeffrey A. Christians; National Renewable Energy Laboratory, United States.

4:30 PM ES1.12.05

Acid Doping of Spiro-OMeTAD towards Planar Perovskite Solar Cells with High-Efficiency and Minimal Hysteresis Zhen Li; National Renewable Energy Laboratory, United States.

4:45 PM ES1.12.06

Deciphering Phase Transformation Induced by Ammonium Iodide in Perovskite Film Growth Haonan Si; University of Science and Technology Beijing, China.

SESSION ES1.13: Poster Session III

Session Chairs: Wallace Choy and Huanping Zhou
Thursday Afternoon, April 20, 2017
8:00 PM - 10:00 PM
Sheraton, Third Level, Phoenix Ballroom

ES1.13.01

Rationalizing the Light-Induced Phase Separation of Mixed Halide Organic-Inorganic Perovskites Sergiu Draguta; University of Notre Dame, United States.

ES1.13.02

Electronic Structure and Polaronic Transport of Methylammonium Lead Bromide Crystals—Implications for Photo-Conversion Efficiency in Solar Cells Hye Ri Jung; Ewha Womans University, Korea (the Republic of).

ES1.13.03

Preheating Assisted Deposition of Cesium Lead Halide Perovskite with Improved Efficiency for Solar Cells Khan Mamun Reza; South Dakota State University, United States.

ES1.13.04

Relationships between Bulk Properties of $\text{CH}_3\text{NH}_3\text{PbI}_{3-x}\text{Cl}_x$ Hybrid Lead Halide Perovskite Thin Films and Substrate—Beyond the Interface [Carmen Coya](#); Universidad Rey Juan Carlos, Spain.

ES1.13.05

Engineering Inorganic Lead-Free Perovskite CsSnI_3 —Materials Design, Theoretical Predictions and Efficient Photovoltaics [Ning Wang](#)^{1,2}; ¹Nanyang Technological University, Singapore; ²Brown University, United States.

ES1.13.06

High Open Circuit Voltages in Tin-Rich Low Bandgap Perovskites Based Planar Heterojunction Photovoltaics [Baodan Zhao](#); University of Cambridge, United Kingdom.

ES1.13.07

Improved Efficiency in CsSnI_3 -Based Pb-Free Perovskite Solar Cells via Grain Boundary Engineering [Srinivas K. Yadavalli](#); Brown University, United States.

ES1.13.08

Interface Formation of Mixed Halide Perovskites and Its Influence on the Chemical and Electronic Structure [Evelyn Handick](#); Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Germany.

ES1.13.09

New Electron Transporting Material for Perovskite and Organic Hybrid Solar Cell [Pisist Kumnorkaew](#); National Nanotechnology Center, Thailand.

ES1.13.10

Dopant-Free Polymer HTM in Efficient and Stable Perovskite Solar Cell [Guan-Woo Kim](#); Pohang University of Science and Technology (POSTECH), Korea (the Republic of).

ES1.13.11

Highly Efficient and Stable Planar Perovskite Solar Cells with Electron-Beam Induced Reduced Graphene Oxide as a Hole Transporting Layer [Rira Kang](#); Korea Atomic Energy Research Institute (KAERI), Korea (the Republic of).

ES1.13.12

Designing New Fullerene Derivatives as Electron Transporting Materials for Efficient Perovskite Solar Cells with Improved Moisture Resistance [Xiangyue Meng](#)^{1,2}; ¹Beijing University of Chemical Technology, China; ²Hong Kong University of Science and Technology, Hong Kong.

ES1.13.13

A Facile Molecularly Engineered Copper (II) Phthalocyanine as Hole Transport Materials for Planar Perovskite Solar Cells with Enhanced Performance and Stability [Guang Yang](#); Wuhan University, China.

ES1.13.14

Improved Efficiency and Stability of Perovskite Solar Cells Employing a TiO_2/ZnO Core-Shell Photoanode [Peng Chen](#); Electronic Materials Research Laboratory, China.

ES1.13.15

Tuning the Energetics of Hole Transporting Materials for Perovskite Solar Cells by Alloying [Tracy H. Schloemer](#); Colorado School of Mines, United States.

ES1.13.16

Cuprous Oxide Thin Films by Chemical Bath Deposition (CBD) for Perovskite Solar Cells [Odin R. Vallejo](#); IER-UNAM, Mexico.

ES1.13.17

The Role of Polar Insulating Polymer in ZnO :Poly(Ethylene Glycol) Hybrid Interlayer for Highly Stable Perovskite Solar Cells [Dong Hun Sin](#); Pohang University of Science and Technology (POSTECH), Korea (the Republic of).

ES1.13.18

Highly Thin and Uniform Copper Thiocyanate Hole Transporting Layer for High Efficiency and Remarkable Long-Term Stability Perovskite Solar Cell by Spray Deposition [Inseok Yang](#); Inha University, Korea (the Republic of).

ES1.13.19

Integration of <001> Oriented Anatase TiO_2 Electron Transport Layer into Perovskite Solar Cells to Improve Carrier Separation [Hasti Gheibi Dehnashi](#); San Francisco State University, United States.

ES1.13.20

Development of Semi-Transparent Perovskite Solar Cells for Tandem Applications [Yasuhiro Shirai](#); NIMS, Japan.

ES1.13.21

Effect of Mixed Lead Halide Based Perovskite Films on Performance of Photodetectors [Son Singh](#); Kookmin University, Korea (the Republic of).

ES1.13.22

Photo Detection Applications of Methyl Ammonium Lead Iodide Thin Films by Pulsed Laser Deposition [Nagabhushan Patel](#); Indian Institute of Science, India.

SESSION ES1.14: Synthesis, Scale-up Inks and Vapor-Based

Session Chairs: Tzung-Fang Guo and Yuanyuan Zhou

Friday Morning, April 21, 2017

PCC North, 200 Level, Room 224 B

8:00 AM ES1.14.01

Improving the Performance of Formamidinium and Cesium Lead Triiodide Perovskite Solar Cells Using Lead Thiocyanate Additives [Yue Yu](#); University of Toledo, United States.

8:15 AM ES1.14.02

Complex-Assisted Gas Quenching as a Universal Deposition Method for Single, Double, Triple and Quadruple Cation Perovskite Solar Cells with High Efficiency [Bert Conings](#)^{1,2}; ¹Hasselt University - Materials Research Institute, Belgium; ²University of Oxford, United Kingdom.

8:30 AM ES1.14.03

Purely Oriented Crystalline Organolead Halide Perovskite Films [Nam Chul Cho](#)^{1,2}; ¹King Abdullah University of Science and Technology, Saudi Arabia; ²Soonchunhyang University, Korea (the Republic of).

8:45 AM ES1.14.04

Controlling Growth Thermodynamics and Phase Stability through Rational Engineering of the Interstitial Site in Hybrid Organic-Inorganic Perovskites [Spencer T. Williams](#); UW, United States.

9:00 AM ES1.14.05

Controlling Nucleation, Growth and Orientation of $\text{CH}_3\text{NH}_3\text{PbI}_3$ Perovskite Thin Films with Rationally Selected Additives [Benjamin Foley](#); University of Virginia, United States.

9:15 AM ES1.14.06

A Low Viscosity, Low Boiling Point, Clean Solvent System for the Rapid Crystallisation of Highly Specular Perovskite Films [Nakita K. Noel](#); University of Oxford, United Kingdom.

9:30 AM ES1.14.07

Meniscus-Assisted Solution Printing of Perovskite Solar Cells [Ming He](#); Georgia Institute of Technology, United States.

9:45 AM BREAK**10:15 AM ES1.14.08**

Methylamine Vapor-Annealing on MAPbI₃ Perovskite Improves Device Stability and Efficiencies up to 18.4% [Yan Jiang](#); Okinawa Institute of Science and Technology Graduate University (OIST), Japan.

10:30 AM ES1.14.09

'Soft' Processing of Hybrid Perovskites [Yuanyuan Zhou](#); Brown University, United States.

10:45 AM ES1.14.10

Microwave Near-Field Imaging and Morphology of Perovskite Photovoltaics [Samuel Berweger](#); National Institute of Standards and Technology, United States.

11:00 AM ES1.14.11

Formulating Perovskite Precursor Inks for Scale-Up [Mengjin Yang](#); National Renewable Energy Laboratory, United States.

11:15 AM ES1.14.12

Compact-TiO₂ Deposited via ALD for Highly-Repeatable and Low-Hysteresis Perovskite Solar Cells [Arun S. Chouhan](#); Indian Institute of Science, India.

11:30 AM ES1.14.13

All Vapor-Deposited Lead-Free Doped CsSnBr₃ Planar Solar Cells [Lili Wang](#); Michigan State University, United States.

11:45 AM ES1.14.14

Perovskite Solar Cells on Flexible Glasses [Benjia Dou](#)^{1,2}; ¹National Renewable Energy Laboratory, United States; ²University of Colorado Boulder, United States.

SESSION ES1.15: Fundamental, Spectroscopy and Hysteresis

Session Chair: Ivan Mora-Sero

Friday Afternoon, April 21, 2017

PCC North, 200 Level, Room 224 B

1:30 PM ES1.15.01

Local Structure Effects in Hybrid Organometal Trihalide Perovskites Probed by High Energy Resolution X-Ray Spectroscopy [Walter Drisdell](#); Lawrence Berkeley National Laboratory, United States.

1:45 PM ES1.15.02

Optoelectronic Structures of Organic-Inorganic Hybrid Lead Iodide Perovskites Probed by Electron-Rotor Interactions [Jue Gong](#); Northern Illinois University, United States.

2:00 PM ES1.15.03

Hybrid Perovskite Phase Transition and Its Ionic, Electrical and Optical Properties under Normal Solar Cell Operation [Md Nadim Ferdous Hoque](#); Texas Tech University, United States.

2:15 PM ES1.15.04

Understanding the Effect of Band Alignment and Surface States on the Hysteresis and Response Time of TiO₂-Based Perovskite Solar Cells [Heping Shen](#); Australian National University, Australia.

2:30 PM ES1.15.05

Determining Band-Edge Energies and Morphology-Dependent Stability of Formamidinium Lead Perovskite Films Using Spectroelectrochemistry and Photoelectron Spectroscopy [R. C. Shallercross](#); University of Arizona, United States.

2:45 PM ES1.15.06

Real-Time Observation of Iodide Ion Migration and Its Influence on Hysteresis in Methylammonium Lead Halide Perovskites [Sven Huettnr](#); University Bayreuth, Germany.

3:00 PM BREAK

SESSION ES1.16: Synthesis, Nanoparticles and Single Crystal

Session Chair: Luis Ono

Friday Afternoon, April 21, 2017

PCC North, 200 Level, Room 224 B

3:30 PM ES1.16.01

Perovskite CH₃NH₃PbI₃(Cl) Single Crystals—Rapid Solution Growth, Large Size, State-of-the-Art Crystalline Quality and Low Trap Density towards 10⁸ cm⁻³ [Zhipeng Lian](#); Tsinghua University, China.

3:45 PM ES1.16.02

Molecularly Engineered Phthalocyanines as Charge-Transporting Materials in Perovskite Solar Cells [Olga Trukhina](#)^{1,2}; ¹EPFL Valais, Switzerland; ²Autonoma University of Madrid, Spain.

4:00 PM ES1.16.03

Long-Lived Carriers Found in Double Metal Lead-Free Halide Perovskite by Time-Resolved Microwave Conductance Measurements [Davide Bartesaghi](#)^{1,2}; ¹Delft University of Technology, Netherlands; ²M2i, Netherlands.

4:15 PM ES1.16.04

Consolidation of the Optoelectronic Properties of CH₃NH₃PbBr₃ Perovskite Single Crystals [Bernard Wenger](#); University of Oxford, United Kingdom.

4:30 PM ES1.16.05

Thin-Film Single Crystal Metal-Halide Perovskite for Optoelectronics via Mechanical Spalling Transfer [Sang-Hoon Bae](#); University of California, Los Angeles, United States.

4:45 PM ES1.16.06

Extreme Sensitivity of Optoelectronic Properties of Methylammonium-Lead Tribromide Single Crystals to Environmental Gases [Hong-Hua Fang](#); University of Groningen, Netherlands.