



Playing with Light in Organic Thin-Film Solar Cells

Pastorelli, Francesco

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Symposium NM4 : Nanomaterials-Based Solar Energy Conversion

Nov 28

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2016-11-30 [+](#) [Show All Abstracts](#)

Symposium Organizers

Jia Zhu, Nanjing University
Marina Leite, Univ of Maryland-College Park
Rao Tatavarti, MicroLink Devices, Inc.
Gang Xiong, First Solar

Symposium Support

MilliporeSigma (Sigma-Aldrich Materials Science), Nano | A Nature Research Solution, SpringerMaterials

NM4.11: Nanostructures III

Session Chairs

David Mitzi

Wednesday AM, November 30, 2016
Hynes, Level 2, Room 208

8:30 AM - *NM4.11.01

Doping Effect in Si Nanocrystals

[Jun Xu](#)¹, [Dongke Li](#)¹, [Peng Lu](#)¹, [Kunji Chen](#)¹

¹ National Laboratory of Solid State Microstructures and Collaborative Innovation Center of Advanced Microstructures Nanjing University Nanjing China

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9:00 AM - NM4.11.02

Nanoscale Tomographic Investigation of Photocarrier Transport in Operating CdTe Solar Cells

[Justin Luria](#)¹, [Yasemin Kutes](#)¹, [Katherine Atamanuk](#)¹, [Andrew Moore](#)², [Bryan Huey](#)¹

¹ University of Connecticut Storrs United States, ² Colorado State University Fort Collins United States

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9:15 AM - NM4.11.03

Photocurrent in Si Quantum Dot Solar Cells with Inorganic-Organic Hybrid Structure

Mitsuru Inada¹, Nozomi Isobe¹, Tomoki Miyake¹, Tadashi Saitoh¹¹ Kansai University Osaka Japan[+](#) Show Abstract**9:30 AM - NM4.11.04**Defect-Tolerant Bil₃ Nanoplates for Photovoltaic ApplicationsXing Huang^{1,2}, Yoon Myung^{1,2}, Taehun Kim^{1,2}, Parag Banerjee^{1,2}, Rohan Mishra^{1,2}¹ Department of Mechanical Engineering and Materials Science St. Louis United States, ² Institute of Materials Science and Engineering St. Louis United States[+](#) Show Abstract**9:45 AM - NM4.11.05**

Nanostructured Titaniumdioxide—Synthesis, Characterization and Photoactive Application

Frederick Buabeng¹¹ University of Ghana Accra Ghana[+](#) Show Abstract**10:00 AM - ***

Break

NM4.12: Nanomaterials—Silicon**Session Chairs**

Harry Atwater

Wednesday AM, November 30, 2016

Hynes, Level 2, Room 208

10:30 AM - *NM4.12.01

Ultra-Thin Crystalline Silicon Solar Cells and Near-Field Thermo-Radiative Cells

Wei-Chun Hsu ¹, Matthew Branham ¹, Jonathan Tong ¹, Bolin Liao ², Yi Huang ¹,
Svetlana Boriskina ¹, Gang Chen ¹

¹ Mechanical Engineering Massachusetts Institute of Technology Cambridge United States,
² Division of Chemistry and Chemical Engineering California Institute of Technology
Pasadena United States

 Show Abstract

11:00 AM - NM4.12.02

Playing with Light in Organic Thin-Film Solar Cells

Francesco Pastorelli ¹

¹ Risø DTU National Laboratory for Sustainable Energy Roskilde Denmark

 Hide Abstract

The goal of our work is to increase light-matter interactions in organic photovoltaics. As first design we implemented a self-assembled nano-gap antenna. The nano-gap antennas are linked at a controlled distance of a few nanometers by Dithiothreitol molecules (self-assembly method). The spacing molecules ensure a minimum distance that plays a fundamental role in the formation of intensity hot spots in the nanogap as well as large and red-shifted scattering peaks. This device exhibited an efficiency 14% higher than the reference one showing a relevant enhancement in the red part of the EQE measurements*. As second design we build up a photonic crystal and a metal cavity around a transparent organic solar cell. We enclosed the active material in between two metal electrodes forming an optical cavity designed to optimize photon trapping inside the cell. To increase near IR light trapping, while maintaining transparency in the visible, an anti-reflection coating was deposited on top of the front metal contact while a non-periodic multi-layer was inserted in between the back metal contact and the substrate. The cavity configuration was designed specifically for the cell architecture used and we achieved semi-transparent cells with 5.3% PCE, corresponding to 90% the PCE of the opaque cell.

Francesco Pastorelli, Sebastien Bidault, Jordi Martorell, Nicolas Bonod, DOI:
10.1002/adom.201300363

Francesco Pastorelli, Pablo Romero Gomez, Rafael Betancur, Alberto Martinez-Otero,
Nicolas Bonod, Jordi Martorell, DOI:10.1002/aenm.201400614.

Francesco Pastorelli, DOI: 10.1002/aenm.201570008

11:15 AM - *NM4.12.03

Thin Silicon Solar Cells with Nanoscale Photon Management

Yi Cui ^{1,2}

¹ Stanford University Stanford United States, ² SLAC National Accelerator Laboratory
Stanford Institute for Materials and Energy Sciences Stanford United States

[+](#) Show Abstract**11:45 AM - NM4.12.04**

Plasmonic Nanomesh Sandwiches for Ultrathin-Film Silicon Solar Cells

Tongchuan Gao¹, Baomin Wang², Paul Leu¹¹ University of Pittsburgh Pittsburgh United States, ² The Pennsylvania State University State College United States[+](#) Show Abstract**NM4.13: Perovskites II****Session Chairs**

Naomi Halas

Wednesday PM, November 30, 2016
Hynes, Level 2, Room 208**1:30 PM - *NM4.13.01**

Structural Diversity and Engineering of Perovskite Semiconductors

David Mitzi¹¹ Duke University Durham United States[+](#) Show Abstract**2:00 PM - NM4.13.02**Solution-Processed Ag Nanowires + PEDOT:PSS Hybrid Electrode for Cu(In,Ga)Se₂ Thin-Film Solar CellsTaeGeon Kim¹, Dong Hyeop Shin¹, Byung Tae Ahn¹, Seung Min Han²¹ Materials Science and Engineering Korea Advanced Institute of Science and Technology Daejeon Korea (the Republic of), ² Energy, Environment, Water and Sustainability Korea Advanced Institute of Science and Technology Dejeon Korea (the Republic of)[+](#) Show Abstract**2:15 PM - NM4.13.03**Solution-Processed Hybrid Sb₂S₃ Planar Heterojunction Solar CellWenxiao Huang¹, David Carroll¹

¹ Wake Forest University Winston Salem United States

[+](#) Show Abstract

2:30 PM -
Break

NM4.14: Nanomaterials—High Efficiency II

Session Chairs

Jeremy Munday

Wednesday PM, November 30, 2016
Hynes, Level 2, Room 208

3:30 PM - *NM4.14.01

Intermediate Band Solar Cells and the Path to High Efficiency

Jacob Krich^{1,2}

¹ Physics University of Ottawa Ottawa Canada, ² School of Electrical Engineering and Computer Science University of Ottawa Ottawa Canada

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4:00 PM - NM4.14.02

Density of States of CZTS by Molecular Modelling and Tight Binding

Jarvist Frost¹, Suzanne Wallace¹, Aron Walsh¹

¹ University of Bath Bath United Kingdom

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4:15 PM - NM4.14.03

Investigating Interface Effects in Bulk-Heterojunction Organic Solar Cells by Kinetic Monte Carlo Simulations

Tim Albes¹, Alessio Gagliardi¹

¹ Technische Universität München München Germany

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4:30 PM - NM4.14.04

Molecular Singlet Fission—Intramolecular Triplet Formation in Pentacene Dimers

Dirk Guldi¹¹ University of Erlangen Erlangen Germany[+](#) Show Abstract**4:45 PM - NM4.14.05**

Photovoltaic Performance Enhancement in Organic Photovoltaic Cells with Cytosine Nucleobase

Jisu Yoo¹, Soohyung Park¹, Kwanwook Jung¹, Donghee Kang¹, Minju Kim¹, Hyunbok Lee², Yeonjin Yi¹¹ Department of Physics Yonsei University Seoul Korea (the Republic of), ² Department of Physics Gangwon University Chuncheon-Si Korea (the Republic of)[+](#) Show Abstract**NM4.15: Poster Session III: Nanomaterials****Session Chairs**Aruna Devi Rasu Chettiar
Jun XuWednesday PM, November 30, 2016
Hynes, Level 1, Hall B**8:00 PM - NM4.15.01**Cu₂ZnSnS₄ Decorated MoS₂-Reduced Graphene Oxide Nanocomposites for Improved Photocatalytic Hydrogen ProductionEnna Ha¹, Wei Liu¹, Yoon Suk Lee¹, Kwok-yin Wong¹¹ Hong Kong Polytechnic University Hong Kong Hong Kong[+](#) Show Abstract**8:00 PM - NM4.15.02**

The Role of Metal as an Recombination Center on Metal-Semiconductor Nanodumbbell Photocatalysts

Choi Ji Yong¹, Hyunjoon Song¹¹ Korea Advanced Institute of Science and Technology Daejeon Korea (the Republic of)

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8:00 PM - NM4.15.03

ZnO-CuO Core-Shell Heterostructure for Improving the Efficiency of ZnO Based Dye-Sensitized Solar Cells

Kichang Jung^{2,1,4}, Taehoon Lim^{3,1,4}, Nicholas Corum^{1,4}, Alfredo Martinez-Morales^{3,1,4}

² Chemical and Environmental Engineering University of California, Riverside Riverside United States, ¹ Southern California Research Initiative for Solar Energy University of California, Riverside Riverside United States, ⁴ College of Engineering Center for Environmental Research and Technology University of California, Riverside Riverside United States, ³ Materials Science and Engineering Program University of California, Riverside Riverside United States

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8:00 PM - NM4.15.14

Synthesis and Dielectric Properties of the Nanocrystalline Solar Oxide Perovskites, $[\text{KNbO}_3]_{1-x}[\text{BaNi}_{0.5}\text{Nb}_{0.5}\text{O}_{3-\delta}]_x$, Derived from Potassium Niobate KNbO_3 by Gel Collection

Julien Lombardi^{1,2,3}, Frederick Pearsall^{1,2,3}, Stephen O'Brien^{1,2,3}

¹ City College of New York New York United States, ² City University of New York New York United States, ³ Chemistry City University of New York New York United States

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8:00 PM - NM4.15.04

Silicon Diselenide a Possible Top Cell Material for a Silicon Based Tandem Junction Photovoltaic Cell

Chito Kendrick¹, Logan Pauli¹

¹ Michigan Technological University Houghton United States

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8:00 PM - NM4.15.05

Colloidal Quantum Dot and Polymer:Fullerene Hybrid Tandem Solar Cells

Taesoo Kim¹, Yangqin Gao¹, Buyi Yan¹, Hanlin Hu¹, Ru-Ze Liang¹, Mingjian Yuan², Edward Sargent², Pierre Beaujuge¹, Aram Amassian¹

¹ King Abdullah University of Science and Technology Thuwal Saudi Arabia, ² University of Toronto Toronto Canada

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8:00 PM - NM4.15.06

Influence of Dendritic Gold Underlayer on Photoelectrochemical Water Splitting Using Copper (I) Oxide as a Photocathode

Tian Lan¹, Colton Mundt¹, Sonal Padalkar¹

¹ Iowa State University Ames United States

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8:00 PM - NM4.15.07

High Efficiency Dye Sensitized Solar Cells Employing Silica/Titania Double-Shelled Hollow Nanoparticles for Enhanced Light Scattering

Jungsup Lee¹, Jyongsik Jang¹, Chang-Min Yoon¹

¹ Seoul National University Seoul Korea (the Republic of)

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8:00 PM - NM4.15.08

High Efficiency Double Absorber PbS/CdS Heterojunction Solar Cells by Enhanced Charge Collection Using a ZnO Nanorod Array

Deuk Ho Yeon^{1 3}, Bhaskar Chandra Mohanty², Seung Min Lee¹, Ah Ra Cho¹, Jin Woo Jang¹, Yong Soo Cho¹

¹ Department of Materials Science and Engineering Yonsei University Seoul Korea (the Republic of), ³ LG Display Co. Gyeonggi-do Korea (the Republic of), ² School of Physics and Materials Science Thapar University Patiala India

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8:00 PM - NM4.15.18

Comparison of Spin-Coated and Sputtered ZnO Buffer Layers for Inverted Organic Solar Cells

Jeongll Park¹, SangMok Lee¹, Sung-Hyun Park¹, Yoon-Young Choi¹, Han-Ki Kim¹

¹ Advanced Materials Engineering for Information and electronics Kyung Hee University Yongin-Si Korea (the Republic of)

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8:00 PM - NM4.15.16

Organic Parallel Tandem Solar Cells with Thin Metal Layers as Transparent Intermediate Contact

Toni Meyer¹, Ronny Timmreck¹, Christian Koerner¹, Karl Leo¹

¹ Dresden University of Technology Dresden Germany

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8:00 PM - NM4.15.19

Colloidal Quantum Dot Lead Sulfide Photovoltaic Devices—Towards Fully Sprayable Devices

Diogenes Placencia¹, Janice Boercker¹, Edward Foos², Joseph Tischler¹

¹ Naval Research Laboratory Washington United States, ² Indian Head Naval Surface Warfare Center Indian Head United States

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8:00 PM - NM4.15.20

Origin of Passivation in Hole-Selective Transition Metal Oxides for Crystalline Silicon Heterojunction Solar Cells

Luis Gerling Sarabia¹, Cristobal Voz¹, Ramon Alcubilla¹, Joaquim Puigdollers¹

¹ Enginyeria Electrònica University of Politecnica-Catalunya Barcelona Spain

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8:00 PM - NM4.15.13

High-Performance Polymer Solar Cells with PCE of 10.42% via Al-Doped ZnO Cathode Interlayer

Xiaohui Liu^{1,2}, Xiaodong Li^{1,2}, Yaru Li¹, Changjian Song¹, Liping Zhu¹, Wenjun Zhang¹, Hai-Qiao Wang^{1,2}, Junfeng Fang^{1,2}

¹ Ningbo Institute of Materials Technology and Engineering Ningbo China, ² University of Chinese Academy of Sciences Beijing China

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8:00 PM - NM4.15.17

Study about an Experimental Design for Synthesis of CdTe Quantum Dots—Analysis of the Optical and Electrochemical Changes after Their Interaction with Hydroxyl Radicals

Eduardo Munoz¹, Emilio Navarrete¹, Rodrigo Henriquez¹, Ricardo Schrebler¹, Manuel Bravo¹, Ricardo Cordova¹

¹ Pontificia Universidad Católica de Valparaíso Valparaíso Chile

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8:00 PM - NM4.15.10

Swapping Donor and Acceptor Units in Benzo[1,2-b:4,5-b']dithiophene-Difluoroquinoxaline Small Molecule Donors Impacts Material Self-Assembly and BHJ Solar Cell Efficiencies

Ru-Ze Liang¹, Kai Wang¹, Qasim Saleem¹, Maxime Babics¹, Michael Hansen², Pierre Beaujuge¹

¹ King Abdullah University of Science and Technology Jeddah Saudi Arabia, ² Westfälische Wilhelms-Universität Münster Münster Saudi Arabia

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8:00 PM - NM4.15.21

Sonochemical Assisted Hydrothermal Synthesis of Gallium Oxynitride Nanosheets and Their Solar-Driven Photoelectrochemical Water-Splitting Applications

Naseer Iqbal¹, Ibrahim Khan¹, Ahsanulhaq Qurashi¹

¹ King Fahd University of Petroleum and Minerals Dhahran Saudi Arabia

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8:00 PM - NM4.15.22

Block Copolymer Compatibilized Polymer:Fullerene Blend Morphology and Properties

Dharmaraj Raghavan¹, Yan Sun², Praveen Pitliya¹, Chang Liu², Xiong Gong², Alamgir Karim², Ren Zhang²

¹ Howard University Washington United States, ² Polymer Engineering University of Akron Akron United States

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8:00 PM - NM4.15.23

SnS/CdS Heterostructures Prepared by High Vacuum Evaporation Method

Naidu Revathi¹, Olga Volobujeva¹, Mihkel Loorits¹, Sergei Bereznev¹, Jaan Raudoja¹, Rainer Traksmaa¹, Enn Mellikov¹

¹ Department of Material Science Tallinn University of Technology Tallinn Estonia

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8:00 PM - NM4.15.11

Antireflective and Self-Cleaning Properties of SiO₂-MgF₂/TiO₂ Double-Layer Films Prepared by Sol-Gel Method at Low Calcination Temperature

Hung-Chou Liao¹, Sheng-min Yu¹, Wen-Ching Sun¹, Wan-Ying Chou¹, Shou-Yi Ho¹, Tzu-Yu Wang², Wei Jen Lu², LiFang Lu²

¹ Industrial Technology Research Institute Hsinchu Taiwan, ² JM Material Technology Inc Taoyuan Taiwan

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8:00 PM - NM4.15.12

High-Energy-Band-Gap Hole-Transport Layer Improves the Efficiency and Stability of Colloidal Quantum Dot Photovoltaics

Hunhee Lim¹, Min-Jae Choi¹, Yeon Sik Jung¹

¹ Korea Advanced Institute of Science and Technology Daejeon Korea (the Republic of)

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8:00 PM - NM4.15.24

Use of Natural Sensitizers of Nanocrystalline TiO₂-Semiconductor #xD; for the Construction of DSSC

Enrique Rocha-Rangel¹, Lucia Tellez-Jurado², Jose A. Rodriguez-Garcia¹, Pablo Carbo Vela¹, Eddie N Armendariz-Mireles¹

¹ Universidad Politécnica de Victoria Victoria Mexico, ² Chemical Engineering and Extractive Industries Instituto Politecnico Nacional Mexico City Mexico

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8:00 PM - NM4.15.29

Improvement of Surface Passivation and p-Doping for High-Efficient Photovoltaic Performance Based on PbS Colloidal Quantum Dots *via* Multifunctional Ligand Exchange

Process

Jung Hoon Song ^{1 2}, Sohee Jeong ^{2 3}, Yong-Hyun Kim ¹

¹ Korea Advanced Institute of Science and Technology Daejeon Korea (the Republic of), ² Nanomechanical Systems Research Division Korea Institute of Machinery and Materials Daejeon Korea (the Republic of), ³ Department of Nanomechatronics University of Science and Technology Daejeon Korea (the Republic of)

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8:00 PM - NM4.15.15

Photocurrent Enhancement by Introducing Gold Nanoparticles in Nanostructures Based Heterojunction Solar Cell Device

Gen Long ¹, Kenneth Sabalo ¹, Michael Beattie ¹, Natalie Macdonald ¹, Mohammad Khan ², Raheeb Alsaidi ², Blawal Chaudhry ², Juhayer Uddin ², Mostafa Sadoqi ¹

¹ Physics St. John's University Jamaica United States, ² Biology St John's University Jamaica United States

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8:00 PM - NM4.15.09

FRET-Assisted Upconversion of Organic Quantum Dots for the Utilization of Below-Bandgap Solar Energy

Su Young Lee ¹, Sungju Yu ¹, Ha Nee Umh ¹, Suji Shin ¹, Sung Eun Jerng ¹, Jongheop Yi ¹

¹ School of Chemical and Biological Engineering Seoul National University Seoul Korea (the Republic of)

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8:00 PM - NM4.15.33

Organic Cyanine Chromophores Bound to ZnO Nanoparticles as Thermal Stable Passive Solar Absorbers

Kenneth Skorenko ², Brendan Hughes ¹, Linyue Tong ¹, Frank Goroleski ³, Bradley Galusha ³, William Bernier ², Wayne Jones ¹

² ChromaNanoTech Binghamton United States, ¹ Binghamton University Binghamton United States, ³ Crysta-Lyn Binghamton United States

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8:00 PM - NM4.15.34Photoexcited Surface Frustrated Lewis Pairs for CO₂ ReductionKulbir Ghuman¹, Chandra Singh¹¹ Materials Science and Engineering University of Toronto Toronto Canada[+](#) Show Abstract**8:00 PM - NM4.15.26**

The Influence of Slip-Stacking Angle on Device Efficiency Demonstrated through Polymorphism in a Representative Squaraine

Devon Shedden¹, Tory Welsch², Chenyu Zheng¹, Chris Collison¹¹ Rochester Institute of Technology Rochester United States, ² Suny Geneseo Geneseo United States[+](#) Show Abstract**8:00 PM - NM4.15.27**

Self-Organized Lead(II) Sulfide Quantum Dots Superlattice

Jose Maria Silva Filho¹, Victor Ermakov¹, Luiz Bonato², Ana Nogueira², Francisco Marques¹¹ Applied Physics University of Campinas Campinas Brazil, ² Chemistry Institute University of Campinas Campinas Brazil[+](#) Show Abstract**8:00 PM - NM4.15.28**

Three-Dimensional Assembly of Catalyst-Gold Nanoparticles for Efficient Plasmonic Solar Water Splitting

Ho Yeon Son¹, Yoon Sung Nam^{1 2}¹ Materials Science and Engineering Korea Advanced Institute of Science and Technology Daejeon Korea (the Republic of), ² Institute for the Nanocentury Korea Advanced Institute of Science and Technology Daejeon Korea (the Republic of)[+](#) Show Abstract**8:00 PM - NM4.15.32**

Three-Dimensional Organic Photovoltaics Devices Fabricated by Electrospray Deposition

Yusuke Tajima¹, Harumi Hayakawa¹, Hideaki Takaku¹, Tetsuya Aoyama¹

¹ RIKEN Saitama Japan

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8:00 PM - NM4.15.30

Study of Bile Salt's Derivates with Bulky Group Variation as Coadsorbents in DSSC's

Andrea Soto Navarro¹, Leslie W. Pineda¹, Ariel Alfaro², Victor Hugo Soto Tellini², Thomas Moehl³, Eva Barea⁴, Francisco Fabregat-Santiago⁴

¹ Universidad de Costa Rica San José Costa Rica, ² Universidad de Costa Rica San José Costa Rica, ³ Department of Chemistry University of Zürich Zürich Switzerland, ⁴ Universitat Jaume I Castelló Spain

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8:00 PM - NM4.15.31

High Temperature Annealing for Structural Optimization of Silica Aerogels in Solar Thermal Applications

Elise Strobach¹, Bikram Bhatia¹, Sungwoo Yang¹, Lin Zhao¹, Lee Weinstein¹, Thomas Cooper¹, Svetlana Boriskina¹, Gang Chen¹, Evelyn Wang¹

¹ Massachusetts Institute of Technology Cambridge United States

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8:00 PM - NM4.15.25

Studies on $[\text{KNbO}_3]_{0.9}[(\text{BaNi}_{1/2}\text{Nb}_{1/2}\text{O}_3)]_{0.1}$ Ferroelectrics for Photovoltaic Applications

Blanca Rosas¹, Shojan Pavunny¹, Nora Ortega¹, Alvaro Instan¹, Ram Katiyar¹

¹ Department of Physics and Institute for Functional Nanomaterials, University of Puerto Rico San Juan United States

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