Playing with Light in Organic Thin-Film Solar Cells

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Symposium NM4 : Nanomaterials-Based Solar Energy Conversion

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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

Show Abstract

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 Inada [1], Nozomi Isobe [1], Tomoki Miyake [1], Tadashi Saitoh [1]

[1] Kansai University Osaka Japan

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9:30 AM - NM4.11.04
Defect-Tolerant BiI_3 Nanoplates for Photovoltaic Applications

Xing 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

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9:45 AM - NM4.11.05
Nanostructured Titaniumdioxide—Synthesis, Characterization and Photoactive Application

Frederick Buabeng [1]

[1] University of Ghana Accra Ghana

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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

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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

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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

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11:45 AM - NM4.12.04
Plasmonic Nanomesh Sandwiches for Ultrathin-Film Silicon Solar Cells

Tongchuan Gao [1], Baomin Wang [2] , Paul Leu [1]

[1] University of Pittsburgh Pittsburgh United States, [2] The Pennsylvania State University State College United States

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NM4.13: Perovoskites 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 Mitzi [1]

[1] Duke University Durham United States

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2:00 PM - NM4.13.02
Solution-Processed Ag Nanowires + PEDOT:PSS Hybrid Electrode for Cu(In,Ga)Se_2 Thin-Film Solar Cells

TaeGeon Kim [1], Dong Hyeop Shin [1] , Byung Tae Ahn [1] , Seung Min Han [2]

[1] 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)

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2:15 PM - NM4.13.03
Solution-Processed Hybrid Sb2S3 Planar Heterojunction Solar Cell

Wenxiao Huang [1], David Carroll [1]

[1] Wake Forest University Winston Salem United States

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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 Frost [1], Suzanne Wallace [1], Aron Walsh [1]

[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 Albes [1], Alessio Gagliardi [1]

[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 Guldi [1]

[1] University of Erlangen Erlangen Germany

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4:45 PM - NM4.14.05
Photovoltaic Performance Enhancement in Organic Photovoltaic Cells with Cytosine Nucleobase

Jisu Yoo [1], Soohyung Park [1] , Kwanwook Jung [1] , Donghee Kang [1] , Minju Kim [1] , Hyunbok Lee [2] , Yeonjin Yi [1]

[1] Department of Physics Yonsei University Seoul Korea (the Republic of), [2] Department of Physics Gangwon University Chuncheon-Si Korea (the Republic of)

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NM4.15: Poster Session III: Nanomaterials

Session Chairs
Aruna Devi Rasu Chettiar
Jun Xu

Wednesday PM, November 30, 2016
Hynes, Level 1, Hall B

8:00 PM - NM4.15.01
Cu_2ZnSnS_4 Decorated MoS_2-Reduced Graphene Oxide Nanocomposites for Improved Photocatalytic Hydrogen Production

Enna Ha [1], Wei Liu [1] , Yoon Suk Lee [1] , Kwok-yin Wong [1]

[1] Hong Kong Polytechnic University Hong Kong Hong Kong

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8:00 PM - NM4.15.02
The Role of Metal as an Recombination Center on Metal-Semiconductor Nanodumbbell Photocatalysts

Choi Ji Yong [1], Hyunjoon Song [1]

[1] 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, $[KNbO_3]_{1-x}[BaNi_{0.5}Nb_{0.5}O_{3-\delta}]_x$, 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 Kendrick [1], Logan Pauli [1]

[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 Kim [1], Yangqin Gao [1], Buyi Yan [1], Hanlin Hu [1], Ru-Ze Liang [1], Mingjian Yuan [2], Edward Sargent [2], Pierre Beaujuge [1], Aram Amassian [1]

[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 Lan [1], Colton Mundt [1] , Sonal Padalkar [1]

[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 Lee [1], Jyongsik Jang [1] , Chang-Min Yoon [1]

[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 Mohanty [2] , Seung Min Lee [1], Ah Ra Cho [1] , Jin Woo Jang [1] , Yong Soo Cho [1]

[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

JeongIl Park [1], SangMok Lee [1] , Sung-Hyun Park [1] , Yoon-Young Choi [1] , Han-Ki Kim [1]

[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 Meyer [1], Ronny Timmreck [1], Christian Koerner [1], Karl Leo [1]

[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 Placencia [1], Janice Boercker [1], Edward Foos [2], Joseph Tischler [1]

[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 Sarabia [1], Cristobal Voz [1], Ramon Alcubilla [1], Joaquim Puigdollers [1]

[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 Li [1], Changjian Song [1], Liping Zhu [1], Wenjun Zhang [1], 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 Munoz [1], Emilio Navarrete [1], Rodrigo Henriquez [1], Ricardo Schrebler [1], Manuel Bravo [1], Ricardo Cordova [1]

[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 Liang [1], Kai Wang [1], Qasim Saleem [1], Maxime Babics [1], Michael Hansen [2], Pierre Beaujuge [1]

[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 Iqbal [1], Ibrahim Khan [1], Ahsanulhaq Qurashi [1]

[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 Raghavan [1], Yan Sun [2], Praveen Pitliya [1], Chang Liu [2], Xiong Gong [2], Alamgir Karim [2], Ren Zhang [2]

[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 Revathi [1], Olga Volobujeva [1] , Mihkel Loorits [1] , Sergei Bereznev [1] , Jaan Raudoja [1] , Rainer Traksmaa [1] , Enn Mellikov [1]

[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 SiO_2-MgF_2/TiO_2 Double-Layer Films Prepared by Sol-Gel Method at Low Calcination Temperature

Hung-Chou Liao [1] , Sheng-min Yu [1] , Wen-Ching Sun [1] , Wan-Ying Chou [1] , Shou-Yi Ho [1], Tzu-Yu Wang [2] , Wei Jen Lu [2] , LiFang Lu [2]

[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 Lim [1], Min-Jae Choi [1] , Yeon Sik Jung [1]

[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 TiO_2-Semiconductor #xD; for the Construction of DSSC

Enrique Rocha-Rangel [1], Lucia Tellez-Jurado [2] , Jose A. Rodriguez-Garcia [1] , Pablo Carbo Vela [1] , Eddie N Armendariz-Mireles [1]

[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 - NM4.15.34
Photoexcited Surface Frustrated Lewis Pairs for CO_2 Reduction

Kulbir Ghuman [1], Chandra Singh [1]

[1] Materials Science and Engineering University of Toronto Toronto Canada

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8:00 PM - NM4.15.26
The Influence of Slip-Stacking Angle on Device Efficiency Demonstrated through Polymorphism in a Representative Squaraine

Devon Shedden [1], Tory Welsch [2], Chenyu Zheng [1], Chris Collison [1]

[1] Rochester Institute of Technology Rochester United States, [2] Suny Geneseo Geneseo United States

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8:00 PM - NM4.15.27
Self-Organized Lead(II) Sulfide Quantum Dots Superlattice

Jose Maria Silva Filho [1], Victor Ermakov [1], Luiz Bonato [2], Ana Nogueira [2], Francisco Marques [1]

[1] Applied Physics University of Campinas Campinas Brazil, [2] Chemistry Institute University of Campinas Campinas Brazil

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8:00 PM - NM4.15.28
Three-Dimensional Assembly of Catalyst-Gold Nanoparticles for Efficient Plasmonic Solar Water Splitting

Ho Yeon Son [1], 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)

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8:00 PM - NM4.15.32
Three-Dimensional Organic Photovoltaics Devices Fabricated by Electrospray Deposition

Yusuke Tajima [1], Harumi Hayakawa [1], Hideaki Takaku [1], Tetsuya Aoyama [1]

[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 Navarro [1], Leslie W. Pineda [1], Ariel Alfaro [2], Victor Hugo Soto Tellini [2], Thomas Moehl [3], Eva Barea [4], Francisco Fabregat-Santiago [4]

[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 Strobach [1], Bikram Bhatia [1], Sungwoo Yang [1], Lin Zhao [1], Lee Weinstein [1], Thomas Cooper [1], Svetlana Boriskina [1], Gang Chen [1], Evelyn Wang [1]

[1] Massachusetts Institute of Technology Cambridge United States

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8:00 PM - NM4.15.25
Studies on $[KNbO3]_{0.9}[(BaNi_{1/2}Nb_{1/2}O_3)]_{0.1}$ Ferroelectrics for Photovoltaic Applications

Blanca Rosas [1], Shojan Pavunny [1], Nora Ortega [1], Alvaro Instan [1], Ram Katiyar [1]

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

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