Advanced Optoelectronics for Energy and Environment

24 - 27 May 2013 Wuhan National Laboratory for Optoelectronics (WNLO), Wuhan, China

Advanced Optoelectronics for Energy and Environment (AOEE) is part of International Photonics and OptoElectronics Meetings (POEM), launched by Wuhan National Laboratory for Optoelectronics (WNLO). POEM is a large-scale multi-disciplinary international conference in the field of photonics and optoelectronics. It aims to focus on the key techniques of scientific frontier and industry in the field of optoelectronics, grip trend in the future as well as give full play to the industrial advantage of Wuhan - Optics Valley of China.

Advanced Optoelectronic techniques provide keys to solve the global energy crisis and environmental problems. The symposium on Advanced Optoelectronics for Energy and Environment will be a great event for an update on the progress and challenges at the frontier applications of advanced optoelectronics. The conference will focus on the materials, characterisation and processing techniques for advanced optoelectronic devices,. Three topics will be highlighted: solar cells, printable optoelectronics and energy storage devices. This conference will provide a good platform for researchers to discuss cutting-edge progress and the issues associated with these technologies and to promote the commercialization of advanced optoelectronics.

Topics of interest for this symposium include, but are not limited to:

1. Solar Cells: Silicon-based, thin films, , dye-sensitized, organic, quantum dots, hybrid solar cells etc.

2. Printable Optoelectronics: Flexible display, thin film transistor (TFT), circuit, organic light-emitting diode (OLED), radio frequency identification (RFID), sensor, solar cell, e-paper, printing and encapsulation techniques etc.

3. Energy Storage Devices: Li-ion battery, Li-S battery, Li-O2 battery, Supercapacitor, fuel cell, etc.

Committee Chairs

Yi-Bing Cheng, Monash University, **Chair**
Guozhen Shen, Wuhan National Lab for Optoelectronics, China, **Local Organizing Chair**
Jiang Tang, Wuhan National Lab for Optoelectronics, China, **Local Organizing Chair**

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Yang Yang, University of Southern California, United States
Jie Zhang, Inst. of Materials Research & Engineering, South Korea
Zhong Zhou, Beijing Inst. of Graphic Communication, China

Sponsors

International Photonics and OptoElectronics (POEM) 2013 Congress

The 6th International Photonics and OptoElectronics Meetings (POEM 2013) are sponsored by Huazhong University of Science and Technology (HUST), China Hubei Provincial Science & Technology Department (HBSTD), Wuhan East Lake National Innovation Demonstration Zone (Optics Valley of China, OVC), Hubei Association For Science & Technology and Hubei Administration of Foreign Expert Affairs, and are organized by Wuhan National Laboratory for Optoelectronics (WNLO) and The Optical Society (OSA).

POEM will be held on 24-27 May 2013, and brings together a wide range of research, technologies and perspectives in the fields of photonics and optoelectronics. It not only welcomes all your participation in this important international forum, but also has features open to all the individuals and entities worldwide that have interest in joining us by programming and organizing the activities under four technical areas of Biomedical Photonics, Industrial Photonics, Information Photonics and Photonics for Energy.

By combining different disciplines and comprehensive meeting types, POEM 2013 is to serve as a platform on exchanging information on recent advances and future trends for researchers and to boost brand for the enterprises.

Advanced Optoelectronics for Energy and Environment
Agenda of Sessions

Saturday, 25 May 2013

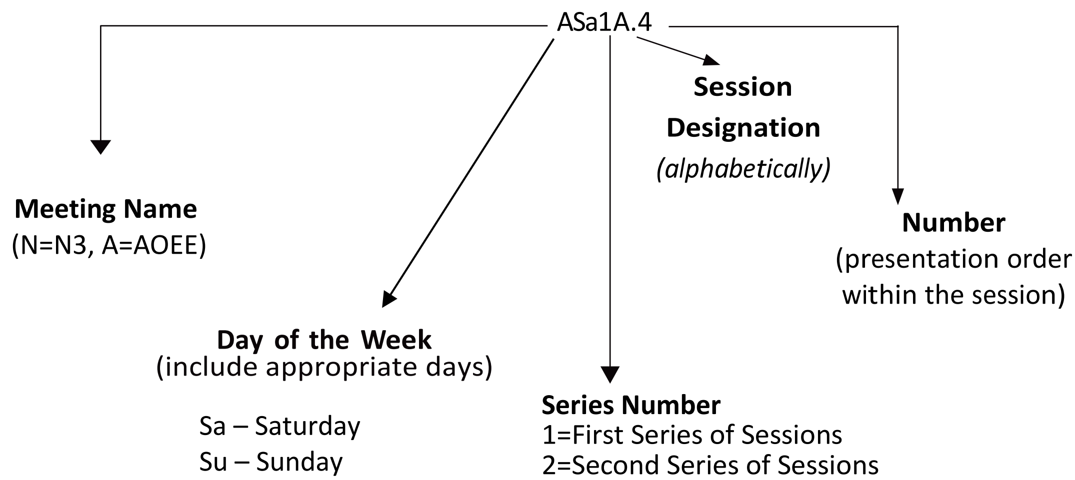
	Registration All Day		
08:00-08:15	Opening Ceremony		
08:15-12:00	JSa1A • Joint N3/AOEE Plenary (with coffee/tea break & group photo)		
	AOEE Room 1	AOEE Room 2	AOEE Room 3
12:00-13:30	Lunch Break		
13:30-15:00	ASa2A • Solar Cells I	ASa2B • Energy Conversion and Storage I	973 Project Worshop
15:00-16:00	ASa3A • Poster Session I (with coffee/tea break)		
16:00-18:00	ASa4A • Solar Cells II (*ends at 17:55*)	ASa4B • Energy Conversion and Storage II	973 Project Workshop
18:00--21:00	Welcome Banquet and Poster Award		

Sunday, 26 May 2013

	AOEE Room 1	AOEE Room 2	AOEE Room 3
08:00-10:00	ASu1A • Solar Cells III	ASu1B • Energy Conversion and Storage III	ASu1C • Printed Electronics I
10:00-10:20	Coffee/tea Break		
10:20-12:00	ASu2A • Solar Cells IV	ASu2B • Solar Cells V (*ends at 12:05*)	ASu2C • Printed Electronics II (*ends at 11:55*)
12:00-13:30	Lunch Break		
13:30-16:00	ASu3A • Solar Cells VI (*ends at 15:55*)	ASu3B • Energy Conversion and Storage IV (*ends at 16:05*)	ASu3C • Printed Electronics III

Advanced Optoelectronics for Energy and Environment (AOEE) Program

Explanation of Session Codes



The first letter of the code designates the meeting (For instance, A=AOEE, N=N3). The second element denotes the day of the week (Saturday=Sa, Sunday=Su). The third element indicates the session series in that day (for instance, 1 would denote the first parallel sessions in that day). Each day begins with the letter A in the fourth element and continues alphabetically through a series of parallel sessions. The lettering then restarts with each new series. The number on the end of the code (separated from the session code with a period) signals the position of the talk within the session (first, second, third, etc.). For example, a presentation coded ASa1A.4 indicates that this paper is part of the AOEE meeting (A) and is being presented on Saturday (Sa) in the first series of sessions (1), and is the first parallel session (A) in that series and the fourth paper (4) presented in that session.

Advanced Optoelectronics for Energy and Environment (AOEE) Abstracts

Saturday, 25 May

Room A101 (Plenary)
08:00 -- 12:00
JSa1A • Joint Plenary Session
Presiders: Yi-Bing Cheng; Monash Univ., Australia and Zhong-Lin Wang; Georgia Inst. of Technology, USA

JSa1A.1 • 08:15 (Plenary)
Nanomaterials for Photovoltaics, Martin Green[1]; *[1]Univ. of New South Wales, Australia.* A realistic appraisal is given of the most promising potential nanomaterial applications in increasing photovoltaic performance, either by enabling implementation of advanced device concepts or by improving existing devices, such as by plasmonics.

JSa1A.2 • 09:00 (Plenary)
Silicon Nanostructures for Energy Applications, S.T. Lee[1]; *[1]Soochow Univ., China.* Si nanostructures in various forms can be controllably synthesized using metal-assisted vapor-liquid-solid growth, oxide-assisted growth, chemical or electrochemical etching methods. Si nanostructures (nanowires, quantum dots) exhibit unique and interesting structural, optical, electronic and chemical properties, which are being exploited for myriad exciting applications. For example, energy devices based on Si nanowire arrays can achieve efficiencies as high as 12% for solar energy conversion. Additionally, Si nanodots and nanowires can serve as efficient photo-catalysts for the redox reactions of organics. This presentation will discuss and highlight our recent works in developing silicon nanostructures for green, high-efficiency, and low-cost solar energy harvesting and catalysis applications.

09:45 – 10:30, Coffee/Tea Break and Group Photo

JSa1A.3 • 10:30 (Plenary)
Nano Etching via Metal-assisted Chemical Etching (MaCE) for Through Silicon Via (TSV) Stacked Chips Application, C. Wong[1,2], Liyi Li[1], Owen Hildreth[3]; *[1]Materials Science and Engineering, George Inst. of Technology, USA; [2]Dept. of Electronic Engineering, Chinese Univ. of Hong Kong, Hong Kong; [3]NIST, USA.* Metal assisted chemical etching (MaCE) is a promising technology for next generation micro- and nano-semiconductor fabrication, where noble metals are used as catalyst to anisotropically etch into bulk materials in solution. In this study, we report the first silicon vias (SV) with sub-100 nm diameter etched by MaCE. The distinct structure of thus fabricated SVs enables the successful copper filling from the bottom of the vias, which is manifested by scanning electron microscope (SEM) and energy dispersive X-ray spectroscope (EDS). The report demonstrates the applicability of nano-scale interconnection in 3D package from the view of fabrication. Also, this novel approach marks the significance in functional filling of semiconductor for nano-photonic devices as well as template-based synthesis of functional nanomaterials.

JSa1A.4 • 11:15 (Plenary)
Engineering Solar Cells using Colloidal Quantum Dots, Andre Labelle[1], Edward H. Sargent[1]; [1]*Department of Electrical and Computer Engineering, Univ. of Toronto, Canada.* We present a review of colloidal quantum dot photovoltaics, emphasizing advancements in the development of device architectures, materials engineering, and mutli-junction configurations in pursuit of high-efficiency, low-cost solar cells for eventual deployment in commercial applications.

12:00 – 13:30, Lunch Break

AOEE Room 1 (WNLO)
13:30 -- 15:00
ASa2A • Solar Cells I
Presider: Guozhong Cao; Univ. of Washington, USA

ASa2A.1 • 13:30 (Invited)
III-V Compound Semiconductor Nanowires for Optoelectronic Applications, Chennupati Jagadish[1]; [1]*Australian National Univ., Australia.* We review various III-V compound semiconductor nanowires grown by metalorganic chemical vapor deposition, mainly focusing on their phase control, optical and structural properties and prototype optically pumped single nanowire lasers.

ASa2A.2 • 14:00 (Invited)
Silicon Nanowire Solar Cells: From Basic Research to Mass Production, Wenzhong Shen[1]; [1]*Shanghai Jiao Tong Univ., China.* Si solar cells have played an extremely important role in the present photovoltaic industry. Modern physics and material research have promoted significantly the application of semiconductor nanostructures in solar cells. In this invited talk, we will present the growth, light trapping and carrier recombination properties of Si nanowires and their two kinds of Si nanowire based solar cell application. The planar Si nanowire array solar cells have been demonstrated for potential increase the efficiency of the crystalline Si solar cells at a low-cost way. We will show under the present industrial manufacture processes the successful suppression of carrier recombination and realization of high performance silicon nanowire based solar cells in large size through the SiO2/SiNx stack passivation via reducing both the Shockley-Reed-Hall recombination and the near-surface Auger recombination.

ASa2A.3 • 14:30 (Invited)
Rational Geometrical Design of Three-dimensional Nanostructures for Efficient Light Harvesting, Zhiyong Fan[1]; [1]*Hong Kong Univ. of Sc. and Tech., Hong Kong.* Three-dimensional (3-D) array of nanostructures have drawn much attention for efficient light harvesting property with a small amount of material compared to their thin film counterparts. In our work the effect of shape, pitch and geometric parameters on absorption of 3-D nanostructure arrays are systematically studied.

AOEE Room 2 (WNLO)
13:30 -- 15:00
ASa2B • Energy Conversion and Storage I
Presider: Samuel Mao; Lawrence Berkeley National Laboratory, USA

ASa2B.1 • 13:30 (Invited)
Graphitic Carbon Materials for Energy Applications, Jun Liu[1], Yuhua Xue[1], Mei Zhang[1,2], Liming Dai[1]; *[1]Department of Macromolecular Science and Engineering, Case Western Reserve Univ., USA; [2]Biomedical Engineering, Case Western Reserve Univ., USA.* In this talk, we will summarize our work on the research and development of graphitic carbon nanomaterials for advanced energy conversion and storage, along with some discussions on challenges and perspectives in this exciting field.

ASa2B.2 • 14:00 (Invited)
Nano-carbon Conductive Films: Fabrication, Processing and Devices, Hui-Ming Cheng[1]; *[1]Shenyang National Laboratory for Materials Science, Inst. of Metal Research, CAS, China.* The fabrication and patterning of CNT and graphene transparent conductive films, and its use as electrodes of electroluminescent devices and organic solar cells are presented. And by using inkjet printing, all-carbon transistors are demonstrated.

ASa2B.3 • 14:30 (Invited)
Advanced carbon-based nanotubes/nanocages for energy conversion and storage: synthesis, performance and mechanism, Zhiyang Lyv[1], Zheng Hu[1]; *[1]Nanjing Univ., China.* A brief introduction to the progressive advancements in our group about the synthesis, performance and mechanism of carbon-based nanotubes/nanocages for energy conversion and storage.

AOEE Poster Area
15:00 -- 16:00
ASa3A • AOEE Poster Session (*includes coffee/tea break*)

ASa3A.01
In situ annealed polymer solar cell by spray coating, Yifan Zheng[1], wei shi[1], Junsheng Yu[1]; *[1]organic photoelectronic laboratory, Univ. of Electronic Science and, China.* Spray coated polymer solar cells by in situ annealing treatment have been fabricated, which bring 12% and 13% enhancement on fill factor and open circuit voltage at low temperature, respectively.

ASa3A.02
Enhanced light extraction in AlInGaN UV light-emitting diodes by embedded AlN/AlGaN distributed Bragg reflector, liu hui[1]; *[1]Wuhan National Laboratory for Optoelectronics, Huazhong Univ. of Science and Technology, China.* High-reflectivity AlN/AlGaN UV distributed Bragg reflector was first proposed to be embedded between the emitting region and the n-GaN layer of the GaN-based AlInGaN UV light-emitting diodes to enhanced the light extraction efficiency.

ASa3A.03
Iodine chemisorbed on Pt(111): A DFT Study, qun liu[1], Ze-Sheng Li[1]; *[1]Beijing Inst. of Technology, China.* The adsorption for I2 on the Pt(111) surface was investigated. The nudged elastic band method was applied to locate transition states. All results show that the dissociative adsorption on surface is more favored.

ASa3A.04
Theoretical investigation on electron transfer between ruthenium dyes and cobalt redox mediators, Zhu-Zhu Sun[1], Ze-Sheng Li[1]; *[1]School of Chemistry, Beijing Inst. of Technology, China.* Semiclassical Marcus theory

combined with density functional theory (DFT) method were performed to study the first-order rate constant of electron transfer in dye regeneration progress for dye-sensitized solar cells

ASa3A.05

Theoretical Studies on Doped Graphene Supported Metal Adatoms as Ttransparent Counter Electrode for Dye-sensitized Solar Cells, Ping-ping Sun[1]; [1]*Beijing Inst. of Technology, China.* Density functional theory (DFT) method was performed to study the activation barrier between iodide and doped graphene supported with metal adatoms on the counter electrode of dye-sensitized solar cells.

ASa3A.06

First-Principles Study of Electronic Structure and Optical Properties of (Zr-Al) Codoped ZnO, Jin-Hua Luo[1], Ze-Sheng Li[1,2]; [1]*School of Chemistry, Beijing Inst. of Technology, China;* [2]*Academy of Fundamental and Interdisciplinary Science, Harbin Inst. of Technology, China.* First-principles calculations is performed to study the electronic structure and optical properties of (Zr-Al) codoped ZnO. The results show that oxygen vacancy introduced by (Zr-Al) codoping can improve the visible-light optical conductivity of ZnO.

ASa3A.07

Theoretical Investigation on Near-IR Phthalocyanine Complexes for Dye-Sensitized Solar Cells, Li-Na Yang[1], Shi-Lu Chen[1], Ze-Sheng Li[1]; [1]*School of Chemistry, Beijing Inst. of Technology, China.* Density functional theory (DFT) and time-dependent DFT have been used to investigate electronic and optical properties of phthalocyanines. It shows that central metal and peripheral ligand both have significant effects on the performance of dyes.

ASa3A.08

Application on RF-exited CO2 Laser's Fuzzy Self-adaptive PI Control algorithm by simulation, Heng Zhao[1]; [1]*College of Optical and Electronic Information, Huazhong Univ. of Science & Technol, China.* A kind of Neural networks Control algorithm has been used for RF-exited CO2 Laser. Through the simulation, the related control parameters are tested and verified. The results verify the good output performances

ASa3A.09

Pyrazine-Based Organic Sensitizers for Highly Efficient and Stable Dye-Sensitized Solar Cells, Xuefeng Lu[1], Gang Zhou[1], Zhong-Sheng Wang[1]; [1]*Fudan Univ., China.* A series of novel pyrazine-based metal-free organic sensitizers have been designed and synthesized for DSSCs. Typically, FNE46 based DSSC with liquid electrolyte displays the highest power conversion efficiency (η) of 8.27%.

ASa3A.10

Varied Alkyl Chain Functionaled Organic Sensitizers Based on Thieno[3,4-c]pyrrole-4,6-dione, Quanyou Feng[1], Gang Zhou[1], Zhong-Sheng Wang[1]; [1]*Fudan Univ., China.* A series of organic sensitizers based on thieno[3,4-c]pyrrole-4,6-dione (FNE38-FNE40) were designed and synthesized through incorporating varied alkyl chain into the pyrrole ring for dye-sensitized solar cells.

ASa3A.11

Theoretical study on aggregation of organic dyes on TiO2 surface in dye-sensitized solar cells, QUANSONG LI[1], Ze-Sheng Li[1]; [1]*School of Chemistry, BEIJING INST. OF TECHNOLOGY, China.* A combined density functional tight-binding (DFTB) and density functional theory (DFT) study was performed on the aggregation of C214 dyes on (TiO2)124 cluster. The aggregation interactions were discussed in terms of structure and optical properties.

ASa3A.12

Thiazolo[5,4-d]thiazole-Based Organic Dyes for Quasi-Solid-State Dye-Sensitized Solar Cells, Weiyi Zhang[1], Quanyou Feng[1], Zhong-Sheng Wang[1], Gang Zhou[1]; [1]*Laboratory of Advanced Materials, FUDAN UNIV., China.* A series of organic dyes containing thiazolo[5,4-d]thiazole moiety (FNE71-FNE74) have been designed and synthesized via introducing different alkoxy chains into the electron donor part of the dye molecules for quasi-solid-state dye-sensitized solar cells.

ASa3A.13

4,8-Dithienylbenzo[1,2-b:4,5-b']dithiophene-Based sensitizers for dye-sensitized solar cells, shenghui jiang[1]; [1]*Laboratory of Advanced Materials, fudan Univ., China.* Two cross-conjugated isomers (I1 and I2) based on 4,8-dithienylbenzo- [1,2-b:4,5-b']dithiophene (DTBDT) have been designed and synthesized for DSSCs. Typically, I2 based DSSC with liquid electrolyte displays the higher power conversion efficiency (η) of 7.0%.

ASa3A.14

Influence of Droplet Diameter on the Surface Morphology of Poly(3-hexylthiophene) Film, wei shi[1]; [1]*Univ. of Electronic Science and Tec, China.* An electrode buffer layer was inserted in organic field-effect transistor (OFET) to tune the diameter of poly(3-hexylthiophene) droplet. The optimized OFET showed a five-fold enhancement of hole mobility due to the enlarged droplet diameter.

ASa3A.15

Highly Efficient Solid-State Dye-Sensitized Solar Cell Based on Hydroxyethyl and Ester Co-functionalized Imidazolium Iodide, Li Juan[1]; [1]*Fudan Univ., China.* A power conversion efficiency of 7.45% has been achieved under the irradiation of simulated AM1.5G solar light (100 mW.cm-2) by the ssDSSC with the hydroxyethyl and ester co-functionalized imidazolium iodide based solid state electrolyte and a metal-free organic dye sensitizer.

ASa3A.16

CdS quantum dots sensitized solar cells made with as- synthesized Cu2ZnSnS4 counter electrodes, Yinghuai Qiang[1], Xiuquan Gu[1]; [1]*China Univ. of Mining and Technolog, China.* Cu2ZnSnS4 (CZTS) thin films have been synthesized for assembly of QD solar cells. Such a cell exhibit a power conversion efficiency of ~0.27 %, which was significantly higher than Pt based one.

ASa3A.17

Electronic structure of different Ga0.5Al0.5As surface from first-principles, Xiaohua Yu[1], Benkang Chang[1], Zhonghao Ge[1]; [1]*Inst. of Electronic Engineering and Opto-Electric Technology, Nanjing Univ. of Science and Technology, China.* Using first-principles plane-wave pseudopotential method, electronic structure of Ga0.5Al0.5As (001), (011) and (111) surfaces are analyzed, result shows that Ga0.5Al0.5As (001)β2(2×4) surface owns the best photoemission properties.

ASa3A.18

A comparable study on structural and optical properties of Cu2ZnSnS4 and Cu2ZnSnSe4 nanocrystallines, Xiuquan Gu[1], Yinghuai Qiang[1]; [1]*Materials Science and Engineering, China Univ. of Mining and Technolog, China.* Kesterite phase Cu2ZnSnS4 (CZTS) and Cu2ZnSnSe4 (CZTSe) NPs have been synthesized by solvothermal routes. Raman analysis showed that both of the samples exhibited a temperature-dependent frequency shift, which was attributed to a 4-phonon damping process.

ASa3A.19

How to Design More Efficient Organic Dyes for Dye-Sensitized Solar Cells? Adding more sp2-Hybridized Nitrogen in the Triphenylamine Donor, Shi-Lu Chen[1], Li-Na Yang[1], Ze-Sheng Li[1]; [1]*School of Chemistry, Beijing Inst. of Technology, China.* In the present paper, we have reported a theoretical design of potential high-efficiency organic dyes with modified triphenylamine donors, using time-dependent density functional theory with the CAM-B3LYP method.

ASa3A.20

Enhance the capacitance of TiO2 nanotube arrays by a facile cathodic reduction process, He Zhou[1], Yanrong Zhang[1]; [1]*Environmental Science Research Inst., Huazhong Univ. of Scienceand Technology, China.*

TiO2 nanotube arrays have been treated with a facile cathodic reduction process to introduce oxygen vacancies. The capacitance of the treated sample is 13 times larger than the pristine TiO2 nanotube arrays.

ASa3A.21
New Spontaneous Conical Emission Phenomena under Femtosecond Laser Pulses, Yin Juanjuan[1], Yu Kan[1], Bao Jiaqi[1]; [1]*Wenhua College,HUST, China.* Theoretical and experimental study of spontaneous parametric conversion in type-I β-barium borate (BBO) crystal was carried out by femtosecond laser pulses, which induced to the generation of new colored conical emission phenomena and second harmonic.

ASa3A.22
Dye aggregates on TiO2 surface in DSSCs: a DFT study, Shuai Feng[1]; [1]*school of chemistry, Beijing Inst. of Technology, China.* The formation of dye aggregates on TiO2 surface plays a prominent role in determining the conversion efficiencies of dye-sensitized solar cells. The aggregation effects can be well described by density functional theory method.

ASa3A.23
solar blind ultraviolet photodetectors based on MgZnO thin films, Zhenzhong ZHANG[1]; [1]*Changchun Inst. of Optics, Fine Mechanics and Physics, China.* Cubic MgZnO thin films were grown by MOCVD. Solar blind ultraviolet photodetectors with metal-semiconductor-metal structure were fabricated based on these thin films. The high responsivity was attributed to photoconductive gain caused by hole trapping.

ASa3A.24
Thickness Dependence of Electrical and Optical Properties of Indium Tin Oxide Film Deposited by Radio Frequency Magnetron Sputtering, Ge Wang[1], Lei Zhao[1], Hongwei Diao[1], Jingwei Chen[1], Baojun Yan[1], Guanghong Wang[1], Wenjing Wang[1]; [1]*Inst. of Electrical Engineering, CAS, China.* Hall, X-ray diffraction and transmission measurements revealed that the carrier concentration and mobility of indium tin oxide film increased due to its microstructure evolution while its thickness enlarged. Burstein-Moss effect led to its bandgap extension

ASa3A.25
Computational study of the Chlorite Dismutase, Shuo Sun[1]; [1]*Beijing Inst. of technology, China.* Using DFT methods to investigate chlorite dismutase (Cld) which can transforms toxic chlorite (ClO2-) into chloride and molecular oxygen (reaction: ClO2- → Cl- + O2).

ASa3A.26
Theoretical Studies on Organic Dyes for Dye-Sensitized Solar Cells, Hongyan Zhou[1]; [1]*Beijing Inst. of Technology, China.* we report a Density Functional Theory (DFT) method study of a series of new organic dyes which are all based on a truxene-based organic dyes-M14.

ASa3A.27
Manganese dioxide nanorod arrays on carbon fabric for flexible solid-state supercapacitors, Minghao Yu[1], Xihong Lu[1], Teng Zhai[1], Yexiang Tong[1]; [1]*School of Chemistry & Chemical Engineering, Sun Yat-sen Univ., China.* We reported the facile synthesis of manganese oxide nanorods (MONRAs) on carbon fabric and their implementation as flexible electrodes for solid-state devices. The fabricated solid-state device exhibited good electrochemical performance

ASa3A.28
An effective way to enhance photoelectrochemical photoactivity and stability of ZnO nanorod arrays by carbon and nitrogen co-treatment, Shilei Xie[1], Xihong Lu[1], Yexiang Tong[1]; [1]*School of Chemistry & Chemical Engineering, Sun Yat-sen Univ., China.* We report the rational synthesis of carbon and nitrogen co-treated ZnO (denoted as CN/ZnO) nanorod arrays with enhanced photocurrent and stability for photoelectrochemical hydrogen evolution.

ASa3A.29

Computational Study of the Properties of Various Redox Electrolytes for Dye Sensitized Solar Cells, Kuiming Zheng[1]; [1]*Beijing Inst. of Technology, China.* Density functional theory (DFT) method was performed to calculate the Gibbs energy difference and reorganization energy of redox electrolytes which show us an easy way to further improvement of the redox couple.

ASa3A.30

MoO2 and PANI/MoO2 Nanocomposites as Anode Materials for Lithium-ion Batteries, Yanyuan Qi[1], Xue Yang[1], Wen Chen[1]; [1]*Wuhan Univ. of Technology, China.* The pristine MoO2 exhibited a reversible discharge capacity of 300 mAh/g density of 0.1 mA/cm2. PANI/MoO2 nanocomposites were obtained and the electrochemical tests demonstrated that the hybrid exhibited enhanced discharge capacity of 530 mAh/g as an anode material for lithium-ion batteries.

ASa3A.31

Reduction of charge recombination by ZnS coating for dye-sensitized solar cells, Hongwei Hu[1], Jianning Ding[1,2], Ningyi Yuan[1,2], Yan Li[1], Li Bai[1], Shuai Zhang[1,2]; [1]*Center for low-dimensional materials, micro-nano devices and system, Changzhou Univ., China;* [2]*Jiangsu Key Laboratory for Solar Cell Materials and Technolgy, China.* The ZnS thin films have been fabricated on the surface of TiO2 nanoparticle electrodes. Results show that ZnS coatings have improved the fill factor of the dye-sensitized solar cells and reduced the recombination rate.

ASa3A.32

Hydrogenated Microcrystalline Silicon Germanium — Promising Infrared Absorber for Multi-junction Solar Cells, Jianjun Zhang[1], Yu Cao[1], Tianwei Li[1], Zhenhua Huang[1], Jun Ma[1], Jian Ni[1], Ying Zhao[1]; [1]*Inst. of Photo-Electronic Thin Film Devices and Technology, Nankai Univ., China.* The properties of μc-Si1-xGex:H thin films and solar cells have been investigated. The results show that the μc-Si1-xGex:H solar cells, which obtain higher Jsc and infrared response than μc-Si:H solar cell, have a great potential as the bottom cell for multi-junction solar cells.

ASa3A.33

Effect of ZnSe Passivation Layer on the Photovoltaic Properties of CuInS2 Quantum Dots Sensitized Solar Cells, Zhuoyin Peng[1], Yueli Liu[1], Yinghan Zhao[1], Wei Shu[1], Keqiang Chen[1], Wen Chen[1]; [1]*Wuhan Univ. of Technology, China.* ZnSe passivation layer onto the CuInS2 quantum dots sensitized solar cells was introduced by the SILAR method. The photovoltaic performance was enhanced and the resistance was lower than without passivation layer or with ZnS layer.

ASa3A.34

Preparation and Characterization of PEG Surfactant V2O5 Nanotubes as Cathode Materials, Reddeppa Nadimicherla[1], Yueli Liu[1], Keqiang Chen[1], Wen Chen[1]; [1]*Wuhan Univ. of Technology, China.* The V2O5 nanotubes and PEG surfactant V2O5 nanotubes were synthesized using simple hydrothermal method. The morphology and microstructure of the samples were investigated by XRD, FTIR, SEM and TEM analysis.

ASa3A.35

Novel magnetically separable composites AgCl/iron oxide with enhanced photocatalytic activity driven by visible light, Ying Zhang[1], Yanrong Zhang[1], Jue Tan[1]; [1]*Environmental Science Research Inst., China.* In this work, we synthesized a composite of AgCl/iron oxide photocatalyst with high efficiency of photocatalytic activity driven by visible light, in addition to being endowed with magnetism for recycle and reuse.

ASa3A.36

TiO2 nanostructure photoanodes for quantum-dot sensitized solar cells, Weiwei Dong[1], Shimao Wang[1], Zanhong Deng[1], Jingzhen Shao[1], Linhua Hu[2], Jun Zhu[2], Xiaodong Fang[1]; [1]*Anhui Inst. of Optics and Fine Mechanics, Chinese Academy of Sciences, China;* [2]*Inst. of plasma physics chinese academy of sciences, Chinese Academy of Sciences, China.* CdSe/CdS semiconductor quantum dots co-sensitized TiO2 nanostructure (nanoflower, nanowire, nanorod, nanotube) photoanodes on Ti substrate were fabricated. Among these different nanostructures, the nanotube based QDSC has the best performance.

ASa3A.37
TiCl4 Modified Single-Crystal Rutile TiO2 Nanorod Arrays for Quantum Dot-Sensitized Solar Cells, Xiaodong Fang[1], Shimao Wang[1], Weiwei Dong[1], Zanhong Deng[1], Jingzhen Shao[1], Linhua Hu[2], Jun Zhu[2]; *[1]Anhui Inst. of Optics and Fine Mechanics, Chinese Academy of Sciences, China; [2]Inst. of Plasma Physics Chinese Academy of Sciences, Chinese Academy of Sciences, China.* TiCl4 modification increased the power conversion efficiency of single-crystal rutile TiO2 nanorod arrays (TNRs) based quantum dot-sensitized solar cells from 0.36% to 1.17%. Vacuum thermal evaporated CuxS counter electrode was introduced for TNRs based QDSCs.

ASa3A.38
Improve the Photovoltage of Dithienopyrrole Dye-Sensitized Solar Cells via Attaching the Bulky Bis(octyloxy)biphenyl Moiety to the Conjugated π-Linker, Min Zhang[1], Peng Wang[1]; *[1]Changchun Inst. of Applied Chemistry, China.* We reported a dithienopyrrole dye featuring the three-dimensional bis(octyloxy)biphenyl segment, which endows a cell with a reduced interfacial charge recombination in comparison with its congener possessing the hexyl substitutent.

ASa3A.39
TiO2 and Carbon Tube in Tube Nanocomposite Arrays for Supercapacitor, gao biao[1], Huo Kai fu[2], Fu Jijiang[1], Chen Rongsheng[1]; *[1]School of Materials and Metallurgy, Wuhan Univ. of Science&Technology, China; [2]Wuhan National Laboratory for Optoelectronics, Huazhong Univ. of Science & Technology, China.* TiO2/C tube in tube nanocomposite was fabricated by anodic oxidization, hydrothermal reaction and successive annealing. This top open nanotube arrays with a conductive carbon layer and order pore structure offer a large effective surface area and a facility channel for electrolyte, which ensures the high capacitance and perfect long ability.

ASa3A.40
Properties of Cu doped Cd1-xZnxTe Films Deposited by Magnetron Sputtering, Lili Wu[1]; *[1]College of Materials &Engineering, Sichuan Univ., China.* A series of Cu doped Cd1-xZnxTe thin films have been deposited on quartz substrates by magnetron co-sputtering and their properties have been investigated. The results demonstrate that copper is an effective dopant for Cd1-xZnxTe films.

ASa3A.41
Efficient Light Harvesting and Application of TiO2 Microspheres in Dye-sensitized Solar Cells, Songyun Dai[1], Linhua Hu[1]; *[1]Key Lab of Novel Thin Film Solar Cells, China.* The nanoporous spheres in the wide diameter range displayed the high abilities of scattering light efficiently from 400 nm to 800 nm and of dye adsorption with large surface area.

ASa3A.42
Effects of Different Acceptors in Triphenylamine-based Organic Dye-sensitized Solar Cells, Guohua Wu[1], Songyun Dai[1]; *[1]Key Lab of Novel Thin Film Solar Cells, China.* Two organic dyes (TPA1 and TPA2) containing triphenylamine as the electron donor and cyanoacrylic acid or rhodanine-3-acetic acid as the electron acceptor were synthesized.

ASa3A.43
Cu2ZnSnS4 film fabricated by nanocrystal-ink coating approach and its photoelectric conversion property, Ening Gu[1], Chang Yan[1], Fangyang Liu[1], Yanqing Lai[1], Jie Li[1], Yexiang Liu[1]; *[1]School of Metallurgical Science and Engineering, Central South Univ., China.* Cu2ZnSnS4(CZTS) nanocrystals synthesized by hot-injection method were utilized to fabricate kesterite thin film with nanocrystal-ink coating approach. Corresponding photovoltaic device achieves a power conversion efficiency of 2.29%.

ASa3A.44
Effect of Adsorbed Cations on Microcosmic Performances in Dye-Sensitized Solar Cells, Dongxing Kou[1], Songyun Dai[1]; [1]*Key Lab of Novel Thin Film Solar Cells, China.* A further investigation about the effect of imidazolium cations on electron transport and recombination behavior in dye-sensitized solar cells (DSCs) is developed in this paper.

ASa3A.45
Optimal design of the laser communication optical system, Peipei Yan, Wenji Shi, Hengjin Zhang; [1]*The Photoelectric Measurement and Control Technology Research Department, Xi'an Inst. of Optics and Precision Mechanics, Chinese Academy Science, China.* a design of a laser communication optical system with high transmitting and receiving performance is given. It has an unobscured eccentric-pupil Cassegrain antenna, so the efficiency of transmitting power and receiving power were improved effectively.

ASa3A.46
Theoretical Design and Screening of Porphyrin, Phthalocyanine and Bipyridyl Ruteniunm Complex Sensitizers for Dye-sensitized Solar Cells, Xianxi Zhang[1]; [1]*Liaocheng Univ., China.* Series of porphyrin, phthalocyanine and bipyridyl ruthenium complex sensitizers are designed and screened for dye-sensitized solar cells using density functional calculations. Some promising candidates with good photon-to-current conversion performances are proposed.

ASa3A.47
Effect of Electrolyte on the Morphology and Photocatalytic Properties of TiO2 Nanotube Arrays, Jingjing Du[1], Junwei Zhao[1]; [1]*Ningbo Univ. of Technology, China.* TiO2 nanotube arrays with controllable lengths (500 nm, 1μm, 10 μm) were prepared in different electrolytes. The photocatalytic results showed that the 1-μm-long nanotube array had remarkable degradation efficiency.

ASa3A.48
Cu2ZnSnS4 solar cells prepared with sulphurized sol-gel precursor thin films, Fangyang Liu[1]; [1]*School of Metallurgical Science and Engineering, Central South Univ., China.* The solar cell light absorber Cu2ZnSnS4(CZTS) thin films were prepared by annealing precursor thin film in a sulfur atmosphere at 560°C based on sol-gel method. Thin film solar cells with a structure of Ag/ZnO:Al/i-ZnO/CdS/CZTS/Mo/SLG were tentatively fabricated and examined.

ASa3A.49
The Application of Molecular Metal Chalcogenide Complexes in Semiconductor Sensitized Solar Cells, Jun Zhu[1]; [1]*Inst. of Plasma Physics, China.* The molecular metal chalcogenide complexes were demonstrated to have a wide application in semiconductor sensitized solar cells. They were used as the precursors of the semiconductor and the counter electrode material respectively.

ASa3A.50
High-Efficiency Hybrid Solar Cells Based on Polymer/PbSxSe1-x Nanocrystals Benefiting from Vertical Phase Segregation, zeke liu[1], Yaxiang Sun[1], Yuan Jianyu[1], Wanli Ma[1]; [1]*Funsom/Soochow Univ., China.* Vertical donor-donor/acceptor-acceptor structured hybrid solar cells employing a low band-gap polymer/PbSxSe1-x alloy nanocrystals (NCs) have been demonstrated with a record high power conversion efficiency (PCE) of 5.50% and a large fill factor of 67%.

ASa3A.51
Fabrication and Raman spectra of bilayer graphene, Shisheng Lin[1]; [1]*Zhejiang Univ., China.* Single crystal bilayer graphene (BLG) and large area (larger than 8cm*5cm) have been fabricated by microcleavage and chemical vapor deposition method, respectively. Raman spectra of the BLG have been systematically investigated.

ASa3A.52

Reflective low-side-band color filters by bilayer metallic nanowire gratings on silicon substrates, Yang Liu[2,1]; [1]*Department of Electronic Engineer, Shanghaijiaotong Univ., China;* [2]*Zhiyuan College, Shanghai Jiao Tong Univesity, China.* bilayer metallic nanowire gratings on silicon substrates were fabricated by nano-imprinting and E-beam evaporator. With lateral surface plasmon resonance, there is single low-side-band peak for TM reflection, while most of the TE light is reflected.

ASa3A.53

Incident angle dependent color filter and polarizer by comprehensive surface plasmon resonances on bilayer silver nanowire gratings, ma yongqian[1,2]; [1]*Zhiyuan College, Shanghai Jiao Tong Univ., China;* [2]*Department of Electronic Engineer, Shanghai Jiao Tong Univ., China.* a two-dimension bilayer silver nanowire grating on glass structure was fabricated by interference lithography and E-beam evaporator. Color filter and polarizer effects based on surface plasmon resonances were measured and analyzed.

ASa3A.54

Multi-excitation of photoluminescence in hydrogenated amorphous Si-rich carbide films prepared by PECVD, guozhi wen[1,2], Xiangbin Zeng[1,2], Wugang Liao[1,2], Chenchen Cao[1,2]; [1]*School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China;* [2]*School of electronic and electrical engineering, Wuhan Polytechnic Univ., 68 South Road, China.* Room-temperature photoluminescence of hydrogenated amorphous Si-rich carbide thin films is investigated. Analyses reveal that there are multi-excitations, the shift of the spectrum is attributed to quantum confinement effects of the silicon QDs.

ASa3A.55

High-Performance Top-Gated Monolayer SnS2 Field-Effect Transistors, Liang Wang[1], Liang Gao[1], Haisheng Song[1]; [1]*Wuhan National Lab for Optoelectronics, China.* Here we report the fabrication of high-performance top-gated field-effect transistors (FETs) from monolayer tin disulfide (SnS2). The carrier mobility of our devices reaches 50 cm2/Vs comparable or higher than that of MoS2 counterparts (15-55 cm2/Vs).

ASa3A.56

Research on Meteorological Forest Fire Danger Index Stain Figure Interpolation Algorithm, fu jia[1]; [1]*Meteorological Service Center of Hubei Province, China.* Abstract:The requirements of high accuracy meteorological forest fire danger index stain map production, in the analysis of the various types of interpolation algorithm based on the method of optimization algorithms based ANUDEM on ANUDEM interpolation algorithm key technologiesthe issues were discussed in detail,

ASa3A.57

Light extraction enhancement of GaN light-emitting diodes with ZnO micro-meshes pattern, ZhengMao Yin[1], Xiaoyan Liu[1,2], Yongzhong Wu[1], Xiaopeng Hao[1], Xiangang Xu[1,2]; [1]*Shandong Univ., China;* [2]*ShanDong Inspur HuaGuang Optoelectronics Co., LTD, China.* To improve the light extraction of GaN light-emitting diodes, we fabricated ZnO micro-meshes pattern (MM) by photolithography and chemical deposition. ZnO MM can increase light output power by 42% attributed to light waveguide and diffraction-grating effect.

ASa3A.58

Dye-sensitized Solar Cells Based on P-type Delafossite Structure Nanocrystals of CuCrO2 and CuGaO2, Dehua Xiong[1], Zhen Xu[1], Wenjun Zhang[1], Xianwei Zeng[1], Liqun Ming[1], Wei Chen[1]; [1]*Wuhan National Lab for Optoelectronics, Huazhong Univ. of Science and Technology, China.* We present ultrasmall delafossites CuCrO2 (CuCr0.9Mg0.1O2) nanocrytals and CuGaO2 nanoplates by hydrothermal synthesis, and their first applications as photocathodes in p-type DSSCs, these delafossites nanocrystal alternative to NiO nanoparticles in efficient p-type DSSCs.

AOEE Room 1 (WNLO)
16:00 -- 17:55
ASa4A • Solar Cells II
Presider: To Be Announced

ASa4A.1 • 16:00 (Invited)
CdS/CdSe Quantum Dot Co-sensitized SolarCells, Jianjun Tian[1,2], Guozhong Cao[1]; *[1]Materials Science and Engineering, Univ. of Washington, USA; [2]Inst. of Advanced Materials Technology, Univ. of Science and Technology Beijing, China.* CdS/CdSe quantum dots co-sensitized solar cells were prepared by combining the successive ion layer absorption and reaction (SILAR) method and chemical bath deposition (CBD) method for the fabrication of CdS and CdSe quantum dots, respectively.

ASa4A.2 • 16:30 (OSA Invited)
Nanostructure Photovoltaics Based on III-V Compound Semiconductors, Lan Fu[1]; *[1]Electronic Materials Engineering, The Australian National Univ., Australia.* In this work, solar cells based on III-V compound semiconductor quantum dots and nanowires are demonstrated. Experimental results based on material and device studies will be presented and discussed for high efficiency photovoltaic applications.

ASa4A.3 • 17:00 (Invited)
Co and Ti Hyperdoped Si: the Possible Intermediate Material for PV Application, Yurong Zhou[1], Fengzhen Liu[1], Meifang Zhu[1]; *[1]Univ. of Chinese Academy of Science, China.* The formation of an intermediate band originated from the Ti or Co deep levels in Si has been observed.

ASa4A.4 • 17:20 (Invited)
Triple-junction P-I-N and N-I-P Type Thin Film Silicon Solar Cells Based on High-rate Microcrystalline Silicon, xiaodan Zhang[1,2], Lisha Bai[1,2], Qian Huang[1,2], Ying Zhao[1,2]; *[1]Inst. of Photoelectronics Thin Film Devices and Technique, Nankai Univ., China; [2]Tianjin Key Laboratory of Photoelectronic Thin Film Devices and Technique, China.* We have developed the a-Si/a-SiGe/μc-Si triple-junction p-i-n and n-i-p solar cells with around 13% initial conversion efficiency by incorporating device-quality intrinsic hydrogenated microcrystalline silicon (μc-Si:H) thin films under a high deposition rate of above 1.5nm/s.

ASa4A.5 • 17:40
Research & Development of Thin-Film Silicon Single- and Muli-junction Solar Cells on Stainless Steel Flexible Substrate, Guofu Hou[1]; *[1]Nankai Univ., China.* Our recent R&D works on how to improve conversion efficiency for n-i-p type a-Si/a-SiGe/μc-Si triple-junction solar cell on stainless steel flexible substrate are summarized in this paper. We have obtained initial efficiencies of 13.09% for a-Si/a-SiGe/μc-Si triple-junction cell.

AOEE Room 2 (WNLO)
16:00 -- 18:00
ASa4B • Energy Conversion and Storage II
Presider: Yunhui Huang, *Huazhong University of Science and Technology, China*

ASa4B.1 • 16:00 (Invited)
Interfacing and Assembling Nanomaterials for Efficient Energy Generation and Storage, Shihe Yang[1]; *[1]HKUST, Hong Kong.* In this contribution, I will present some of our recent results in interfacing and assembling different nanostructures down to molecular levels, as well as using the resulting architectures for energy generation and storage.

ASa4B.2 • 16:30 (Invited)
Application of nanomaterials and nanostructures in fuel cells, Zhiyong Tang[1]; [1]*Natl Ctr for Nanoscience and Technology, China.* Nanomaterials and nanostructures with less utilization of noble metal have been fabricated toward improvement of the efficiency of oxygen reduction and fuel oxidation reactions.

ASa4B.3 • 17:00 (Invited)
Electrochemical Nanowire Devices for Energy Storage, Liqiang Mai[1], Chaojiang Niu[1], Lin Xu[1], Xu Xu[1], Yunlong Zhao[1], Qingyou An[1]; [1]*Wuhan Univ. of Technology, China.* One-dimensional nanomaterials have offered a range of unique advantages in many energy related fields, such as a short Li-ion insertion/extraction distance, facile strain relaxation upon electrochemical cycling, enhanced electron transport, and very large surface to volume ratio, so nanowire has became popular and attracted increasing interest. We designed the single nanowire electrochemical device for in situ probing the direct relationship between electrical transport, structure, and electrochemical properties of the single nanowire electrode to understand intrinsic reason of capacity fading

ASa4B.4 • 17:30 (OSA Invited)
Designing Semiconductor Metal Oxides for Photoelectrochemical Energy Conversion, Lianzhou Wang[1]; [1]*Univ. of Queensland, Australia.* Innovative materials hold the key for renewable energy conversion. In this talk, we will introduce our recent progress in semiconducting metal oxides, which underpin a number of applications including solar cells and solar fuel production.

Sunday, 26 May

AOEE Room 1 (WNLO)
08:00 -- 10:00
ASu1A • Solar Cells III
Presider: Shuzi Hayase; Kyushu Inst. of Technology, Japan

ASu1A.1 • 08:00 (OSA Invited)
Intermediate Band Solar Cells: Promises and Reality, Mario Dagenais[1], Tian Li[1], Yang Zhang[1], Robert Bartolo[1]; [1]*Dept of Electrical Engineering, Univ. of College Park, Maryland, USA.* Recent efforts on quantum dot based intermediate band solar cell in GaAs are presented. Near record conversion efficiency for an intermediate band GaAs solar cell is measured, but this conversion efficiency is still lower than the one obtained for bulk GaAs. External quantum efficiency measurements shed some light on the reasons for getting a lower efficiency in intermediate band solar cells. A discussion of other works in this area is presented and new promising directions are defined.

ASu1A.2 • 08:30 (OSA Invited)
Novel Functional Materials for Highly Efficient Dye-sensitized Solar Cells, Eric Diau[1]; [1]*National Chiao Tung Univ., Taiwan.* I will present in this lecture a systematic approach to fabricate highly efficient dye-sensitized solar cells based on a series of heteroleptic ruthenium complexes and varied types of TiO2 nanostructures.

ASu1A.3 • 09:00 (Invited)
Efficient Electrocatalysts for Dye-Sensitized Solar Cells, Zhong-Sheng Wang[1]; [1]*Fudan Univ., China.* Cathode materials play a crucial role in dye-sensitized solar cells (DSSCs). Herein we present the applications of graphene based composites, conductive polymers and metal selenides in DSSCs as the cathode.

ASu1A.4 • 09:20 (Invited)
The effects of various anchoring groups on optical and electronic properties of dyes in dye-sensitized solar cells, Ze-Sheng Li[1], Li-Na Yang[1]; [1]*School of Chemistry, Beijing Inst. of Technology, China.* In the present paper, using density functional theory (DFT) and time-dependent DFT, we have investigated two sets of dyes with various anchoring groups, such as biscarbodithiolic acid, sulfonic acid, phosphonic acid, and hydroxamic acid.

ASu1A.5 • 09:40 (Invited)
Bandgap-Graded CdSxSe1-x Nanowires for High-Performance Solar Cells, Liang Li[1], Limin Tong[2], yoshio Bando[3]; [1]*Soochow Univ., China;* [2]*Zhejiang Univ., China;* [3]*National Inst. for Materials Science, Japan.* CdSxSe1-x nanowires with a graded bandgap along the length direction were utilized for Schottky junction solar cells. This novel type of nanowires suggests promising optoelectronic applications in the future.

AOEE Room 2 (WNLO)
08:00 -- 10:00
ASu1B • Energy Conversion and Storage III
Presider: Liming Dai; Case Western Reserve Univ., USA

ASu1B.1 • 08:00 (OSA Invited)
Perspectives of Solar-Driven Hydrogen Production, Samuel Mao[1]; [1]*Lawrence Berkeley National Laboratory, USA.* This presentation will provide an overview of recent progress in solar-driven photocatalytic and photoelectrochemical production of hydrogen. The emphasis will be surface and interface engineering that could improve solar absorption and charge transport.

ASu1B.2 • 08:30 (OSA Invited)
Investigation of Doping C60 with Metal Oxide, Yongli Gao[1]; [1]*Department of Physics and Astronomy, Univ. of Rochester, USA.* Fullerene (C60) has been used extensively as an acceptor material in organic photovoltaic (OPV) cells. Other applications including n-channel organic thin film transistors (OTFT) and C60 based organic superconductors have been reported more than a decade ago. Ordinarily C60 behaves as a strongly n-type organic semiconductor with the lowest unoccupied molecular orbital (LUMO) close to the Fermi level. We have investigated p-doping of C60 with molybdenum oxide (MoOx) with ultra-violet photoemission spectroscopy (UPS), inverse photoemission spectroscopy (IPES) and atomic force microscopy (AFM).

ASu1B.3 • 09:00 (Invited)
Suppressing Far-field Plasmonic Irradiation for Molecule Detection: From Gap Confinement to Energy Management, Lihua Qian[1], Juan Li[1]; [1]*School of Physics, Huazhong Univ. of Sci. and Tech., China.* Surface enhanced Raman scattering is considered to a powerful analytic tool for footprint detection of fluorescence molecules, whose mechanism is based on hugely enhanced electromagnetic field near the surface of plasmonic nanostructures resulted from the excitation of surface plasmon.

ASu1B.4 • 09:20 (Invited)
Colloidal I-III-VI Semiconductor Nanocrystals for Light-emitting and Display Applications, Haizheng Zhong[1], Bingkun Chen[1], Zelong Bai[1], Bingsuo Zou[2]; [1]*School of Materials Science & Engineering, Beijing Inst. of Technology, China;* [2]*Micro Nano Technology Center, Beijing Inst. of Technology, China.* Colloidal semiconductor nanocrysals are emerging new generation luminescent materials for light-emitting and display technologies. We here report the recent developments and applications of CuInS2 based nanocrystals for light-emitting and display technologies.

ASu1B.5 • 09:40
Synthesis and Electrochemical Properties of Mesoporous VO_x@Carbon Composites, Chunxia Zhao[1], Jinqiao Cao[1], Wen Chen[1]; [1]*School of Materials Science and Engineering, Wuhan Univ. of Technology, China.* Mesoporous VO_x@carbon composites were synthesized via ultrasound-assistant impregnation method with mesoporous carbon C-FDU15 as the host. The composites with 32.26 wt% V_2O_5 loading yield the best capacitance (128 F/g) in 1 mol/L KNO_3 electrolyte.

AOEE Room 3 (WNLO)
08:00 -- 10:00
ASu1C • Printed Electronics I
Presider: Yanlin Song; Inst. of Chemistry, Chinese Academy, China

ASu1C.1 • 08:00 (Invited)
Printed Transparent Conductive Substrates for Organic Opto-electronic Applications, Zheng Cui[1]; [1]*Suzhou Inst. of Nano-tech & Nano-bionics, China.* A new printing technique has been developed to make transparent conductive substrates which are better than sputtered ITO substrates in terms of conductivity, control of transparency, fabrication complexity and cost.

ASu1C.2 • 08:30 (Invited)
Printing of Flexible Solar Cells, Yi-Bing Cheng[1]; [1]*Monash Univ., Australia.* Bulk HeteroJunction and Dye Sensitized Solar Cell modules can be printed on ITO coated plastic substrates by continuous printing techniques. This presentation will introduce some R&D activities of the Victorian Organic Solar Cell Consortium, Australia in this area.

ASu1C.3 • 09:00 (Invited)
jetDesigner Printed Micro-electronics Professional Software Kit, Jun Qian[1]; [1]*Wuhan Univ., China.* In order to provide an integrated CAD environment with necessary technology and functions of printed electronic product development, we develop a jetDesigner professional software kit, which designed for product automatic designation in printed micro-electronics.

ASu1C.4 • 09:20 (Invited)
Nano Metal Preparation & Application on PE, Mo Lixin[1], Li Yaling[1], Li Weiwei[1], Ran Jun[1], Li Wenbo[1], Fu Jilan[1], Li Luhai[1]; [1]*Beijing Inst. of Graphic Communications, China.* To reach the practical application of printable electronics based on the comparing of organic and inorganic nano conductive materials, high concentration nano metal such as silver, copper and their gravure or ink jet ink was prepared. The RFID antenna was printed with gravure printing and the packaging RFID was identified.

ASu1C.5 • 09:40 (Invited)
Molecular Template Growth and its Applications in Organic Optoelectronics, Junliang Yang[1]; [1]*Inst. of Super Microstructure and Ultrafast Process, School of Physics and Electronics, Centra South Univ., China.* Molecular template growth is a facile method to fabricate high-quality organic semiconductor thin films with controllable properties, which can dramatically improve the performance of the OFETs, OPVs as well as other organic devices.

10:00 – 10:20, Coffee/Tea Break

AOEE Room 1 (WNLO)
10:20 -- 12:00
ASu2A • Solar Cells IV
Presider: Mario Dagenais; Univ. of College Park, Maryland, USA

ASu2A.1 • 10:20 (Invited)
The Way towards Commercialization of Dye Sensitized Solar Cells, Songyuan Dai[1]; [1]*Chinese Academy of Sciences, China.* In this paper, the development of PV was introduced at first. The way towards commercialization of dye-sensitized solar cells and what we have done about this was discussed in detail.

ASu2A.2 • 10:50 (OSA Invited)
Highly Efficient Dye-Sensitized Solar Cells, Liyuan Han[1]; [1]*Photovoltaic Materials Unit, National Inst. for Materials Science, Japan.* Dye-sensitized solar cells (DSCs) are promising next-generation alternatives to conventional silicon-based photovoltaic devices owing to their low manufacture cost. In this presentation, we will discuss the strategy for improving η of DSCs.

ASu2A.3 • 11:20 (Invited)
Efficient Hybrid Solar Cells Based on Conjugated Polymer: PbSxSe1-x Nanocrystal Composites---Benefiting from Vertical Phase Segregation, Wanli Ma[1], zeke liu[1], Yaxiang Sun[1], Jianyu Yuan[1]; [1]*Inst. of Functional Nano & Soft Materials (FUNSOM), China.* Hybrid solar cells employing polymer and PbSxSe1-x nanocrystals have been demonstrated with a record high power conversion efficiency of 5.50% and a large fill factor of 67%, benefiting from the self-assembled vertical phase segregation structure.

ASu2A.4 • 11:40 (Invited)
Hierarchical Nanostructured photoanodes for Efficient Dye-sensitized Solar Cells, Wu-Qiang Wu[1], Jin-Yun Liao[1], Yu-Fen Wang[1], Daibin Kuang[1]; [1]*Sun Yat-Sen Univ., China.* Hierarchical TiO2, ZnO, SnO2 and Zn2SnO4 photoelectrodes have been prepared and shown significant photovoltaic performance in dye (quantum dot)-sensitized soalr cells. The electron transport and recombination of the solar cells have been investigated in detail.

AOEE Room 2 (WNLO)
10:20 -- 12:05
ASu2B • Solar Cells V
Presider: Eric Diau; National Chiao Tung Univ., Taiwan

ASu2B.1 • 10:20 (OSA Invited)
{001} Faceted Anatase Titanium Dioxide Crystals Photoanode for Solar Cells and Photocatalysis, Huijun Zhao[1,2]; [1]*Centre for Clean Environment and Enery, Griffith Univ., Australia;* [2]*Centre for Environment and Energy Nanomaterials, Inst. of Solid State Physics, China.* This work describes the fabrication of photoanode via liquid and vapor phase hydrothermal methods to directly grow the {001} faceted anatase titanium dioxide crystals on to a conducting substrate for solar cells and photocatalysis applications.

ASu2B.2 • 10:50 (OSA Invited)
Secure & Efficient DSSC with Nano-clay Electrolyte, *Satoshi Uchida[1], Takaya Kubo[2] and Hiroshi Segawa[2];* [1]*Komaba Organization for Educational Excellence College of Arts and Sciences (KOMEX), The University of Tokyo, Japan;* [2]*Research Center for Advanced Science and Technology (RCAST), The University of Tokyo, Japan.* The artificial nano-clay powder was newly examined as a gelator of electrolyte of quasi-solid-state dye-sensitized solar cell (DSSC). The DSSC with nano-clay electrolyte (10 wt%) was successfully showed a high photoelectric conversion efficiency of 10.3%.

ASu2B.3 • 11:20 (Invited)
Bifunctional Highly Uniform Core/double-shell Structured B-NaYF4:Er3+, Yb3+ @ SiO2@TiO2 Hexagonal Submicroprisms Upconversion Nanoparticles for High-performance Dye Sensitized Solar Cells, Xingzhong Zhao[1]; [1]*Wuhan Univ., China.* We designed a highly uniform core double-shell (CDS) structure consisting of -NaYF4:Er3+,Yb3+ crystal as core (~400 nm in diameter and ~470 nm in height), amorphous SiO2 as inner shell (~10 nm in thickness), and interconnected anatase TiO2 grains as outer shell (~30 nm in thickness). For device application, various amount of these hexagonal submicroprisms (HSMs) were introduced into TiO2nanoparticles (20-40 nm in diameter) to form a bifunctional nano-submicron composite (NSMC) layer upon a prior prepared transparent TiO2 layer. By utilization of these efficient -

NaYF4:Er3+,Yb3+ upconversion cores, near-infrared irradiation can be absorbed and harvested indirectly by dye molecules to broaden the absorption region and produce more electrons. Owing to the excellent insulating properties, SiO2 shell creates a perfect electrical isolation for the UCP cores. Through this method, the problem of electron trapping and capture caused by ligands and defects on the surface of NaYF4:Er3+, Yb3+ crystals can be thoroughly overcome. However, employment of this submicron sized composites can seriously reduce the internal surface area, leading to a less amount of dye loading. By coating of the outer TiO2 shell, the disadvantage of SiO2 shell can be avoided to the utmost extent. Computer simulation results have shown that scattering of 10-25 nm TiO2particles is negligible and effective Mie scatterers are those particles whose dimensions are comparable to the wavelength of light. With the increasing of mixing amount of these submicron sized HSMs, these bifunctional layers become white gradually, indicating their significant scattering effect of incident light. It is experimentally damostrated that performance of DSCs can be effectively enhanced by employing these bifunctional highly uniform core/double-shell(CDS) structure in the photoelectrodes, an efficiency of 8.65% was obtained, which is 120% higher than the device based on bare NaYF4:Er3+,Yb3+ employed photoelectrode.

Su2B.4 • 11:50
Novel textured glass substrate with high light trapping capacity for thin film Si solar cells application, Yanfeng Wang[1], xiaodan Zhang[1], Lisha Bai[1], Qian Huang[1], Changchun Wei[1], Ying Zhao[1]; *[1]Inst. of Photo-eletronic Thin Film Devices and Technique of Nankai Univ., China.* A novel large feature size crater like glass substrate was proposed in this paper. P-i-n type microcrystalline silicon film solar cell with higher external quantum efficiency was achieved based on this novel substrate.

AOEE Room 3 (WNLO)
10:20 -- 11:55
ASu2C • Printed Electronics II
Presider: Zheng Cui; Suzhou Inst. of Nano-tech & Nano-bionics, China

ASu2C.1 • 10:20 (OSA Invited)
Flexible transparent conductive oxide-less cylinder dye-sensitized solar cells, Jun Usagawa[1], Shyam Pandey[1], Yuhei Ogomi[1], Shuzi Hayase[1]; *[1]Kyushu Inst. of Technology, Japan.* Dye sensitized solar cells which does not need transparent conductive oxide layered glass (TCO-less DSCs) are reviewed. Especially, flexible cylinder TCO-less DSCs with 5.1% efficiency is focused on.

ASu2C.2 • 10:50 (Invited)
Fabrication and Applications of Nanoparticles, Yanlin Song[1]; *[1]Inst. of Chemistry, Chinese Academy, China.* Based on preparation of polymer or inorganic nanoparticles, we achieved the green printing applications in large-scale functional photonic crystals fabrication, green platemaking and print electronics.

ASu2C.3 • 11:20
Flexible NO2 Sensors Based on Colloidal Quantum Dots for Room-Temperature Detection, Huan Liu[1], Min Li[1], Long Hu[1], Jugang He[1], Jiang Tang[2]; *[1]School of Optical and Electronic Information, China; [2]Wuhan National Lab for Optoelectronics, China.* A room-temperature, sensitive (down to 1ppm), fast (few seconds), fully recyclable and stable NO2 gas sensors was constructed on flexible substrates using PbS colloidal quantum dots.

ASu2C.4 • 11:40
Triple-junction P-I-N and N-I-P Type Thin Film Silicon Solar Cells Based on High-rate Microcrystalline Silicon, xiaodan Zhang[1,2], Lisha Bai[1,2], Qian Huang[1,2], Ying Zhao[1,2]; *[1]Inst. of Photoelectronics Thin Film*

Devices and Technique, Nankai Univ., China; [2]Tianjin Key Laboratory of Photoelectronic Thin Film Devices and Technique, Nankai Univ., China. We have developed the a-Si/a-SiGe/μc-Si triple-junction p-i-n and n-i-p solar cells with around 13% initial conversion efficiency by incorporating device-quality intrinsic hydrogenated microcrystalline silicon (μc-Si:H) thin films under a high deposition rate of above 1.5nm/s.

12:00 – 13:30, Lunch Break

AOEE Room 1 (WNLO)
13:30 -- 15:55
ASu3A • Solar Cells VI
Presiders: Wanli Ma; Soochow Univ., Taiwan; co-presider to be announced

ASu3A.1 • 13:30 (Invited)
Dye-sensitized Solar Cells from Fundamental Research to Application, Tingli Ma[1], Yantao Shi[1], Liang Wang[1], Huawei Zhou[1], Jiahao Gao[1]; *[1]Dalian Univ. of Technology, China.* In this paper, we will report the recent progress in improvement of efficiency and reduction of cost of DSCs. In particular, the preparation of high-performance DSC materials and the fabrication of quasi-solid and all-solid large-sized DSCs based on rigid and flexible substrates will be presented.

ASu3A.2 • 14:00 (Invited)
Current status and future prospects of kesterite CZTS thin film solar cells, Yanqing Lai[1], Fangyang Liu[1], Zhenghua Su[1]; *[1]Central South Univ., China.* This report reviews preparation and efficiency improvement techniques for CZTS solar cells. Some work on CZTS solar cells of our group is also present in this report.

ASu3A.3 • 14:30 (Invited)
Conjugated Oligothiophenes with Increased Molecular Dimensionality for Organic Electronics, Changqi Ma[1,2], Peter Bauerle[2]; *[1]Printed Electronics Research Center, Suzhou Inst of Nano-Tech and Nano-Bionic, China; [2]Inst. of Organic Chemistry II and Advanced Materials, Ulm Univ., Germany.* Conjugated oligothiophenes have been widely investigated for their used in organic electronics[1]. Among them, structurely planar molecules, molecules attracted much more attentions for their better charge transport abilities. Recently, conjugated molecules with increased molecular dimensionality, such as X-shaped[2], star-shaped[3] as well as dendritic structures[4] have been reported for use in organic electronics. In this contribution, we will present the latest results of our research group in developing novel three dimensional conjugated oligothiophenes for applications in bulk heterojunction solar cells. By using our recent developed synthetic strategy, 3D all-thiophene dendrimers with different repeating units were successfully synthesized. Functionalizations of these dendritic oligothiophenes at core-, periphery- and/or arm-positions with various optically or redox-active groups were also achieved in order to increase the functionalities of the thiophene dendrimers.

ASu3A.4 • 14:50 (Invited)
Determination of conduction band shift and recombination parameters in dye-sensitized solar cells by a new strategy, shi yushuai[1,2], Xiandui Dong[1]; *[1]Engineering Laboratory for Modern Analytical Techniques, State Key Laboratory of Electroanalytical Chemistry, Changchun Inst. of Applied Chemistry, China; [2]Graduate School, Chinese Academy of Sciences, China.* A new research strategy based on steady-state short-circuit current density versus open-circuit voltage and transient photovoltage decays for determining the conduction band shift and charge recombination was proposed.

ASu3A.5 • 15:10
Structure, Energy level and Morphology Modulations for Obtaining Efficient Polymer/PbS Hybrid Solar Cells via Molecular Engineering, Jianyu Yuan[1], Aidan Gallagher[1], Zeke Liu[1], Yaxiang Sun[1], Wanli Ma[1]; [1]*Soochow Univ., FUNSOM, China.* Polymer/PbS nanocrystal hybrid solar cells were fabricated using a series of new polymers and a high PCE of 4.20% was achieved. The correlation between polymer properties, film morphology and device performance were systematically examined.

ASu3A.6 • 15:25
Preparation of High-performance Single-junction Hydrogenated Amorphous Silicon Germanium Solar Cells, Baojun Yan[1], Lei Zhao[1], Guanghong Wang[1], Hongwei Diao[1], Ge Wang[1], Jingwei Chen[1], Wenjing Wang[1]; [1]*Inst. of Electrical Engineering, CAS, China.* The a-Si:H buffer layer at p/i interface and the annealing treatment were introduced to improve the performance of the single-junction a-SiGe:H solar cell on glass. After optimization, the conversion efficiency of 6.76% was obtained.

ASu3A.7 • 15:40
High Efficiency Amorphous Silicon-Germanium Thin Film Solar Cells Using Band Gap Grading, Bofei Liu[1], Lisha Bai[1], Jian Ni[1], Changchun Wei[1], Ying Zhao[1], xiaodan Zhang[1]; [1]*Inst. Of Photoelectronics, NanKai Univ., China.* With proper band gap profile along the film growth direction, single junction solar cell with initial efficiency of 9.07% and a-Si:H/a-SiGe:H tandem cells of 12.03% efficiency.

AOEE Room 2 (WNLO)
13:30 -- 16:05
ASu3B • Energy Conversion and Storage IV
Presiders: Yongli Gao; Univ. of Rochester, USA; co-presider to be announced

ASu3B.1 • 13:30 (Invited)
Graphene/metal Oxide Nanocomposites for Li-ion Batteries, Junfei Liang[1], Lidong Li[1], Lin Guo[1]; [1]*Beihang Univ., China.* Our work focuses on preparing the graphene/metal oxide nanocomposites by facile methold and exploring the graphene/metal oxide composites with unique structural or compositions for specific applications.

ASu3B.2 • 14:00 (Invited)
Nanoarchitecture of Electrode Materials for Lithium-Ion Batteries with High Capacity, Yunhui Huang[1], Xian-Luo Hu[1], Wu-Xing Zhang[1], Li-Xia Yuan[1]; [1]*Huazhong Univ. of Science and Tech., China.* Rechargeable lithium-ion batteries (LIBs) are now used extensively for portable electronic devices and they are emerging in electric vehicle market as well as in many other applications. The ever-increasing demand has sparked research efforts in developing LIBs with high voltage, high power and long cycle life. There is great interest in developing novel high-performance electrode materials for lithium-ion batteries, which is of great importance for the next generation LIBs. We have been designed, synthesized and investigated various high-capacity cathode and anode materials.

ASu3B.3 • 14:30 (OSA Invited)
Recent Advances in Hydrogen Storage Materials, Xiangdong Yao[1]; [1]*Griffith Univ., Australia.* On-board hydrogen storage is a critical issue to realize the so-called hydrogen economy that is potential to solve the challenges of energy and environment. Hydrogen stored in solid state materials is a promising method to be able to achieve the on-board applications due to its advantages of high density and safety issues. However, the challenges of high temperature and slow kinetics of hydrogen release must be addressed. Fundamentally, the temperature of hydrogen release is directly dependent on the enthalpy of the reaction. It is demonstrated that the previous approaches such as ball milling with catalysts can significantly enhance the hydrogen release rate but

influence very little the thermodynamics (the enthalpy). In this talk, we report some recent research results on hydrogen storage materials (magnesium, complex hydrides and ammonia borane) confined in porous templates. It is confirmed that the hydrogen desorption temperature can be significantly decreased, which means the thermodynamics of hydrogen release reactions can be altered through nanoconfinement.

ASu3B.4 • 15:00 (Invited)
Plasmonic Assemblies for Biosensing, Hongwei Duan[1]; [1]*Nanyang Technological Univ., Singapore.* Metallic nanostructures with localized surface plasmon resonance arising from the collective excitation of conduction electrons have found widespread use in biosensing, bioimaging, surface-enhanced spectroscopy, drug delivery, and catalysis. LSPR spectral shifts induced by interparticle plasmonic coupling have attracted considerable research interest in controlled assembly of plasmonic nanoparticles, which, in conjugation with responsive "smart" coatings, has been exploited to detect a wide range of molecular targets and environmental factors. We have developed versatile approaches to assemble surface-engineered metal nanoparticles into well-defined structures in aqueous dispersion and at oil-water interfaces. This talk will cover synthesis and assembly of the nanoparticles and their applications in detecting targets in-vitro and inside living cells.

ASu3B.5 • 15:20
Fabrication and application of metallic nitrides as cathode electrocatalysts for rechargeable Li-O2 batteries, Lixue Zhang[1], Kejun Zhang[1], Shanmu Dong[1], Guanglei Cui[1]; [1]*Qingdao Inst. of Bioenergy and Bioprocess Technology, Chinese Academy of Sciences, China.* Several metallic nitrides were rationally fabricated and applied in nonaqueous Li-O2 batteries as cathode electrocatalysts. Due to the superior electrocatalytic activity and the specific nanostructure of electrocatalysts, the assembled Li-O2 batteries present remarkable performance.

ASu3B.6 • 15:35
Engineering of Push-Pull Thiophene Dyes to Enhance Light Absorption and Modulate Charge Recombination in Mesoscopic Solar Cells, Renzhi Li[1], Peng Wang[1]; [1]*State Key Laboratory of Polymer Physics and Chemistry, changchun Inst. of applied chemistry, China.* We report four new organic sensitizers with terthiophene, ethylenedioxythiophene, bithiophene, and cyclopentadithiophene as the π-linkers and scrutinize the dye-structure correlated photovoltaic parameters of cells based on a cobalt electrolyte.

ASu3B.7 • 15:50
Semiconductor Nanowires and Nanowire Heterostructures for Supercapacitors, Xihong Lu[1], Teng Zhai[1], Minghao Yu[1], Yat Li[2], Yexiang Tong[1]; [1]*School of Chemistry & Chemical Engineering, Sun Yat-sen Univ., China;* [2]*Department of Chemistry and Biochemistry, Univ. of California Santa Cruz, USA.* High-performance supercapacitor electrodes based on semiconductor nanowires (TiN, and TiO_2) and nanowire heterostructures (e.g., TiO_2/MnO_2 and TiO_2/C core-shell nanowires) have been developed.

AOEE Room 3 (WNLO)
13:30 -- 16:00
ASu3C • Printed Electronics III
Presiders: Liyuan Han; National Inst. for Materials Science, Japan and Junbiao Peng; South China Univ. of Technology, China

ASu3C.1 • 13:30 (OSA Invited)
Advanced Printing Techniques for Flexible Device Fabrication, Toshihide Kamata[1]; [1]*National Inst. of Advanced Industrial Science, Japan.* Not available.

ASu3C.2 • 14:00 (Invited)
AMOLED Backplane with Back-channel Etched Oxide Thin Film Transistors, Lifeng Lan[1], Nana Xiong[1], Peng Xiao[1], Lei Wang[1], Miao Xu[1], Jianhua Zou[1], Junbiao Peng[1]; [1]*South China Univ. of Technology, China.* An AMOLED backplane was fabricated using indium-zinc-oxide (IZO) thin-film transistors (TFTs) with back-channel-etch (BCE) structure. During TFT fabrication, a layer of Mo film was deposited onto IZO active layer, and then patterned by a wet-etch-method as source and drain electrodes. The etch rate selectivity of Mo to IZO was as high as 4×104. This TFT exhibited high mobility and good electrical stability. Furthermore, it had the advantages of low cost and environment protection, because etch-stopper-layer and air-polluted dry-etch process were not require in this TFT fabricating method.

ASu3C.3 • 14:30 (Invited)
Preparation of Platinized Electrode via Photo-Platinization Technique for Flexible Dye- Sensitized Solar Cells, Nianqing Fu[1,2], Yuan Lin[1]; [1]*Beijing National Laboratory for Molecular Sciences, Key Laboratory of Photochemistry, Inst. of Chemistry, Chinese Academy of Sciences, China;* [2]*Univ. of Chinese Academy of Sciences, China.* Transparent platinized electrode were fabricated by a photo-platiniztion technique on TiO2 modified ITO/PEN substrate, which was used as counter electrode in flexible DSCs, and high power conversion efficiency of 8.0% was achieved under rear-side irradiation.

ASu3C.4 • 15:00 (Invited)
One dimensional nano strucutures for flexible electronics, Guozhen Shen[1]; [1]*Wuhan National Lab for Optoelectronics, China.* Not available.

ASu3C.5 • 15:30 (Invited)
Graphene-based Nanohybrid Paper as High-performance Freestanding Electrode for Flexible Supercapacitor Applications, Shuai Wang[1], Fei Xiao[1]; [1]*Huazhong Univ. of Science and Technology, China.* We have developed a new type of flexible nanohybrid paper based on growth of nanostructured transition metal oxides or conductive polymers on multilayered graphene paper and explored its practical application as free-standing electrode for flexible energy storage devices.

ASu3C.6 • 15:45
Flexible Cu2ZnSnS4 Solar Cells Fabricated Based on Successive Ionic Layer Adsorption and Reaction Method, Fangyang Liu[1,2]; [1]*Central South Univ., China;* [2]*Central South Univ., China.* We fabricated flexible Cu2ZnSnS4 solar cells based on sulfurizing stacked ZnS/Cu2SnSx precursor films via successive ionic layer adsorption and reaction method on Mo foil substrate and got 2.42% efficiency.

AOEE Key to Authors