Energy Express focus issue: Thin-film photovoltaic materials and devices

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WASHINGTON, September 13 – Developing renewable energy sources has never been more important, and solar photovoltaic (PV) technologies show great potential in this field. They convert direct sunlight into electricity with little impact on the environment. This field is constantly advancing, developing technologies that can convert power more efficiently and at a lower cost. To highlight breakthroughs in this area, the editors of Energy Express, a bi-monthly supplement to *Optics Express*, the open-access journal of the Optical Society (OSA), today published a special Focus Issue on thin-film photovoltaic materials and devices. The issue is organized and edited by Bernard Kippelen, a professor at the Georgia Institute of Technology.

"Alternative and cost effective energy production technologies are an ever-present challenge to today's society." said Kippelen. "This Focus Issue will present contributions from leading research groups from around the world that illustrate both the depth and the breadth of the research conducted on optical materials and devices in a variety of emerging thin-film photovoltaic technologies."

Summary

Lowering the cost of energy produced by photovoltaic technologies can be achieved by developing new materials and devices architectures that lend themselves to streamlined, high-volume manufacturing with greatly reduced semiconductor consumption. Further advances in new materials and novel device architectures are essential for the increase of market share of PV thin-film technologies. This issue examines the materials already on the market, as well as the latest technologies and methods for harvesting sunlight.

Key Findings & Selected Papers

The following papers are some of the highlights of the Energy Express Focus Issue on Thin-film Photovoltaic Materials and Devices. All are included in volume 18, issue S3 and can be accessed online at http://www.opticsinfobase.org/ee [1].

- A paper by Johanna Schmidtke gives a review of thin film photovoltaic devices and materials already on the market. The paper discusses recent dynamics in the on-grid PV market, as well as an overview of commercial thin-film silicon, cadmium telluride, copper indium gallium diselenide and organic PV modules. Johanna Schmidtke, Lux Research Inc. pp. A477. http://www.opticsinfobase.org/oe/abstract.cfm?URI=oe-18-103-A477 [2]

- Research from the Risø National Laboratory for Sustainable Energy provides insight into the great potential and challenges of the latest photovoltaic technologies based on organic materials. The report provides an examination of the first trial of grid-connected polymer solar panels and also gives a detailed cost analysis. Andrew J. Medford, Mathilde R. Lilliedal, Mikkel Jørgensen, Dennis Aarø, Heinz Pakalski, Jan Fyenbo, and Frederik C. Krebs, the Risø National Laboratory for Sustainable Energy, Technical University of Denmark. pp. A272. http://www.opticsinfobase.org/oe/abstract.cfm?URI=oe-18-103-A272 [3]

- A paper by University of Michigan researchers illustrates how optics can lead to creative new approaches to harvest sunlight more efficiently via novel tandem solar cell architectures. Using realistic material properties for organic absorbers, transport layers, metallic electrodes, and DBR coatings 17% power conversion efficiency can be reached. Brendan O'Connor, Denis Nothern, Kevin P. Pipe, and Max Shtein, Departments of Mechanical Engineering and Materials Science and Engineering, University of Michigan. pp. A432. http://www.opticsinfobase.org/oe/abstract.cfm?URI=oe-18-103-A432 [4]

- Research from the University of Texas at Austin discusses an alternative to organic materials, inks or dispersions of inorganic nanocrystals that enable printing of inorganic semiconductors under moderate processing conditions. The paper describes such an approach using CuInSe2 nanocrystals and reports encouraging efficiencies based on ambient processing. This material system is environmentally friendlier than other semiconductor nanocrystal systems and facilitates incorporation of inexpensive solar cell in variety of applications. Vahid A. Akhavan, Matthew G. Panthani, Brian W. Goodfellow, Dariya K. Reid, and Brian A. Korgel, Department of Chemical Engineering and Texas Materials Institute and Center for Nano- and Molecular Science and Technology, University of Texas at Austin. pp. A411. http://www.opticsinfobase.org/oe/abstract.cfm?URI=oe-18-103-A411 [5]

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