Solution-Processable Organic Solar Cells

Christoph J. Brabec
Tayebeh Ameri
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Christoph J. Brabec\textsuperscript{a,b} and Tayebeh Ameri\textsuperscript{a}

\textsuperscript{a}Friedrich-Alexander University Erlangen-Nuremberg, Materials for Electronics and Energy Technology, Department of Materials Science and Engineering, Martensstrasse 7, 91058 Erlangen, Germany

\textsuperscript{b}Bavarian Center for Applied Energy Research (ZAE Bayern), Haberstr. 2a, 91058 Erlangen, Germany

This special section of JPE focuses on the science and technology of organic solar cells. Tremendous progress has been made in the synthesis and production of organic solar cells. Companies like Merck, BASF, Piletronics, etc. have started to commercialize organic semiconducting materials, while companies like BELECTRIC OPV, Heliatek, and others have begun commercialization of organic solar modules.

Compared to inorganic solar cells, organic photovoltaics (OPVs) offer many advantages, such as low cost, high throughput production, flexible devices, and lightweight products, as well as custom-designed colors. On the down side, OPVs still have significantly lower efficiency values and lifetime expectations as compared to their inorganic counterparts. Nevertheless, the most recent NREL certified power conversion of 10.6\% reported by UCLA, and the record conversion efficiency of 11.8\% reported by Kyung Hee University, position OPVs as the next generation of solar cells and a follow-up technology for thin-film inorganic PVs.

Several things need to take place in order to achieve higher efficiency and better lifetime. For example, stable and low-bandgap semiconductors are required, and they must have excellent charge carrier transport properties, as well as implementation of more advanced approaches such as tandem and ternary solar cells. It is also necessary to find ways to control the microstructure in bulk heterojunction composites. In addition, efficient and environmentally stable interface materials must be developed. Finally, a cost-efficient and long-time stable packaging process needs to be established. For the final product release, light propagation and light management needs to become integrated into organic solar modules.

The papers presented in this special section are a small snapshot of the evolving and ongoing progress in this field, addressing aforementioned issues and challenges.

Christoph J. Brabec holds the chair of Materials for Electronics and Energy Technology (i-MEET) at the Materials Science Department of the Friedrich Alexander University Erlangen-Nürnberg. He is the scientific director of the Erlangen division of the Bavarian Research Institute for Renewable Energy (ZAE Bayern, Erlangen), a board member of the ZAE Bavaria, and a board member of the Energy Campus Nürnberg. He received his PhD in 1995 in physical chemistry from Linz University. His research interests are organic photovoltaics, all aspects of solution-processed semiconductors, and technologies for renewable energy scenarios.

Tayebeh Ameri is a postdoctoral research fellow in the group of Prof. Brabec in the chair of Materials for Electronics and Energy Technology (i-MEET) at the Friedrich Alexander University Erlangen-Nürnberg, where she leads the organic photovoltaics team. She studied physics and solid-state physics at Isfahan University of Technology and Ferdowsi University of Mashhad, Iran. In May 2006, she joined Konarka Austria to study for a PhD and received her PhD in engineering sciences from Johannes Kepler University of Linz in 2010. Her main research interests include investigation and development of organic and hybrid solar cells.

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