

Guest Editorial: Special Section on Organic Photovoltaics

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Organic photovoltaics (OPVs) have a long history, stretching back three decades into the 1980s, when first studies were conducted on the photogeneration of charge carriers in organic solids. The breakthrough in this field was in 1995, when Heeger's group published the first efficient solution-processed solar cells based on a bulk heterojunction consisting of a polymer blend with C₆₀, a new concept reported three years earlier by Sariciftci and Heeger.

Since then, many active research activities have been undertaken to develop highly efficient organic photovoltaic devices. The number of papers on organic solar cells has been rising exponentially, and the peak of publications has not yet been reached. Tremendous progress has been made in the synthesis and production of organic solar cells. Companies such as Merck, BASF, and Plextronics have started to commercialize organic semiconducting materials, while companies such as Konarka Technologies, Inc. and Heliatek have begun commercialization of organic solar modules.

Compared to inorganic solar cells, OPVs offer many advantages, such as low cost, high-throughput production, flexible devices, lightweight products, as well as custom-designed colors. On the downside, OPVs still have significantly lower efficiency values and lifetime expectations as compared to their inorganic counterparts. Nevertheless, the most recent National Renewable Energy Lab (NREL) certified power conversion of more than 8%, as reported by Konarka and Heliatek, positions OPVs as the next generation of solar cells and a follow-up technology for thin-film inorganic PVs.

In order to achieve higher efficiency and better lifetime, further development is necessary: stable and low-bandgap semiconductors with excellent charge carrier transport properties are required, concepts to control the microstructure in bulk heterojunction composites are essential, the development of efficient and environmentally stable interface materials has to take place, and, finally, strategies for a cost-efficient and long-time stable packaging process need to be developed. In addition, further fundamental understanding of the photophysical processes, including the different interfaces in organic solar cells, is essential to unravel device degradation mechanisms. For the final product release, light propagation and light management need to become integrated in organic solar modules.

In this special section of the *Journal of Photonics for Energy*, papers that address the above issues and challenges are presented. These papers are based on talks and posters given at the conference on Organic Photovoltaics XI at the SPIE Optics + Photonics meeting held in San Diego in August 2010. We believe that readers will find the results of the studies discussed in these manuscripts interesting, educational, and stimulating, and we hope that you will enjoy reading them.