

Abstract Submitted
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Fine-tuning Structures from Molecules to Nanophases: Insight into the Origin of Superior Organic Photovoltaic Efficiency¹

WEI CHEN, SETH DARLING, Center for Nanoscale Materials, Argonne National Laboratory — Organic photovoltaics (OPV) represent one of the most promising technologies for next-generation solar energy conversion due to their low-cost and scalability. To realize this potential, efficiencies must be improved for which a deeper understanding of the nanoscale morphology and molecular organization is required. Using the state-of-the-art PTB series of conjugated copolymers synthesized at the University of Chicago, we probed the internal structure of these materials both in solution and in films containing polymer/fullerene blends using a suite of tools spearheaded by neutron and x-ray scattering and, thereby, conceive the structural evolution from solution to thin films. Fine-tuning molecular structures via selective atomic replacement on the main chain of PTB copolymers, we gained unique insights into the structure-performance relationships, especially key features such as intermixing of polymers with fullerenes. Progress established in the course of these structural and morphological characterizations outline above will serve as the foundation for further improving the efficiency of polymer solar cells to realize their large-scale commercial use.

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Wei Chen
Center for Nanoscale Materials, Argonne National Laboratory

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