RATIONAL DESIGN OF ACTIVE LAYER MORPHOLOGY FOR HYBRID SOLAR CELLS

Ioan Botiz and Seth B. Darling
Center for Nanoscale Materials, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439

INTRODUCTION

It is commonly accepted that in order to develop high-performance organic and/or hybrid organic-inorganic solar energy devices, it is necessary to use, among other components, an active donor-acceptor layer with highly ordered nanoscale morphology. In an idealized morphology, the effectiveness of internal processes including exciton generation and separation and charge carrier migration is optimized leading to an efficient conversion of photons to electricity.

RESULTS

With this idea in mind, we have rationally designed and developed an ordered nanoscale morphology consisting of self-assembled poly(3-hexylthiophene) donor domains of molecular dimension, each of them separated by fullerene C_{60} hydroxide acceptor domains. A poly(3-hexylthiophene)-*block*-poly(L-lactide) rod-coil block copolymer was used as a structure-directing agent to pattern active material into ordered nanostructures.

Using this intimate morphological control, we can begin to probe structure-property relationships with unprecedented detail with the ultimate goal of maximizing the performance of future organic/hybrid photovoltaic energy devices.