

Organic Photovoltaics – from Solution to Solar Energy

Opportunity

Polymer solar cells based on organic photovoltaic materials have the potential to be a lower cost solution for producing solar energy without exotic materials

The ability to perform reel-to-reel processing of organic photovoltaic materials from solution is the key to making polymer solar cells inexpensive

The pathway between the solution state of the materials to the final, self-assembled thin film structure in the device is not sufficiently understood

Morphological control in the bulk heterojunction active layer can be obtained

Meso Challenge

Length scales range from nanometers within the bulk heterojunction to mesoscale film thicknesses and macroscopic film areas

Techniques capable of spanning all length scales are required to understand polymer phase segregation

Parallel spectroscopic characterizations are critical for fully understanding the potential device performance

References:

Approach

Synthesize novel materials including selectively deuterated polymers

Utilize non-destructive neutron scattering characterization methods to track a single sample from solution structure to multilayer thin films

Perform simultaneous structure-function (efficiency) characterizations to obtain a holistic picture of the system

Use data-driven modeling and simulation to obtain fundamental insight into the evolution of the materials throughout thin-film processing

Impact

Energy Security

Reduce environmental impact of the Energy Economy

Fundamental soft matter physics