

**Near IR sensitization of polymer/fullerene solar cells: controlling the morphology and transport in ternary blends**

In this research proposal we suggest an elegant, alternative strategy to extend the spectral sensitivity of wide bandgap polymers. In detail, we propose to design ternary bulk heterojunction systems, consisting of a conjugated polymer donor, a fullerene acceptor, and a sensitizer. Each of the components needs to fulfill specific roles: The fullerene needs to act as an electron acceptor as well as an electron transport matrix, the polymeric donor should provide a sufficiently high hole mobility and the small-molecule-based sensitizers should sensitize the bulk heterojunction solar cell in the red/NIR region. Ideally, the sensitizer molecules are located near the donor/acceptor interface. The design and development of ternary bulk heterojunction (BHJ) composites requires the investigation of three separate aspects and fundamental topics of organic semiconductors and photovoltaics.

1. Synthesis: The synthesis part is focused on small-molecule-based sensitizers. Several classes of materials with a favorable energy level alignment will be tested. Promising materials will be optimized in terms of solubility and blend morphology.
2. Morphology: The morphology assessment and morphology control of ternary BHJ composites will be another challenge in this project.
3. Transport and Charge Transfer: Transport in binary BHJ composites is already a complex process. Here we need to investigate and clarify the transport mechanisms in ternary composites.