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Structure and miscibility investigation of PTB7:PC71BM BHJ thin films

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Currently, polymer-fullerene bulk heterojunction solar cells (PSCs) are attracting a great deal of attention and getting more and more important. It shows great promise as a new kind of renewable energy source due to its low-costs, lightweight, flexibility as well as its easy process of fabrication attracts many attentions.

In recent years, the power-conversion efficiency of state-of-the-art PSCs has exceeded 8% in the scientific literature . However, despite the relatively good performance, deep understanding of the fundamental principles is still not well-known.To get an efficient organic solar cell, simply a two-component system used to separate the excitons is not enough. We need a three-phase-system, which compared to the two-phase-system, a new intermixed phase is added. The structural length scales are needed in the range of the mean exciton diffusion length (usually 10-20 nm).
In this work up to date the most promising system PTB7:PC71BM will be investigated. Samples with different blend ratios will be made as the Starting for the work. As for the basic characterization of the active layer, AFM will be used to get information about solvents'treated film topography and XRR works for vertical profile. The focus is the usage of grazing incidence small angle neutron scattering (GISANS) for the determination of structural length scales of the active layers and the miscibility between the two components. For a better analysis and understanding of the scattering data, the simulation software IsGISAXS may also be considered. In addition, devices are prepared and characterized in terms of IU-curves and photophysical properties. Consequently, the morphology information such as structure length scales and molecular miscibility are resolved, and correlated with the final device performance.

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