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Structural evolution in polythiophene-fullerene mixtures ENRIQUE GOMEZ, DEREK KOZUB, KIARASH VAKHSHOURI, The Pennsylvania State University — The morphology of organic semiconductor mixtures employed as the active layer of organic solar cells is a result of the complex interplay between the crystallinity of the constituents and the chemical incompatibility. Given that device performance can depend critically on the morphology of the active layer, efforts aimed identifying at the critical parameters for the structure formation process are important for the development of high-performance devices. We demonstrate that polythiophene-fullerene mixtures are partially miscible and that the crystallization of the electron donor drives the characteristic length scales of the structure. By modeling fullerene as a solvent for polythiophene, we have estimated the Flory-Huggins interaction parameter from measurements of the melting point depression of polythiophene. The miscibility between poly(3-hexylthiophene) (P3HT) and fullerene at P3HT volume fractions greater than 0.4 leads to a severe suppression of the crystallization of fullerene. Our efforts have enabled us to develop a hypothesis for the structure formation process in polythiophene/fullerene mixtures.

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