Morphology of P3HT and PCBM blends in thin films obtained with different deposition methods

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Patterns and structures, formed when a semiconducting polymer blend in solution is subject to controlled evaporation, have been of great interest due to their influence on the performance of organic devices. By controlling the processes of pattern formation, function properties of organic semiconductor structures can be tailored, allowing for facile manufacturing of the active layers in organic devices, e.g. solar cells [1].

By analyzing the morphologies of polymer blends resulting from different deposition methods, a deeper insight into the pattern formation process can be acquired. In this study, we have analyzed the morphology of blends of poly(3-hexylthiophene) (P3HT) and [6,6]-phenyl-C₆₁-butyric acid methyl ester (PCBM) formed upon solvent evaporation. We used the following deposition methods: dip-coating, droplet evaporation within a constrained geometry and drop-casting. Dip-coated films revealed various types of morphology depending on the coating speed. At low coating speeds, where evaporation is the dominant factor, well-ordered patterns were obtained. When increasing the coating speed, viscous forces become dominant over evaporation yielding optically homogenous films [2]. Morphologically similar structures to those observed at low coating speeds, were also obtained with spatially constrained droplets. The blend morphologies were analyzed with polarized, fluorescence and atomic force microscopy.

References:
