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Semiconducting polymer nanostructures studied by a combination of synchrotron techniques and AFM

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Conjugated polymers have been proposed for application in a wide variety of next generation technologies including displays, solid-state lighting, transistors and organic photovoltaic devices. In organic photovoltaics (OPVs), the dissociated free charges (electrons and holes) are generated at the interface between the donor (e-donor) and acceptor (e-acceptor) phases, and then transported to their respective electrodes, forming the external circuit. Therefore, increasing the interfacial area between the e-donor and e-acceptor phases and limiting the morphology of the heterojunction to the nanoscale are critical for improving the device performance [1].
In this work we will report on the laser induced periodic surface structures (LIPSS) in conjugated polymers such as poly-3-hexylthiophene (P3HT), poly[N-9'-heptadecanyl-2,7-carbazole-alt-5,5-(4',7'-di-2-thienyl-2',1',3' benzothiadiazole)] (PCDTBT) and the blend P3HT/PCDTBT. The investigation of the thin films as well as the nanostructured films was performed by using different synchrotron techniques. The evolution of the polymer nanostructures was followed by in situ Grazing Incidence X-Ray Scattering (GISAXS and GIWAXS) [2]. The polymer blend was studied by Scanning Transmission X-Ray Microscopy (STXM) based on the Near Edge X-Ray Absorption Fine Structure (NEXAFS) spectra of the two polymers P3HT and PCDTBT. By this technique it is possible to obtain the compositional maps of the blend P3HT/PCDTBT before and after irradiation. In both cases the results reveal a phase separation of the two polymers. In addition a synergy in the LIPSS formation was found for the polymer blend. The structure-properties relationship was investigated by conductive AFM [3].

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Caption (s) - Add figures as attached files (2 fig. max)

Figure 1. (up) in situ GISAXS patterns of PCDTBT thin films irradiated at 532 nm using a fluence of 26 mJ/cm2 for different number of pulses, (down) STXM images of the P3HT/PCDTBT blend before and after irradiation.

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