

# Effect of Substrate Roughness on Photoluminescence of Poly(3-Hexylthiophene)

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**Abstract.** Charge transfer in conjugated polymers depends on morphology and aggregation of polymer molecules. In this paper we study by photoluminescence the influence of substrate roughness and solvent and thermal annealings on polymer morphology of poly(3-hexylthiophene) (P3HT) thin-films. Spano's model (F. C. Spano, J. Chem. Phys. 122, 234701-234715 (2005)) is applied to analyze spectral shape changes in photoluminescence spectra caused by substrate roughness. We demonstrate that even small variance in the surface roughness can result in the formation of various crystal phases observable in the photoluminescence spectra. Our study also reports on dependence of the formation of intramolecular and intermolecular assemblies on thermal and solvent annealings, which would be reversibly broken through thermally induced side chain disordering.