Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Crystallizing Conjugated Polymer Chains of P3HT Stretched for Dramatic Enhancements in Optoelectronic Efficiencies CHIH-HUNG CHANG, ARNOLD C.-M. YANG, Department of Materials Science and Engineering, National Tsing Hua University, Hsinchu 300, Taiwan — Previously the amorphous conjugated polymer MEH-PPV was shown to illustrate huge enhancement in photoluminescence (PL) efficiencies upon stretching to large molecular strains. In this work the crystallizing polymer of poly(3-hexylthiophene) (P3HT), dispersed in the polystyrene (PS) matrix, was stretched in the PS local deformation zones to study the effect of molecular deformation. A huge enhancement of the PL intensity was observed that when normalized to the fraction of the strained polymer corresponded to an increase of 15 folds, significantly larger than that of the stretched MEH-PPV. Moreover, when examined under a con-focal micro-PL (spot size $\sim 5\mu$m), the emission from the local deformation zones subject to a high stress ($\sim$40MPa) manifested marked increase of the intrachain emission relative to the effect on the interchain. These emission peak positions, however, were unaffected by the stretching. The PL enhancements were attributed to the depression of electron-phonon interactions of the stretched P3HT chains. Constraining conjugated polymers to yield high efficiencies thus may provide a feasible way for improving the performance of polymer-based devices.

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Date submitted: 28 Nov 2011 Electronic form version 1.4