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Optical Probes of MEH-PPV films at High Hydrostatic Pressure[1]

E. OLEJNIK, S. SINGH, B. PANDIT, V. MORANDI, J. HOLT, C.-X. SHENG, Z.V. VARDENY, Department of Physics, University of Utah — We investigate the primary and long-lived photoexcitations in π-conjugated polymer films with increased interchain coupling by studying the photophysics of substituted PPV derivative thin films, namely 2-methoxy-5-(2'-ethylhexyloxy) [MEH-PPV] at high hydrostatic pressure, P up to 120 kbar in a diamond anvil cell, using both ultrafast transient mid- and near-IR spectroscopies with 0.1 ps resolution, and cw optical techniques (photo induced absorption (PA) and photoluminescence (PL) in a broad spectral range from 0.2 to 2.2 eV). With increasing P the cw PL band weakens, broadens, and red-shifts by $\sim$ 2 meV/kbar; whereas the triplet PA red shifts to a lesser extent. The ultrafast PA band of the singlet exciton at $\sim$ 0.95 eV at ambient splits, blue shifts and acquires a much longer decay component. A second, weak PA band at $\sim$ 0.33 eV at ambient, dramatically blue-shifts ($\sim$ 3 meV/kbar) and substantially intensifies with P. These pressure-induced effects are discussed considering the interplay of two phases in the MEH-PPV film: a disordered phase with large PL efficiency, and PA that does not change much with P; and a less emissive ordered phase that increases with P, where the interchain coupling substantially increases with P.

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