

ULTRAFAST TRANSIENT ABSORPTION SPECTROSCOPY INVESTIGATION OF PHOTOINDUCED DYNAMICS IN POLY(3-HEXYLTHIOPHENE)-BLOCK-OLIGO(ANTHRACENE-9,10-DIYL)

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Semiconducting polymer nanostructures featuring bulk heterojunction (BHJ) architecture are promising light harvesters in photovoltaic (PV) devices because they allow control of individual domain sizes, internal structure and ordering, as well as well-defined contact between the electron donor and acceptor. Power conversion efficiency (PCE) of PV devices strongly depends on photoinduced dynamics. Understanding and optimizing photoinduced charge transfer processes in BHJ's hence help improve the performance of PV devices and increase their PCE in particular. We have investigated the photoinduced dynamics of a block polymer containing moieties of poly-3-hexylthiophene (P3HT) and polyanthracene (PANT) in solution and in solid state with femtosecond transient absorption (TA) spectroscopy. The dynamics of the polymer PANT alone are also studied as a control. The TA spectra of PANT includes a strong excited state absorption centered at 610 (nm) along with a stimulated emission signal stretching past the detection limit into the UV region which is absent in the monomer's spectra in the detection window. The block polymer's TA spectra strongly resembles that of P3HT but a noticeable positive pull on P3HT's stimulated emission signal residing at 575-620 (nm) is indicative of the excited state absorption of PANT in the adjacent spectral region. The doubling of the lifetime exciton delocalization on the block polymer versus P3HT alone have alluded that the lifetime of P3HT is extended by the covalent addition of PANT. The current spectroscopic investigation represents an interesting example of photoinduced processes in systems with complex energy level structure. Studies of dependence of charge generation and separation on composition, dimension, and morphology of the heterojunctions are in process.