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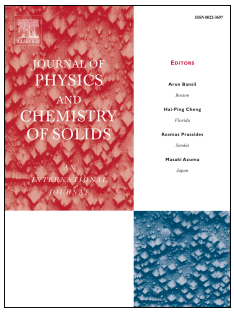

Effect of spin traps on charge transport in low-bandgap copolymer: Fullerene composites

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Effect of spin traps on charge transport in low-bandgap copolymer:fullerene composites

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Abstract. Light-Induced EPR study of magnetic, relaxation and dynamic parameters of spin charge carriers background photoinduced in bulk heterojunctions of composites formed by poly[2,7-(9,9-dioctylfluorene)-alt-4,7-bis(thiophen-2-yl)benzo-2,1,3-thiadiazole] (PFO-DBT) and poly[N-9'-heptadecanyl-2,7-carbazole-alt-5,5-(4',7'-di-2-thienyl-2',1',3'-benzothiadiazole)] (PCDTBT) with methanofullerene [6,6]-phenyl-C_{61}-butyric acid methyl ester is described. A part of polarons is captured by deep spin traps whose number and energy depth are governed by the structure, morphology of a copolymer matrix and also by the photon energy. Both the composites exhibit photo-response within photon energy/wavelength 1.32-3.14 eV/940-395 nm region which is wider than that of other polymer composites. Magnetic, relaxation and dynamics parameters of spin charge carriers were shown to be governed by their exchange interaction and photon energy. Specific morphology of the composites causes selectivity of these parameters to the photon energy. It was shown that the anisotropy of spin mobility through bulk heterojunctions reflects the system dimensionality and is governed by the photon properties. The replacement of the PFO-DBT backbone by the PCDTBT matrix leads increases the ordering of a copolymer, decreases the number of spin traps and changes a mechanism of charge recombination. The decay of free charge carriers was interpreted in terms of the trapping-detrapping spin diffusion in bulk heterojunctions.

Keywords: low-bandgap copolymers; Light-Induced EPR; spin charge carriers; spin traps; spin recombination; spin dynamics

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