Features of Charge Carrier Mobility and Recombination in Organic Solar Cells

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Our main expertise lies in the field of investigation of the transport and recombination processes of photogenerated and injected charge carriers in thin films of π-conjugated polymers, small molecules, bulk heterojunction structures and systems of porous TiO_2, dye and polymer.

Methods

TOF - time of flight technique for investigation of charge carrier mobility dependence on field and temperature.

SCLC transients - integral TOF in space charge limited current regime for measurement of recombination coefficient at zero electric field and comparison with Langevin-type recombination coeficient [1].

CELIV - charge extraction in a linearly increasing voltage for bulk conductivity, equilibrium charge carrier density and mobility measurements and determination of the , nature of field dependence of mobility (also for high conducting materials) [2].

Photo-CELIV - for separate measurements of charge carrier mobility and density kinetics after photoexitation in the case of stochastic transport [3].

DoI - plasma injection into semiconductors and double injection and extraction current transients for investigation of recombination dependence on electric field and density of carriers in bulk-heterojunction solar cells [4]

Main Results:

The charge carrier transport features in layers of small organic molecules, π-conjugated polymers, bulk heterojunction structures and hybride materials were investigated.

In RRP3HT/PCBM blends

a) mobilities are independent on time and electric field, whereas in MDMO-PPV/PCBM and RRa-PHT decreases hyperbolicaly on time;

b) the influence of charge carrier deep trapping is insignificant;

c) bimolecular recombination coefficient is strongly reduced compared to Langevin recombination one and depends on the carrier density (Auger- type), whereas in MDMO-PPV/PCBM this reduction is negligible.

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