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**Time-Resolved Microwave Photoconductivity study of the Photophysics of Bulk Heterojunction Organic Photovoltaic Devices** NIKOS KOPIDAKIS, ANDREW FERGUSON, SEAN SHAHEEN, GARRY RUMBLES, National Renewable Energy Laboratory — Bulk heterojunctions composed of a blend of the polymer poly(3-hexylthiophene) (P3HT) and the acceptor fullerene derivative [6,6]-phenyl $C_{61}$-butyric acid methyl ester (PCBM) are the prototypical organic photovoltaic devices. The photophysical processes that take place in these structures involve exciton generation and quenching, and free carrier transport, trapping and recombination. To probe these processes we have performed contactless Time-Resolved Microwave Photoconductivity measurements in pure polymer films and in bulk heterojunctions with varying PCBM concentration. We compare our results with various models for free carrier generation in the pure polymer and in the bulk heterojunction and develop a kinetic scheme to describe free carrier generation and recombination that is consistent with our experimental data. We show that exciton quenching in the presence of the acceptor (PCBM) involves first and second order processes that become prevalent at low and high light intensities, respectively.

Nikos Kopidakis
National Renewable Energy Laboratory

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