Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Manipulating Energy Transfer in Conjugated Polymers using Radical Mediators DANIEL WILCOX, SANJOY MUKHERJEE, BRYAN BOUDOURIS, Purdue Univ — Previous efforts have demonstrated that polymers containing open-shell moieties can be used to improve the performance of organic electronic devices (e.g., organic field-effect transistors (OFETs) and photovoltaic devices). However, the exact mechanism of how these redox-active radical polymers improve the performance of these next-generation devices has yet to be described in full. Here, we take the first steps towards elucidating this full picture by demonstrating that the galvinoxyl radical can be used as an electron acceptor for a common electron-donating macromolecule. First, galvinoxyl was used as a fluorescence quencher for poly(3-hexylthiophene) (P3HT) with quenching performance on par with that of oft-used fullerene derivatives. This effect was caused by photoinduced electron transfer between the two materials. Additionally, the galvinoxyl radical was used as an active layer dopant for P3HT OFETs. By increasing the P3HT carrier density through spontaneous electron transfer, the behavior of the device was changed from that of an intrinsic semiconductor to that of a highly-doped semiconductor. Thus, these initial studies lay the foundation for a paradigm where open-shell entities are used to dope conjugated polymer semiconductors for high-performance device applications.

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Date submitted: 09 Nov 2016 Electronic form version 1.4