Abstract Submitted
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Disorder induced spin coherence in polyfluorene thin film semiconductors[1] RICHARD G. MILLER, KIPP VAN SCHOOTEN, HANS MALISSA, DAVID P. WATERS, JOHN M. LUPTON, CHRISTOPH BOEHME, Department of Physics and Astronomy, University of Utah, Salt Lake City, Utah — Charge carrier spins in polymeric organic semiconductors significantly influence magneto-optoelectronic properties of these materials [1]. In particular, spin relaxation times influence magnetoresistance and electroluminescence. We have studied the role of structural and electronic disorder in polaron spin-relaxation times. As a model polymer, we used polyfluorene, which can exist in two distinct morphologies: an amorphous (glassy) and an ordered (beta) phase [2]. The phases can be controlled in thin films by preparation parameters and verified by photoluminescence spectroscopy. We conducted pulsed electrically detected magnetic resonance (pEDMR) measurements to determine spin-dephasing times by transient current measurements under bipolar charge carrier injection conditions and a forward bias. The measurements showed that, contrary to intuition, spin-dephasing times increase with material disorder. We attribute this behavior to a reduction in hyperfine field strength for carriers in the glassy phase due to increased structural disorder in the hydrogenated side chains, leading to longer spin coherence times.

[1] C. Boehme, J.M. Lupton, Nature Nano. 8, 612 (2013).
[2] A. Khan et al. Phys. Rev. B 69, 085201 (2004).

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