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Spin-dependent charge carrier recombination in PCBM HIROKI MORISHITA, WILLIAM J. BAKER, DAVID P. WATERS, RACHEL BAARDA, University of Utah, JOHN M. LUPTON, University of Regensburg, CHRISTOPH BOEHME, University of Utah, UTAH SPIN ELECTRONICS GROUP COLLABORATION, LUPTON GROUP COLLABORATION — We present room temperature pulsed electrically detected magnetic resonance (pEDMR) measurements on [6,6]-phenyl-C_{61}-butyric acid methyl ester (PCBM) (electron acceptor) thin film unipolar and bipolar devices. Our study aimed at identifying the dominating spin-dependent transport and recombination processes therein. Experimentally, the devices were operated under a constant positive bias, and the resultant transient current response was then monitored after the application of a short resonant microwave pulse excitation. The measurements did not reveal any observable signal for unipolar electron devices which suggests that spin-dependent transport mechanisms are not dominant in PCBM. However, under bipolar injection, at least two pronounced spin-dependent signals were detected whose magnitudes increased as the devices degraded upon exposure to air. Electrical detection of spin-Rabi beat oscillation revealed that one of these two signals is due to weakly coupled pairs of spins with s=1/2. We therefore attribute this signal to electron-hole recombination. This observation shows that while PCBM is a poor hole conductor, hole injection can be significant.

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