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Spin injection effects on exciton distributions in conjugated organic semiconductors[1] MOHAMMAD YUNUS, P. PAUL RUDEN, University of Minnesota, DARRYL SMITH, Los Alamos National Laboratory — Conjugated organic semiconductors are under rapid development as the active material in organic light emitting diodes (OLEDs). Electrons and holes injected into the organic semiconductor form bound singlet or triplet excitons. Singlet excitons may recombine radiatively giving rise to light emission whereas triplet excitons do not recombine radiatively. Thus the quantum efficiency of OLEDs is limited by the fraction of singlet excitons, χ_S. In this work, we explore theoretically an approach to control χ_S through spin-polarized electron and hole injection from ferromagnetic contacts. Conventional ferromagnetic transition metals and half-metallic materials, such as LSMO, are considered as candidate electrode materials. Electron and hole transport in the organic semiconductor is treated through the conventional device equations with the formation of excitons described by a Langevin process. Once formed, the excitons may recombine or diffuse. Triplet excitons have a lower recombination probability and hence a longer diffusion length. The model calculations yield steady state spatial profiles for singlet and triplet exciton densities in the organic semiconductor.

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