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Engineering of spin injection and spin transport in organic spin valves using π-conjugated polymer brushes.[1] RUGANG GENG, ANANDI ROY, RAM SUBEDI, JASON LOCKLIN, THO NGUYEN, University of Georgia, WENBO ZHAO, XIAOGUANG LI, University of Science and Technology of China — Charge transport in amorphous organic semiconductors is governed by carriers hopping between localized states with small spin diffusion length. Furthermore, the spin interfacial resistance of organic spin valves (OSVs) is poorly controlled resulting in controversial reports of the magnetoresistance response. Here, we used surface initiated Kumada transfer polycondensation to covalently graft π-conjugated poly(3-methylthiophene) brushes from the $La_{0.67}Sr_{0.33}MnO_3$ (LSMO) bottom electrode. The covalent attachment along with the brush morphology allows for more control over the LSMO/brush interfacial resistance and large spacer mobility. Remarkably, with 15 nm brush spacer layer, we observed an optimum magnetoresistance (MR) effect of 70% at cryogenic temperatures and a MR of 2.7% at 280K. The temperature dependence of the MR is nearly an order of magnitude weaker than that found in control OSVs made from spin-coated poly(3-hexylthiophene). Using a variety of different brush layer thicknesses, the thickness dependent MR at 20K was investigated. A spin diffusion length of 20 nm at 5 mV junction voltage rapidly increases to 55 nm at -280 mV.

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Rugang Geng
University of Georgia

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