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ESR Study of Electric-Field Controlled Conductance of Fully-doped Polymers in a Transistor Structure[1] FANG-CHI HSU, ARTHUR J. EPSTEIN, Department of Physics, The Ohio State University — It was recently reported that use of doped "metallic" polymer as the active channel in a field effect transistor structure results in unexpected "normally on" transistor-like behavior. Epstein *et al.* proposed [1] that ion motion is involved in the conductance modulation of the "metallic" polymer. We study here the role of ion migration in the "metallic" polymer (poly(3,4-ethylenedioxythiophene) doped with poly(styrenesulfonic acid) (PEDOT:PSS)) based transistors by employing ESR spectroscopy. We found that approximately 18% reduction of localized polaron concentration in PEDOT:PSS caused by ions insertion results in 10^3 times decrease in the polymer conductance. The $N(E_F)$ determined from the Pauli susceptibility remains essentially unchanged after ions are inserted into the active channel. This indicates that the major conductance suppression in PEDOT:PSS occurs in the disordered regions. We proposed that the inserted ions modulate the charge carrier hopping distance in the disordered regions of the PEDOT:PSS resulting in a conductor-nonconductor transition. [1]A. J. Epstein *et al.*, Curr. Appl. Phys. **2**, 339 (2002).

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