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Charge injection and band alignment in organic field effect transistors. BEHRANG HAMADANI, Department of Physics and Astronomy, Rice University, HUANJUN DING, Department of Physics and Astronomy, University of Rochester, JACOB CISZEK, Department of Chemistry, Rice University, YONGLI GAO, Department of Physics and Astronomy, University of Rochester, JAMES TOUR, Department of Chemistry, Rice University, DOUGLAS NATELSON, Department of Physics and Astronomy, Rice University, GAO LABORATORY COLLABORATION, TOUR LABORATORY COLLABORATION — We have studied metal/organic semiconductor charge injection in poly(3-hexylthiophene) (P3HT) field effect transistors with Pt and Au electrodes as well as Au electrodes modified by self-assembled monolayers (SAMs) as a function of annealing in vacuum. At low impurity dopant densities, Au/P3HT contact resistances show nonohmic behavior, whereas Pt/P3HT contacts remain ohmic. Ultraviolet photoemission spectroscopy (UPS) reveals that metal/P3HT band alignment shifts dramatically as samples are dedoped, leading to an increased injection barrier for holes. We also present the results of a preliminary study in which we modified the Au surface with electron poor (rich) SAMs, resulting in an effective increase (reduction) of the workfunction of Au and drastically changing the nature of charge injection at the contacts. Our results indicate that understanding the band alignment at the metal/polymer interface is an important step towards understanding the nature of charge injection in these devices.

Behrang Hamadani
Department of Physics and Astronomy Rice University

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