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Charge Transport Properties in Polymer Brushes. MARK MOOG, FRANK TSUI, IAN VONWALD, WEI YOU, University of North Carolina at Chapel Hill — Electrical transport properties in poly(3-methyl)thiophene (P3MT) brushes have been studied. The P3MT brushes correspond to a new type of surface-tethered, vertically oriented conjugated molecular wires, sandwiched between two metallic electrodes to form the electrode-molecule-electrode (EME) devices. P3MT is a highly conjugated polymer, a "workhorse" material for organic electronics and photonics. The P3MT brushes were grown on ITO surfaces with controlled length (between 2 and 100 nm). The top electrodes were transfer-printed Au films with lateral dimensions between 200 nm and 50 μm. I-V and differential conductance measurements were performed using conductive AFM and 4-terminal techniques. Tunneling and field-emission measurements in EME devices with molecular lengths < 5 nm show HOMO mediated direct hole tunneling with energy barriers of 0.3 and 0.5 eV at the respective interfaces with ITO and Au. The transport properties in longer brushes are indicative of the two quasi-Ohmic interfaces with a characteristic offset in the conductance minimum of 0.12 V biased toward the ITO. Temperature dependent parameters have been examined at various molecular lengths. The drift mobility and the interplay between intra- and intermolecular transport have been investigated.

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