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Electron transport through OPE-based molecules in junctions formed by electromigration XUEQING LIU, WEI CHEN, ZHONGKUI TAN, KONSTANTIN K. LIKHAREV, JAMES LUKENS, Department of Physics and Astronomy, Stony Brook University, ANDREAS MAYR, Department of Chemistry, Stony Brook University — We have studied the self-assembly and electron transport properties of (i) simple oligo(phenylene ethynylene) (OPE) chains (2.2 nm) and (ii) OPE based molecules with a naphthalene diimide acceptor group (4.5 nm). Both are capped with terminal isocyanide groups. The molecules are self-assembled on gold wires with a cross-section $\sim 20\times100$ nm^2. The junctions are formed by electromigration and the transport measurements are carried out at 4.2 K. For simple OPE chains, more than 40% of the junctions have shown non-linear I-V curves with resistance R in the range from MΩ to GΩ, due to trapping of single or multiple molecules. In $\sim$10% of the junctions (R $\sim$ a few GΩ), we observe I-V curves with discrete current steps due to electron transport through one or a few molecules. The histogram of the step voltages shows grouping at certain levels. These levels are in a semi-quantitative agreement with our calculations based on the general theory of single-electron transport. For long OPE molecules with acceptor groups, the yield is low (<15%), and the data show Coulomb blockade with threshold voltages from 30 to 200meV. Currently we are working on different support nano-structures that will promise higher yield. This work is supported by AFOSR and NSF.

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