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Growth of Thin, Anisotropic, π-Conjugated Molecular Films by Step-Wise 'Click' Assembly of Molecular Building Blocks: Characterizing Reaction Yield, Surface Coverage, and Film Thickness vs. Addition Step Number ABEL DEMISSIE, GREG HAUGSTAD, C. DANIEL FRISBIE, University of Minnesota — Molecular electronics is an active field of nanotechnology that has gained much interest due to the advent of modern microscopy techniques, and thin film synthesis using click chemistry – an approach which has enabled scientists to achieve a sub-angstrom control of monolayer length. Among the major challenges to grow oriented, surface-confined wires by click chemistry is development of synthetic routes that yield monodisperse wires, and lack of systematic way to measure the surface coverage of molecules. In this work, we report a comprehensive characterization of π-conjugated oligophenylene imine (OPI) wires synthesized step-wise by imine condensation click chemistry. OPI wire synthesis began with a self-assembled monolayer (SAM) of 4-formylthiophenol or 4-aminothiophenol on Au, followed by alternate addition of terepthaldehyde or phenylenediamine. OPI wires were characterized after each monomer addition via Rutherford backscattering spectrometry, x-ray photoelectron spectroscopy, cyclic voltammetry, reflection-absorption infrared spectroscopy, and nuclear reaction analysis. We have determined an average extent of reaction greater than 98% completion for each growth step using five different techniques. Overall, these nanoscale scale surface characterization techniques proved to be an extremely sufficient method for monitoring wire growth and surface coverage.

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