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Correlating Internal Chemical and Physical Structure with Electrical Data for Nanoscale Molecular-Electronic Devices JASON J. BLACKSTOCK, Quantum Science Research, HP Labs, WILLIAM F. STICKLE, HP Labs Corvallis, CARRIE L. DONLEY, DUNCAN R. STEWART, R. STANLEY WILLIAMS, Quantum Science Research, HP Labs — The critical limitation for most nanoscale molecular-electronic devices is the lack of physical/chemical characterization accompanying electrical data. Present most device geometries and fabrication processes are incompatible with conventional photon and electron spectroscopies and scanning probe microscopies – critical layers and interfaces are frequently inaccessibly buried inside the as-built device structures. We present the fabrication of a new stencil-based nanopore device geometry, along with techniques for studying the in-situ characterization of the as-build internal properties of these devices. These methods were developed in combination to allow the cleaving of completed device stacks at internal inorganic/organic interfaces in a UHV environment. This cleaving process exposes the uncontaminated and unaltered internal nanoscale chemical and physical structure in UHV for examination with a range of conventional tools. We specifically present on XPS, IR and STM data from several metal/organic-monolayer/metal device stacks of interest, and conclude by correlating temperature-dependant and IETS electrical data on nanoscale devices with the physical/chemical characterization.

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