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X-ray Photoelectron Spectroscopy of Buried Electronic Layers and Interfaces JASON J. BLACKSTOCK, CARRIE L. DONLEY, Quantum Science Research, HP Labs, WILLIAM F. STICKLE, HP Labs Corvallis, DUNCAN R. STEWART, DOUGLAS OHLBERG, R. STANLEY WILLIAMS, Quantum Science Research, HP Labs — Miniaturization of integrated circuits requires ever more detailed nanoscale physical and chemical characterization to engineer successful devices, as critical device layers are now only nanometers thick and frequently buried within complex material stacks. Nonetheless, correlating electronic device behavior with internal chemical structure remains essential for producing reliable devices. We present a new method for accessing the internal chemical structure of critical nanoscale layers in electronic device stacks via x-ray photoelectron spectroscopy (XPS). The method is based on engineering a weakened interface between two critical layers, then cleaving the stacks at this interface in a UHV environment and using XPS to characterize the layers and interfaces adjacent the cleave-plane. We present data from Pt/Pt-oxide/organic-monolayer/metal device stacks which show useful electrical switching behavior. This method reveals unexpected changes to the metastable Pt-oxide occur during stack fabrication. These changes to the buried nanoscale Pt-oxide layer are also shown to be inaccessible with conventional ion-milling or sputtering techniques that destroy the evidence of these subtle changes.

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