X-ray Photoelectron Spectroscopy of Buried Electronic Layers and Interfaces

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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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