HfO_2/Al_2O_3 Cap Interaction

Beamline: X24A & X23A2

Category of Researcher: PRT member

Technique: EXAFS & HAXPES

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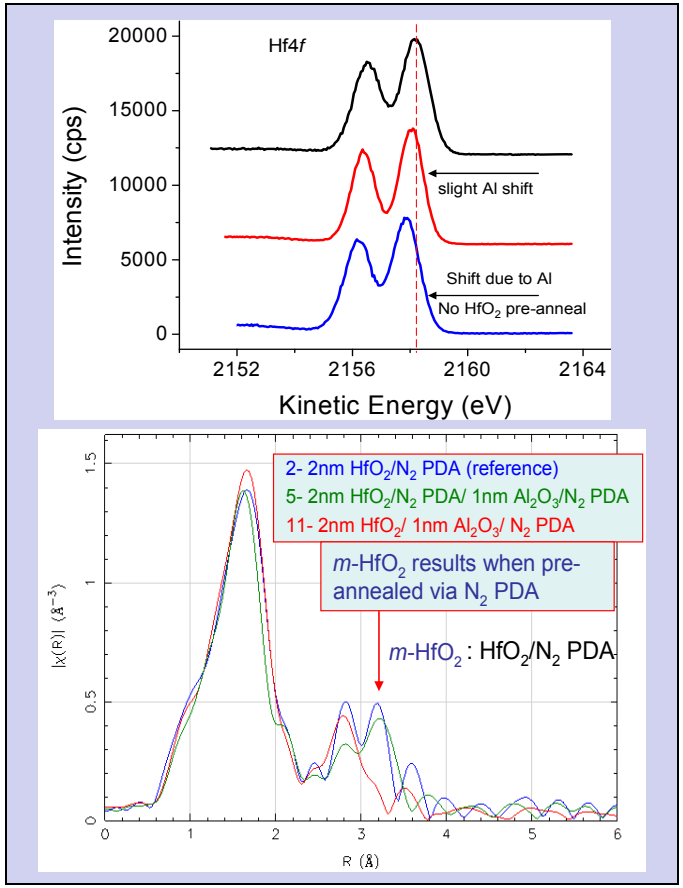
Motivation: Al_2O_3 is widely used as a cap dielectric layer to tune the effective work function of p-metal electrodes and Al_2O_3 is common in Flash memory stack systems. Understanding interactions with adjacent layers as a function of anneal processing is critical to the explanation of mechanistic pathways that limit performance.

Results: XPS of Hf core lines illustrates the dependence of Al in-diffusion on the pre-anneal condition of the HfO_2 layer. Consistent with this spectra, EXAFS of these samples indicate: 1) pre-anneal in N_2 ambient yields *m*- HfO_2 which remains stable to the Al_2O_3 cap layer during subsequent anneal processing. 2) as-deposited HfO_2 converts to HfAlO due to Al in-diffusion during the final anneal process.



XPS Hf 4f core line shifts to higher binding energy due to Al in-diffusion forming hafnium aluminate when the HfO_2 is not pre-annealed. The Radial Distribution function of the Hf L_3 edge EXAFS data illustrates m-HfO_2 for the pre-annealed samples and HfAlO formation (t-HfO_2) due to Al in-diffusion when the HfO_2 is not pre-annealed.