Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Real-time studies of the atomic layer deposition of metal oxides using Ambient pressure x-ray photoelectron spectroscopy[1] JOACHIM SCHNADT, ASHLEY R. HEAD, SHILPI CHAUDHARY, SOFIE YNGMAN, NICLAS JOHANSSON, OLESIA SNEZHKOVA, JAN KNUDSEN, JESPER N. ANDERSEN, Lund University, HENDRIK BLUHM, Lawrence Berkeley National Laboratory, ANDERS MIKKELSEN, RAINER TIMM, Lund University — Performing atomic layer deposition (ALD) of metal oxides at pressures around 0.01 mbar slows the half reactions of the process to allow *in situ* real-time probing of changes in the surface electronic structure using Ambient pressure x-ray photoelectron spectroscopy (APXPS). By monitoring the ALD process as it occurs, new details on the mechanisms of interface formation and thin film growth can be obtained. The deposition of HfO_2 on InAs and the deposition of TiO_2 on rutile titania from transition metal complexes and water were studied with APXPS. Predictable, cyclic chemical shifts of ligand and substrate ionizations are seen in the growth of the films, but the kinetics of the film growth differs for the two systems. Upon exposure to the titania surface, the titanium precursor reacts straightaway and gradually proceeds to completion. In contrast, the hafnium precursor does not interact with the surface immediately. Once an activation barrier is surpassed, the reaction occurs instantaneously. By understanding the reactivity of different precursors, the ALD process can be more easily optimized in applications that require thin films of metal oxides such as metal-oxide-semiconductor devices and catalytic surfaces.

[1]Support by the Swedish Research Council (grant no. 2010-5080) is gratefully acknowledged.

Joachim Schnadt
Lund University

Date submitted: 12 Nov 2013 Electronic form version 1.4