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In-situ and operando characterization of atomic layer deposited SnO_2 and SnO_2/CeO_2 heterostructures for gas sensing applications — •Rudi Tschammer, Carlos Morales, Karsten Henkel, and Jan Ingo Flege — Applied Physics and Semiconductor Spectroscopy, Brandenburg University of Technology, Cottbus, Germany

The amorphous and defective nature of atomic layer deposited (ALD) thin films results in material properties deviating from those of well-ordered and crystalline samples. For instance, we recently reported that ALD cerium oxide (CeO_2) ultrathin (<10nm) layers could be reduced under H_2/O_2 mixtures at room temperature without decoration with noble metals, thus opening the door to design miniaturized resistive sensors based on ALD-CeO_2 active layers. However, the remaining challenges include high electrical resistance (GΩ) and relatively long response and recovery times, which may be solved by combination with conductive oxides. In particular, tin oxide (SnO_2) has been shown to improve the sensing properties of CeO_2, tentatively explained by interface effects. Here, we present in-situ X-ray photoelectron spectroscopy (XPS) and operando spectroscopic ellipsometry measurements of ultrathin ALD-SnO_2 layers, highlighting a linear growth rate, an evolution of the Sn Auger parameter related to distinct chemical envioroments rather than different oxidation states, and changes in C and N residues with the ALD number of cycles. Lastly, preliminary results from structural and chemical characterization, as well as sensing capabilities, of ALD-SnO_2/CeO_x heterostructures are discussed.

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Type: Vortrag;Talk
Topic: Thin Film Properties: Structure, Morphology and Composition (XRD, TEM, XPS, SIMS, RBS, AFM, ...)
Keywords: tin oxide; atomic layer deposition (ALD); X-ray photoelectron spectroscopy (XPS); spectroscopic ellipsometry (SE)
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