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Atomic layer deposition of cerium oxide monitored by operando ellipsometry and in-situ X-ray photoelectron spectroscopy — •Rudi Tschammer[1], Yuliia Kosto[1], Carlos Morales[1], Marcel Schmickler[2], Karsten Henkel[1], Anjana Devi[2], and Jan Ingo Flege[1] — [1]Applied Physics and Semiconductor Spectroscopy, BTU Cottbus-Senftenberg, Cottbus, Germany — [2]Inorganic Materials Chemistry, Ruhr University Bochum, Universitätsstraße 150, Bochum, Germany

Atomic layer deposition (ALD) has been used extensively to grow homogeneous films with excellent coverage and atomic-scale thickness control for a variety of applications. However, remaining challenges include the investigation of novel precursor-oxidant combinations for low-temperature deposition as well as unraveling the complex interplay between substrate and coating for ultrathin films. In this work, we present a detailed investigation of ultrathin cerium oxide films grown using the novel $Ce(dpdmg)_3$ precursor with H_2O and O_2. Following a surface science-based approach, we have combined operando spectroscopic ellipsometry and in-situ X-ray photoelectron spectroscopy to allow rapid process optimization and determination of the complex relation between oxide stoichiometry, film thickness and ALD growth parameters, revealing a distinct dependence of inital Ce^{3+} content on the film thickness and choice of oxidant. This offers the possibility of adjusting the oxide properties to application requirements e.g. in gas sensing by choosing a suitable precursor-oxidant combination.

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Email: tscharud@b-tu.de