# In-situ investigation of oxidant influence on materials properties of ultrathin cerium oxide films using novel $Ce(dpdmg)_3$ precursor

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, 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 aiming for high growth rates, low-temperature deposition as well as unraveling the complex interplay between film stoichiometry and oxidant choice for reducible oxides. In this work, we present a detailed investigation of ultrathin cerium oxide films grown using the novel $Ce(dpdmg)_3$ precursor with different oxidants ($H_2O$, $O_2$, and $O_3$). 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 film properties such as stoichiometry, contaminations, and thickness under ultra-high vacuum conditions. This way, a distinct dependence of initial $Ce^{3+}$ content on film thickness and choice of oxidant is revealed, paving the way for tailoring the deposit properties toward different applications, e.g., gas sensing, through optimization of deposition parameters and precursor-oxidant interplay.