Abstract

Atomic layer deposition is a versatile thin film deposition technique with comprehensive underlying reaction chemistry. Developed only in the early 1970s for fabrication of thin film electroluminescent displays, it is nowadays a worldwide hot topic of research in industry and academia. Even though ALD deposition of binary oxides is well investigated, studies on active control over film properties *via* co-precursor choice, doping and deposition parameters are relatively preliminary. Moreover, research on the use of hetero-bimetallic precursors to obtain ternary oxides is fairly absent.

In this work ZnO thin films have been deposited with different co-precursors (H_2O and O_3) on flat substrates and on TiO_2 nanorods. The influence of the used co-precursor on the structural and optical properties such as film thickness and band gap of ZnO films was analyzed. In addition ZnO films were doped with niobium via ALD and the optical properties of the films deposited at different temperature and of different thickness investigated. On the basis of these results a relation was found between defect states as measured *via* photoluminescence and the deposition parameters. This work highlights the successful ALD deposition of a ternary oxide from a hetero-bimetallic cerium-tin precursor on flat and high-aspect-ratio substrates and its application as chemical gas sensor. The composition and structure of the obtained CeSn mixed metal oxide were thoroughly studied with techniques such as thin film XRD, cross-sectional TEM and XPS.

As future substrates for ALD depositions, the growth of TiO_2 nanorods and SnO_2 nanowires on various substrates was studied as well. A method was found to produce relatively large area, free-standing TiO_2 nanorod films. Finally ZnO/ TiO_2 heterostructures were prepared by ALD and the influence of pulse and purge times on the quality of the deposition was studied with SEM. Depositions of the ternary CeSn mixed metal oxide on SnO_2 wires were analyzed *via* high resolution TEM and their response to reducing and oxidizing atmospheres investigated.