

New Master Theses in the AG Jooß in 2024

Hello and welcome!

We are pleased about your interest in a Master's thesis in our group, which is concerned with fundamental investigations on materials for the use of renewable energy. If you are interested, please contact: cjooss@gwdg.de or joerg.hoffmann@phys.uni-goettingen.de

Investigation of structure-property relationships of epitaxial perovskite oxide thin films using depth-profiled X-ray photoelectron spectroscopy

Perovskite oxides exhibit a variety of novel electronic and magnetic structures. Of particular interest are electronic phase transitions that can be induced by external fields, in which the subtle interplay of charges, spins, orbitals, lattice distortions and crystal structure changes in fascinating ways. These electronic correlations are highly dependent on the chemical composition and defect structure.

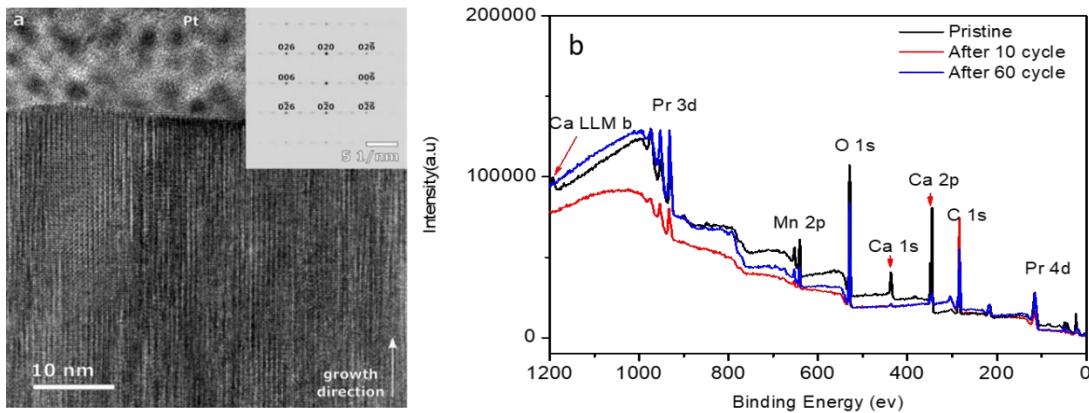


Figure: (a) Transmission electron microscopy cross-sectional image of a typical Ruddlesden-Popper Pr-Ca-Mn-O film whose crystallographic c-axis lies in the film plane. (b) XPS spectra of the surface of such films as prepared and after use as electrodes for electrochemical water splitting.

The aim of the master's thesis is to use depth profiled X-ray photoelectron spectroscopy (XPS) to investigate the chemical composition as well as the valence and bonding states in the material as a function of the distance to the surface. For this purpose, the information depth of the photoelectrons is varied by the energy of the X-ray photons and the exit angle of the photoelectrons. Furthermore, the layer is successively ablated using a so-called ion cluster source and the newly generated surface is analyzed. With ion cluster sources, it is not individual ions, e.g. Ar⁺ ions, but ionized clusters Ar_n⁺ that are used for ablation.

The investigations will be carried out on epitaxial La-Sr-Mn-O and Pr-Ca-Mn-O gradient layers produced by ion beam sputtering. In this process, the deposition geometries are selected in such a way that the composition of the layer changes continuously and thus different chemical compositions can be realized in one sample.

These results are correlated with further investigations of the structure (including transmission electron microscopy) and the physical properties through collaboration within the working group. The

work is therefore characterized by the fact that by working in a team a very comprehensive picture of the structure-property relationships of the investigated epitaxial perovskite oxide thin film system is created, which should also result in a publication.