Spectroscopic investigation of the impact of film thickness and post-growth treatment on the electronic structure of $La_xSr_{1-x}MnO_3$ films

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$La_xSr_{1-x}MnO_3$ (LSM) is currently the material of choice for commercial use as solid oxide fuel cell (SOFC) cathodes. This is due, among other reasons, to its low chemical reactivity and a thermal expansion coefficient similar to the solid yttria-stabilized zirconia (YSZ) electrolyte. To optimize the oxygen reduction reaction (ORR) activity, the surface electronic structure and chemical composition of the cathode are of particular interest. Since the ion conductivity in LSM is low and the ORR is believed to take place at air-LSM-YSZ triple points, the interface between LSM and YSZ is also of large interest.

The surfaces of LSM thin films were investigated with a “tool chest” of soft x-ray and electron spectroscopies (lab-based, as well as using high-brilliance synchrotron radiation). These techniques allow the determination of electronic structure and chemical composition as well as chemical environment of the components of the material. The thin films were grown on different substrates (YSZ, $NdGaO_3$, and $SrTiO_3$) by pulsed laser deposition (PLD). In this presentation, we particularly focus on the trends in surface chemical composition as a function of film thickness. Furthermore, we investigate the impact of annealing under pO_2 environment as a function of annealing temperature.