In situ NAP-HT-XPS studies of $La_{0.31}Sr_{0.58}Ti_{0.97}Ni_{0.03}O_{3-\delta}$ thin film SOFC anode

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For rational development of solid oxide cells (SOC) it is essential to understand processes occurring at operating electrodes. Because of harsh operating conditions and several technical limitations, the number of high temperature *in situ* spectroelectrochemical and XRD studies is rather limited.[1,2] Simultaneous chemical and electrochemical characterization of operating electrode is very promising approaches for deconvolution of surface processes occurring at SOFC anode.

One possible way to improve reliability and reduce complexity of the SOFC balance of plant is the implementation of mixed ionic-electronic conductive (MIEC) ceramic materials instead of metal-cermet (as Ni-YSZ or Ni-GDC) composites as hydrogen electrode. One of most studied MIEC electrode compositions is perovskite type La doped $SrTiO_3$. Different modifications and doping levels with different properties have been demonstrated in numerous studies.[3] Because of good stability, $La_{0.31}Sr_{0.58}Ti_{0.97}Ni_{0.03}O_{3-\delta}$ (LSTN) was selected as the model material for NAP-HT-XPS EIS experiment.

In the present study thin film $La_{0.31}Sr_{0.58}Ti_{0.97}Ni_{0.03}O_{3-\delta}$ electrode was prepared using pulsed laser deposition (PLD) technique. Current collectors were made from Pt (using magnetron sputtering) and placed under the thin film electrode layer.

Electrodes were characterized using XPS and EIS methods at near ambient pressure conditions (1-5 mbar) at 650 °C and at normal pressure. Surface chemistry was characterized at different H_2/H_2O ratios i.e. at controlled oxygen partial pressures. Electrochemical activation of LSCN electrode was carried out at cathodic polarization and surface chemistry of electrode was monitored afterwards. Impedance analysis of LSTN microelectrodes was carried out at controlled pO_2 and discussed together with *in situ* NAP-HT-XPS results.

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