In situ X-ray studies of $La_{0.6}Sr_{0.4}Fe_{0.8}Co_{0.2}O_3$ epitaxial thin films as model solid oxide fuel cell cathodes

Kee-Chul Chang[1*], Brian Ingram[2], Hui Du[3], Daniel Hennessy[1], Paul Salvador[3], and Hoydoo You[1]

[1]Materials Science Division, Argonne National Laboratory
[2]Chemical Sciences and Engineering Division, Argonne National Laboratory
[3]Department of Materials Science and Engineering, Carnegie Mellon University

[*]Corresponding author Email: kcchang@anl.gov, Tel: 630-252-5538

ABSTRACT

We probed the near surface properties of model $La_{0.6}Sr_{0.4}Fe_{0.8}Co_{0.2}O_3$ (LSCF) cathodes under solid oxide fuel cell (SOFC) operating conditions using synchrotron X-rays. Epitaxial thin-films of LSCF, grown on single crystal yttria-stabilized zirconia (YSZ) substrates with and without a Gd doped ceria (GdC) buffer layer, were used as cathodes in a half-cell configuration to enable surface sensitive X-ray techniques. The LSCF cathode was fully characterized between 500-800°C with and without applied potential, using a combination of X-ray reflectivity, diffraction, florescence and spectroscopy.

We find that LSCF on YSZ(111) without the GdC buffer layer is more unstable under thermal annealing, with a decrease in the film density. This system was also found to have different Co and Fe oxidation states compared to the bulk after annealing. We will present our recent electrochemistry results, experimentally relating the active area under applied potential at different temperatures for the LSCF thin films. and discuss possible changes in the surface properties of these activated areas.