**In-Operando XRD of Anode-Supported LSCF Cathodes at 700 – 800°C for 1000 h**

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Anode-supported solid oxide fuel cells with LSCF cathodes were operated at 700, 750, and 800°C for more than 1000 hours at constant current approximating an operating voltage of 0.8 V. X-ray diffraction (XRD) of the cathode was performed continuously over the entire duration of each test to monitor any changes that occur in the XRD patterns over time during cell operation. The XRD results collected at the three temperatures are compared to one another and to previous tests including those of a duplicate cell that, rather than generating current, was held at open circuit voltage (OCV) at 750°C for over 1000 hours in the XRD test stand. SEM and EDS mapping of polished cross-sections was performed after XRD testing was complete. Summation of the XRD patterns taken over the entire duration of the tests resulted in cumulative count times that greatly enhanced the signal to noise ratio of peaks associated with minor phases, making it possible to identify trace phases such as LaCoO3, Fe3O4, and Co3O4 present in the cathode in concentrations of less than 1%. While no change in the peaks of the major LSCF perovskite phase was observed over time in any of the XRD patterns, at 700°C & 0.8V and 750°C & OCV, the peaks of the minor Fe3O4 and Co3O4 phases exhibited peaks shifts indicating that their crystal lattice volumes were diverging. SEM/EDS indicated regions of high Fe-concentration in the SDC layer and high Co-concentration in the LSCF layer.