

Modeling and Investigation of Oxygen Reduction Activity on Mixed Ionic-Electronic Conductors for SOFC Cathodes

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Porous cathodes are of primary importance to the electrochemical operation of a solid oxide fuel cell (SOFC). The compound $\text{La}_{1-x}\text{Sr}_x\text{Co}_{1-y}\text{Fe}_y\text{O}_{3-\delta}$ (LSCF) is a candidate material for the cathode, and shows good mixed ionic-electronic conductivity as well as good activity toward the oxygen reduction reaction. The compound $\text{La}_{1-x}\text{Sr}_x\text{MnO}_{3\pm\delta}$ (LSM) is also a good candidate, lacking the ionic conductivity of LSCF but having better chemical stability. Recently, we found that a thin coating of LSM on an LSCF backbone enhances the oxygen reduction kinetics under a cathodic bias and also enhances the chemical stability. In this poster, we present possible explanations for that activation under a bias. We model the defect chemistry of both LSCF and LSM as a function of bias and effective partial pressure of oxygen, and show how they could affect the oxygen reduction kinetics on the surface. Grain boundaries in the LSM may also play an important role and we describe a possible mechanism for that enhancement. We also outline our recent findings in probing the fundamental properties of LSCF and LSM using carefully designed cells with well-defined electrodes and current collectors to eliminate the effect of sheet resistance.