



Material development for Cr resistant SOFC cathodes

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Abstract

Cr poisoning of perovskitic cathodes is a well-identified reason for long-term performance degradation of solid oxide fuel cells (SOFC). Parameters like temperature, Cr partial pressure and cathode gas humidity have been identified to have a major influence on the degradation process. The interaction of the volatile Cr and the cathode includes chemical and electrochemical reactions resulting in microstructural changes due to Cr deposition or element depletion of the cathode perovskite lattice. For state-of-the-art (La,Sr)(Co,Fe)O₃ (LSCF) cathodes Sr-segregation is a well-known phenomenon leading to an insulating SrCrO₄ layer on top of LSCF cathode materials. When using a composite electrode like the established (La,Sr)(Mn)O₃ with yttria-stabilized zirconia (LSM/8YSZ) Cr deposition is often found on the triple phase boundary between LSM, 8YSZ and the gas phase. Therefore, SOFCs facilitating LSCF and LSM show quite different degradation behavior. Based on external and internal results from model experiments and stack operation, a practical approach for the material development of Cr tolerant ceramic cathode materials will be presented. Focus lies on the interaction of volatile Cr species and cathode materials with varying compositions including A-site deficiency. The overall aim is to find a balance between Cr resistance, ionic and electronic conductivity and stability at elevated temperatures to ensure an even longer operation time for future SOFCs systems.