

$\text{Pr}_x\text{Sr}_{1-x}\text{MnO}_{3-\delta}$ (PSM) and $\text{La}_{0.8}\text{Sr}_{0.2}\text{Mn}_{0.8}\text{Co}_{0.2}\text{O}_{3-\delta}$ (LSMC) Infiltrated LSCF Cathodes for SOFCs

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The cathode is an important area of SOFC development since cathode polarization still makes considerable contribution to energy loss; reduction in cathode polarization and improvement in stability by catalysts infiltration will ultimately reduce the cost of SOFC technology. We demonstrated that the activity and stability of commonly used $\text{La}_{0.6}\text{Sr}_{0.4}\text{Co}_{0.2}\text{Fe}_{0.8}\text{O}_{3-\delta}$ (LSCF) cathode can be significantly enhanced by a thin-film coating of $\text{La}_x\text{Sr}_{1-x}\text{MnO}_{3-\delta}$ (LSM) or $\text{Pr}_x\text{Sr}_{1-x}\text{MnO}_{3-\delta}$ (PSM), with the latter showing more significant enhancement. TEM observations suggest that a layer of La and Sr oxide was formed on the surface or between grain boundaries of LSCF samples after annealing, which severely hamper the electrochemical activities. In contrast, there is no such oxide layer on the LSM-coated LSCF samples under similar annealing conditions. Theoretical reaction-rate and point defect analysis suggests that the enhanced electrocatalytic activity of LSM-coated LSCF is attributed possibly to surface activation under cathodic polarization due to the promotion of oxygen adsorption and/or dissociation by the surface layer and the dramatically increased oxygen vacancy population in the surface film. Further, the observed time-dependent activation over a few hundreds of hours and durability are likely associated with the formation of a favorable hybrid surface phase intermediate (LSMC) between coating species and substrate LSCF. Further investigation on LSMC suggested that it is chemically compatible with the YSZ electrolyte, and has an activation behavior similar to LSM but better electrode performance than LSM.