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Manganese oxide formation in LSM-YSZ cathodes

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Abstract

In solid oxide fuel cells (SOFC) with lanthanum strontium manganite (LSM)-based cathodes and zirconia-based electrolytes, excess Mn is often added to the LSM to prevent the formation of lanthanum zirconates. The degradation rate (increase of area specific resistance (ASR) with time) in such cells is observed to be significantly higher at lower temperatures (e.g. 800 °C) than at higher temperatures (e.g. 925 °C). Therefore, a detailed study of microstructural changes at the cathode-electrolyte interface was performed on SOFCs after long-term operation at different temperatures. Thin foils from the cathode-electrolyte interface were prepared using a focused-ion beam (FIB) milling technique. Transmission electron microscopy (TEM) with energy-dispersive x-ray spectroscopy (EDS) and electron energy-loss spectroscopy (EELS) were used to characterize concentration profiles and to detect and identify secondary phases. Submicron manganese oxide particles were detected near the cathode-electrolyte interface: Mn_3O_4 in cells operated at 925 °C, and both Mn_3O_4 and Mn_2O_3 in cells operated at 800 °C.