

PHASE STABILITY OF SOFC CATHODE MATERIALS LANTHANUM STRONTIUM COBALT OXIDE AND LANTHANUM STRONTIUM IRON OXIDE UNDER LOW PARTIAL PRESSURES OF OXYGEN

James Ovenstone, Jeffrey White and Scott T. Misture

Kazuo Inamori School of Engineering at Alfred University, Alfred, New York

Lanthanum strontium cobalt oxide (LSC) and lanthanum strontium iron oxide (LSF) are important candidates for use as cathodes in solid oxide fuel cells. The phase stability of LSC ($\text{La}_x\text{Sr}_{1-x}\text{CoO}_{3-\delta}$, $x = 0.3, 0.6$ and 0.8) and LSF ($\text{La}_x\text{Sr}_{1-x}\text{FeO}_{3-\delta}$, $x = 0.3$) under varying partial pressures of oxygen from 10 ppm -10000 ppm in a temperature range 25-1000°C have been investigated using high temperature X-ray diffraction. All three compositions of LSC have been shown to decompose reversibly at elevated temperatures (above 300°C) and low oxygen partial pressures (100ppm), but recover their original stoichiometry, but with a smaller particle size when oxygen is re-introduced. The temperatures and oxygen partial pressures at which these changes take place, however, vary with composition, as do the decomposition products. LSC also manifests an isothermal unit cell volume change at 800°C in which the unit cell decreases in size irreversibly. This is observed for compositions where $x = 0.6$ and 0.8 , but not for $x = 0.3$. By contrast, LSF did not undergo decomposition even at an oxygen partial pressure of 10 ppm during heating to 1000°C, but instead the unit cell expands significantly. Upon cooling, the lattice remains expanded, and the particle sizes are also reduced (from peak broadening). The changes in crystal structure are discussed in terms of the microstructure of the materials and their application as cathodes in solid oxide fuel cells.