Intermediate temperature ionic conductivity of Sm1.92Ca0.08Ti2O7–δ pyrochlore

The results of concentration cell electromotive force methods (EMF) and electrochemical impedance spectroscopy measurements on the pyrochlore system Sm1.92Ca0.08Ti2O7–δ are presented. The data have been used to estimate total and partial conductivities and determine transport numbers for protons and oxide ions under various conditions. The EMF techniques employed include corrections for electrode polarisation resistance. The measurements were performed using wet and dry atmospheres in a wide range using mixtures of H2, N2, O2, and H2O in the temperature region where proton conductivity was expected (500–300 °C). The impedance measurements revealed the conductivity to be mainly ionic under all conditions, with the highest total conductivity measured being 0.045 S/m under wet oxygen at 500 °C. Both bulk and grain boundary conductivity was predominantly ionic, but electronic conductivity appeared to play a slightly larger part in the grain boundaries. EMF data confirmed the conductivity to be mainly ionic, with oxide ions being the major conducting species at 500 °C and protons becoming increasingly important below this temperature.

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