

2016

The effect of Sintering condition on the microstructure and Electrical Conductivity of Apatite- type $\text{La}_{9.33}(\text{SiO}_4)_6\text{O}_2$ ceramic

A. Saouadel, N. Azzouz, S. Boulfrad, J. T. SIRR Irvine

Abstract : Rare-earth apatite-type lanthanum silicates, $\text{La}_{9.33}(\text{SiO}_4)_6\text{O}_2$ is prepared in air by the conventional solid state reaction for solid oxide electrolyte. The microstructure and electrical properties of $\text{La}_{9.33}(\text{SiO}_4)_6\text{O}_2$ ceramic are investigated by X-ray diffraction (XRD), scanning electron microscopy (SEM) and electrochemical impedances spectroscopy (EIS). The principal objective is the study of the effect of the sintering condition (time, temperature), on the morphology and the electrochemical properties of this phase. $\text{La}_{9.33}(\text{SiO}_4)_6\text{O}_2$ ceramic consist of a hexagonal apatite type structure and a small amount of a second phase of La_2SiO_5 due to the low temperature of sintering. Electrical properties of the sample have been studied between 302 and 802°C by the complex impedances method. The results of the conductivity measurements obtained between 302 and 605°C are treated first, in the total form of the sample, and then, by separating the grain from the grain boundary. Electrical conductivity of the $\text{La}_{9.33}(\text{SiO}_4)_6\text{O}_2$ apatite-type was found of a value of $1.04 \times 10^{-3} \text{ S}\cdot\text{cm}^{-1}$ at 605°C. This value is higher than that obtained with yttria stabilized zirconia (YSZ) at the same intermediate temperatures.

Keywords : electrolyte, Apatite, Lanthanum silicate, Ionic conductivity