Processing of La1-xSrxGa1-yMgyO3-d by Mechanical Activation

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Abstract

The limitations of the conventional ceramic processing route are well known: high reaction temperatures are required and a limited degree of chemical homogeneity is frequently obtained. Alternative techniques to partly overcome these limitations include sol-gel routes, co-precipitation, hydrothermal reaction, or mechanochemical synthesis, assisted or not by a subsequent high temperature treatment. The mechanochemical process is of great interest since the mechanical energy leads to an increase of the total energy of the system. As a result, the lattice is progressively amorphised, leading in some cases to the formation of the desired phase at room temperature. On the other hand, the total free surface area of the powders increases enhancing their reactivity and, consequently, the sintering temperature is lowered. This work reports on a first attempt to obtain La0.95Sr0.05Ga0.90Mg0.10O3- ceramics by mechanical activation of La2O3, SrO, Ga2O3 and MgO precursors. The activation process was carried out dry grinding the powder precursors in a planetary ball mill. A significant amorphisation of the precursors is observed and dense homogeneous submicrometric ceramic samples were obtained after sintering at 1450C for 2 h in air, as shown by X-ray diffraction and scanning and transmission electron microscopy. Samples obtained by a conventional ceramic route were also prepared, but the sintering temperature was 100C higher. Preliminary impedance spectroscopy data show similar grain conductivities for both materials. However, a significant degradation is observed on ageing the LSGM prepared by the conventional solid state route. This degradation is not present in the material prepared from the mechanically activated precursors, showing clearly higher conductivity values.