Journal of ELECTRONIC MATERIALS, Vol. 42, No. 6, 2013
DOI: 10.1007/s11664-012-2464-0

Effect of Sintering Temperature on Microstructure, Electrical Properties, and Thermal Expansion of Perovskite-Type $La_{0.8}Ca_{0.2}CrO_3$ Complex Oxides Synthesized by a Combustion Method

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Perovskite-type $La_{0.8}Ca_{0.2}CrO_3$ complex oxides were synthesized by a combustion method. Microstructural evolution, electrical properties, and thermal expansion behavior of the ceramics were investigated in the sintering temperature range of 1250°C to 1450°C. It was found that the electrical conductivity (σ_e) remarkably improved with increasing sintering temperature from 1250°C to 1400°C, ascribed to the development of microstructural densification, whereas it declined slightly above 1400°C due to generation of excessive liquid. The specimen sintered at 1400°C had a maximum conductivity of 31.6 S cm^{-1} at 800°C, and lowest activation energy of 0.148 eV. The improvement of the thermal expansion coefficient (TEC) with increasing sintering temperature was monotonic as a result of the microstructural densification of the materials. The TEC of $La_{0.8}Ca_{0.2}CrO_3$ sintered at 1400°C was about 10.5×10^{-6} K^{-1}, being consistent with other components as high-temperature conductors. With respect to microstructure, electrical properties, and thermal expansion, the preferable sintering temperature was ascertained to be about 1400°C, which is much lower than for the traditional solid-state reaction method.

Key words: $La_{0.8}Ca_{0.2}CrO_3$, microstructure, electrical conductivity, activation energy, thermal expansion coefficient (TEC)

INTRODUCTION

Perovskite-type complex oxides of doped lanthanum chromites are attracting increasing attention as high-temperature conductors because of their superior electronic conductivity and excellent chemical stability in both oxidizing and reducing atmospheres. These preeminent characteristics make them promising candidate materials for many important applications, such as interconnectors for solid-oxide fuel cells (SOFC), heating elements for high-temperature furnaces, and current-collecting electrodes in magnetohydrodynamics (MHD).[1–4] However, their applications are limited by poor sinterability, due to appreciable volatilization loss of chromium oxide at high temperatures in oxidizing atmosphere.[5] Therefore, a considerable amount of research effort has been applied to improving the sinterability of doped lanthanum chromites, and it was found that alkaline-earth doping, especially Ca doping, provided reasonably optimum properties.[6–8]

The combustion method, as a wet chemical method, is accompanied by the release of a relatively large

(Received November 19, 2012; accepted December 28, 2012; published online February 28, 2013)