World Academy of Science, Engineering and Technology
International Journal of Energy and Power Engineering
Vol:12, No:09, 2018

Studies on Structural and Electrical Properties of Lanthanum Doped $Sr_2CoMoO_{6-\delta}$ System

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Abstract : A widespread research work on Mo-based double perovskite systems has been reported as a potential application for electrode materials of solid oxide fuel cells. Mo-based double perovskites studied in form of B-site ordered double perovskite materials, with general formula $A_2B'B''O_6$ structured by alkaline earth element (A = Sr, Ca, Ba) and heterovalent transition metals (B′ = Fe, Co, Ni, Cr, etc. and B″ = Mo, W, etc.), are raising a significant interest as potential mixed ionic-electronic conductors in the temperature range of 500-800 °C. Such systems reveal higher electrical conductivity, particularly those assigned in form of $Sr_2CoMoO_{6-\delta}$ (M = Mg, Mn, Fe, Co, Ni, Zn etc.) which were studied in different environments (air/H_2/H_2-Ar/CH_4) at an intermediate temperature. Among them, the $Sr_2CoMoO_{6-\delta}$ system is a potential candidate as an anode material for solid oxide fuel cells (SOFCs) due to its better electrical conductivity. Therefore, $Sr_2CoMoO_{6-\delta}$ (SCM) system with La-doped on Sr site has been studied to discover the structural and electrical properties. The double perovskite system $Sr_2CoMoO_{6-\delta}$ (SCM) and doped system $Sr_{2-x}La_xCoMoO_{6-\delta}$ (SLCM, x=0.04) were synthesized by the citrate-nitrate combustion synthesis route. Thermal studies were carried out by thermo-gravimetric analysis. Phase justification was confirmed by powder X-ray diffraction (XRD) as a tetragonal structure with space group I4/m. A minor phase of $SrMoO_4$ (s.g. I41/a) was identified as a secondary phase using JCPDS card no. 85-0586. Micro-structural investigations revealed the formation of uniform grains. The average grain size of undoped (SCM) and doped (SLCM) compositions was calculated by a linear intercept method and found to be ∼3.8 μm and 2.7 μm, respectively. The electrical conductivity of SLCM is found higher than SCM in the air within the temperature range of 200-600 °C. SLCM system was also measured in reducing atmosphere (pure H_2) in the temperature range 300-600 °C. SLCM has been showed the higher conductivity in the reducing atmosphere (H_2) than in air and therefore it could be a promising anode material for SOFCs.

Keywords : double perovskite, electrical conductivity, SEM, XRD
Conference Title : ICSOFCT 2018 : International Conference on Solid Oxide Fuel Cell Technology
Conference Location : Tokyo, Japan
Conference Dates : September 10-11, 2018