Elaboration of Ruddlesden-Popper Thin Film Via a Sol-Gel Process for Cathode Materials for SOFC Devices

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One of the most important tasks in SOFC research is the reduction of the working temperature from 900-1000°C to about 700°C for future application. This requires an increase in the length of the triple boundary point to minimize the ohmic loss at the interface cathode/electrolyte/air. Thus, one approach is to synthesize new materials having both good electrical and good ionic conductivities. This paper presents a simple and cost-effective process based on Pechini method for the synthesis of both powders and thin films of La_2NiO_4 compounds. The influences of several processing parameters such as viscosity, nature of chelating and polymeric agents, ionic concentration in the sol, heating temperature on the structural and the morphological properties of both thin films and powders are studied.

Powders of $La_2NiO_{4+\delta}$ materials are synthesized in air at low temperature, 700°C. The symmetry of the powders is orthorhombic for a non stoichiometry level of 0.20. The particles evaluated from XRD and MET results are small and value is around 150 nm.

Polycrystalline thin films of $La_2NiO_{4+\delta}$ are synthesized on YSZ substrates by dip-coating using a polymeric sol. Crack free films are obtained after sintering in air at temperatures ranging from 800°C to 1000°C. The microstructure, characterized by SEM, shows the formation of dense polycrystalline films with smooth surface and mean grains size of 50 nm, for films sintered at 1000°C. The thickness, evaluated from rugosimetry measurement, is thin (100 nm) and is a function of the viscosity of the sol. The higher the thickness, the higher the viscosity. Then, it is possible by modifying processing parameters to synthesize thin films with a controlled microstructure (thickness and porosity).