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Preparation and Conductivity Measurements of LSM/YSZ Composite Solid Oxide Electrolysis Cell Anode Materials

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Abstract : One of the most promising anode materials for solid oxide electrolysis cell (SOEC) application is the Sr-doped LaMnO₃ (LSM) which is known to have a high electronic conductivity but low ionic conductivity. To increase the ionic conductivity or diffusion of ions through the anode, Yttria-stabilized Zirconia (YSZ), which has good ionic conductivity, is proposed to be combined with LSM to create a composite electrode and to obtain a high mixed ionic and electronic conducting anode. In this study, composite of lanthanum strontium manganite and YSZ oxide, La_{0.8}Sr_{0.2}MnO₃/Zr_{0.92}Y_{0.08}O₂ (LSM/YSZ), with different wt.% compositions of LSM and YSZ were synthesized using solid-state reaction. The obtained prepared composite samples of 60, 50, and 40 wt.% LSM with remaining wt.% of 40, 50, and 60, respectively for YSZ were fully characterized for its microstructure by using powder X-ray diffraction (XRD), Thermogravimetric analysis (TGA), Fourier transform infrared (FTIR), and Scanning electron microscope/Energy dispersive spectroscopy (SEM/EDS) analyses. Surface morphology of the samples via SEM analysis revealed a well-sintered and densified pure LSM, while a more porous composite sample of LSM/YSZ was obtained. Electrochemical impedance measurements at intermediate temperature range (500-700 °C) of the synthesized samples were also performed which revealed that the 50 wt.% LSM with 50 wt.% YSZ (L50Y50) sample showed the highest total conductivity of 8.27x10⁻¹ S/cm at 600 ^oC with 0.22 eV activation energy.

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