Impact of Thermally-Induced Microstructural Evolution on the Mechanical, Thermal, and Electrical Properties of Strontium Cerate

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Abstract: Perovskite oxide $SrCeO_3$ has been emerged as a versatile material due to multifunctional properties. Its application for practical devices requires in-depth understanding of the role of grains, grain boundaries, and porosity on the properties. In this study, $SrCeO_3$ was synthesized via the conventional solid-state reaction route. To study the effect of grain growth and elimination of porosity on the properties, pellets of the synthesized powder were sintered at different temperatures (1300-1600 °C). The mono-phasic formation was confirmed through X-ray diffraction (XRD) analysis and structural parameters determination by Rietveld refinement. Scanning electron microscopy was used to study changes in the microstructure. The optical band gap was estimated using UV-Visible spectroscopy in reflectance mode. To measure the hardness of the samples, Vicker microindenter was used. Hardness and grain size follow the Hall–Petch equation. Oliver and Pharr's method was employed to measure the elastic modulus of the samples. Phase and thermal stability of samples were confirmed by recording XRD and TG/DSC regularly at an interval of 10 days. The dielectric and electrical properties of the sintered pellets were measured across a wide frequency range (100 Hz - 2 MHz) and temperature range (RT - 600 °C). Conduction in the sample above room temperature is governed by doubly ionized oxygen vacancies. This study further helps in application of strontium cerate as TBC materials.