Structural and Electrical Properties of Perovskite SrSnO$_3$ and Ruddlesden Popper Oxide Sr$_2$SnO$_4$: A comparative study

Upendra Kumar$^1$ and Manisha Jatiya$^1$

$^1$Indian Institute of Information Technology Allahabad

June 16, 2023

Abstract

Perovskites and Ruddlesden Popper oxide should have piqued the interest of researchers looking for an alternative to fossil fuels to fill societal gaps. Thus, in this paper, a comparative analysis of the structural and electrical properties of perovskite SrSnO$_3$ and Ruddlesden Popper oxide Sr$_2$SnO$_4$ was carried out. Both the samples were prepared via solid-state reaction route by taking stoichiometric amounts of SrCO$_3$, SnO$_2$ in accordance with SrSnO$_3$ and Sr$_2$SnO$_4$. The single phase of the samples was obtained by heat treatment at several temperatures, such as 1000°C and 1200°C. The X-ray diffraction analysis of both samples suggests the formation of cubic structure under the space group pm-3m and tetragonal structure under I4/mmm respectively for SrSnO$_3$ and Sr$_2$SnO$_4$. The lattice strain and crystallite size were found to be higher for Sr$_2$SnO$_4$ than SrSnO$_3$, which might be due to difference in atomic arrangement. The Raman studies confirm the symmetry and structure at the local level. The electrical properties of SrSnO$_3$ and Sr$_2$SnO$_4$ were studied as a function of frequency (100 Hz to 2.5 MHz) and temperature range of (50–600°C). These studies have indicated that the Sr$_2$SnO$_4$ shows improved value of electrical parameters such as electrical conductivity, dielectric constant, and tangent loss than SrSnO$_3$. It has been observed that in Sr$_2$SnO$_4$, the migration of mixed type conduction takes place mainly along the a and c directions, i.e., via perovskite cells useful for the mixed ionic and electronic conductor for the intermediate temperature solid oxide fuel cell. The current work can be further explored to develop electrode materials for IT-SOFCs by lattice and structural modification.

Hosted file