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Electrochemical Study of Prepared Cubic Fluorite Structured Titanium Doped Lanthanum Gallium Cerate Electrolyte for Low Temperature Solid Oxide Fuel Cell

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Abstract : Today, the need of the hour is to find out alternative renewable energy resources in order to reduce the burden on fossil fuels and prevent alarming environmental degradation. Solid oxide fuel cell (SOFC) is considered a good alternative energy conversion device because it is environmentally benign and supplies energy on demand. The only drawback associated with SOFC is its high operating temperature. In order to reduce operating temperature, different types of composite material are prepared. In this work, titanium doped lanthanum gallium cerate (LGCT) composite is prepared through the co-precipitation method as electrolyte and examined for low temperature SOFCs (LTSOFCs). The structural properties are analyzed by X-Ray Diffractometry (XRD) and Fourier Transform Infrared (FTIR) Spectrometry. The surface properties are investigated by Scanning Electron Microscopy (SEM). The electrolyte LGCT has the formula $LGCTO_3$ because it showed two phases La.GaO and $Ti.CeO_2$. The average particle size is found to be (32 ± 0.9311) nm. The ionic conductivity is achieved to be 0.073S/cm at 650°C. Arrhenius plots are drawn to calculate activation energy and found 2.96 eV. The maximum power density and current density are achieved at 68.25mW/cm² and 357mA/cm², respectively, at 650°C with hydrogen. The prepared material shows excellent ionic conductivity at comparatively low temperature, that makes it a potentially good candidate for LTSOFCs.

Keywords : solid oxide fuel cell, $LGCTO_3$, cerium composite oxide, ionic conductivity, low temperature electrolyte
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