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Synthesis and Characterization of $Ce_{0.9}Sm_{0.05}Pr_{0.05}O_{1.95}$ as a solid electrolyte for intermediate-temperature solid oxide fuel cell

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Abstract : Co-doped sample of electrolyte$Ce_{0.9}Sm_{0.05}Pr_{0.05}O_{1.95}$have been preparedby Sol-gel method and characterized to explore its use as a solid electrolyte for intermediate temperature solid oxide fuel cells (IT-SOFCs).The crystal structure, microstructure, and ionic conductivity have been determined by X-ray diffraction (XRD), Scanning electron microscopy (SEM), Energy dispersive X-ray spectrometer (EDX), Raman Spectroscopy (Raman), and impedance spectroscopy, respectively. The XRD result reveals that the sample is single phase with cubic fluorite-type structure. The relative density of sample sintered at 1400^0C isabout98% of theoretical density. The average grain size of $Ce_{0.9}Sm_{0.05}Pr_{0.05}O_{1.95}$ sample found from SEM image is 451.4nm. The Raman spectra result showed formation of two distinctive peaks in the $Ce_{0.9}Sm_{0.05}Pr_{0.05}O_{1.95}$lattice. The peak at lower wavenumber (463) cm^{-1}) can be attributed to F_{2g} vibration mode (O-Ce-O) of the fluorite-like structure of pure CeO_2. Besides, the peak at higher wavenumber (564) cm^{-1} can be ascribed to the oxygen vacancies extrinsically introduced into $Ce_{0.9}Sm_{0.05}Pr_{0.05}O_{1.95}$ for maintaining the charge neutrality.The ionic conductivity and activation energy of $Ce_{0.9}Sm_{0.05}Pr_{0.05}O_{1.95}$found at 500^0C was(5.95×10^{-3}S/cm, Ea = $0.64eV$) respectively. All the results confirmed that $Ce_{0.9}Sm_{0.05}Pr_{0.05}O_{1.95}$is a promising alternative electrolyte for intermediate temperature solid oxide fuel cell (IT-SOFC) applications.

Key words : IT-SOFCS, electrolyte,$Ce_{0.9}Sm_{0.05}Pr_{0.05}O_{1.95}$, ionic conductivity.

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