Metal-doped Pyrochlore as Novel Electrode Materials for Intermediate Temperature Solid Oxide Fuel Cell

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In this study, the W-doped pyrochlore oxides $La_2Zr_2O_7$ (LZO) were synthesized by Pechini sol-gel method, which were characterized by X-ray powder diffraction (XRD) and X-ray photoelectron spectroscopy (XPS). The solubility of W is around x=0.1-0.15 in $La_2(Zr_{1-x}W_x)_2O_7$ (LZWO). Measurements of temperature-programmed reduction (TPR) showed no sign of reaction with H_2 for all LZWO samples. XPS study indicated the valence state of La^{3+}, Zr^{4+}, and W(5+, 6+), suggested excess amount of oxygen in the structure. Ionic and electronic conductivity were measured and compared with the commercial intermediate-temperature electrolyte material GDC. The ionic conductivity of 15% W-doped LZO is within 2.2×10^{-3} - 1.9×10^{-2} S/cm at 400 - 700˚C. The structure is stable under temperature close to 1400˚C and reductive condition. The single cell with the electrolyte, Gd-doped ceria (GDC) and 15% W-doped LZO was fabricated and the results suggested that the $La_2(Zr_{1-x}W_x)_2O_{7+\delta}$ is a good candidate to be used as a electrolyte in IT-SOFC device.

Keywords: IT-SOFC, metal-doped pyrochlore, B-site doping, electrode, ionic conductivity, electronic conductivity

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