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Performance and Processing Evaluation of Solid Oxide Cells by Co-Sintering of GDC Buffer Layer and LSCF Air Electrode

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Abstract : Solid Oxide Cell(SOC) systems can contribute to the transition to the hydrogen society by utilized as a power and hydrogen generator by the electrochemical reaction with high efficiency at high operation temperature (>750 ℃). La1-xSrxCo1-yFeyO3, which is an air electrode, is occurred stability degradations due to reaction and delamination with yittria stabilized zirconia(YSZ) electrolyte in a water electrolysis mode. To complement this phenomenon SOCs need gadolinium doped ceria(GDC) buffer layer between electrolyte and air electrode. However, GDC buffer layer requires a high sintering temperature and it causes a reaction with YSZ electrolyte. This study carried out low temperature sintering of GDC layer by applying Cu-oxide as a sintering aid. The effect of a copper additive as a sintering aid to lower the sintering temperature for the construction of solid oxide fuel cells (SOFCs) was investigated. GDC buffer layer with 0.25-10 mol% CuO sintering aid was prepared by reacting GDC power and copper nitrate solution followed by heating at 600 ℃. The sintering of CuO-added GDC powder was optimized by investigating linear shrinkage, microstructure, grain size, ionic conductivity, and activation energy of CuO-GDC electrolytes at temperatures ranging from 1100 to 1400 ℃. The sintering temperature of the CuO-GDC electrolyte decreases from 1400 ℃ to 1100 ℃ by adding the CuO sintering aid. The ionic conductivity of the CuO-GDC electrolyte shows a maximum value at 0.5 mol% of CuO. However, the addition of CuO has no significant effects on the activation energy of GDC electrolyte. GDC-LSCF layers were co-sintering at 1050 and 1100 ℃ and button cell tests were carried out at 750 ℃.

Keywords : Co-Sintering, GDC-LSCF, Sintering Aid, solid Oxide Cells
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