Isostatically pressed bilayer electrolyte for highly stable and enhanced performance of low temperature solid oxide fuel cells

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A gadolinium-doped ceria/yttria-stabilized zirconia (GDC/YSZ) bilayer electrolyte has received significant attention due to its high electrochemical performance at low operating temperature. A GDC layer enables to use high-performance cobalt-containing cathode while preventing the side reaction caused by direct contact between YSZ and the cathode. In addition, a YSZ layer stable in reducing atmosphere could also inhibit the short circuit problem which is attributed to the exposure of GDC to hydrogen. However, the low sintering temperature to avoid side reactions between the two electrolytes decreases the density of the electrolytes. In this study, we report a facile method for the fabrication of dense GDC/YSZ bilayer electrolyte at low sintering temperatures. Even at 1250 °C, highly dense bilayer electrolyte structure could be achieved by employing an isostatic pressure process on the dip-coated electrolyte layers and anode support substrate. This dense bilayer electrolyte system exhibits high power density of 1.251Wcm^{-2} at 650 °C and high stability for 100 h attributed to the highly reduced porosity (<2.5%) in the bilayer electrolyte without any side reaction.