Densification of Ce$_{0.9}$Gd$_{0.1}$O$_{1.95}$ barrier layer by in-situ solid state reaction

A novel methodology, called in-situ solid state reaction (SSR), is developed and achieved for the densification of gadolinia doped ceria (CGO) barrier layer (BL) within the solid oxide fuel cell (SOFC) technology. The method is based on the combined use of impregnation technique and a designed two-step sintering process to promote the densification of the CGO-BL on dense yttria stabilized zirconia (YSZ) electrolyte. A pre-sintering step is carried out at temperature T1 (1150e1250 °C) to obtain porous and interconnected CGO-BL on dense electrolyte substrate. Impregnation of the porous BL is then carried out with small amount of either cobalt or copper nitrate solutions as sintering aids. Final sintering of the CGO-BL at temperature T2 (1250e1275 °C, T2 > T1) is used to promote an SSR between the sintering aid and CGO-BL to obtain densification and grain growth. The approach proposed in this work was proved on both screen printed and tape cast CGO-BL, showing feasibility for the densification of generic ceramic multilayer systems undergoing different constrained sintering conditions and for a large variety of materials.

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