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YSZ / GDC bilayer and gradient barrier layers deposited by reactive magnetron sputtering for Solid Oxide Cells

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Abstract

In this work, the ability to use the magnetron sputtering deposition technique to synthesize YSZ electrolyte and GDC barrier layer for a solid oxide cell is studied. A particular attention is paid to optimize the YSZ / GDC interface in order to promote adhesion between the layers and the global ionic conductivity. First successive deposition of YSZ and GDC is investigated which leads to the formation of bilayer structure. Then co-deposition of both compounds is carried out in order to obtain a chemical composition gradient, ensuring a smooth transition from the electrolyte to the barrier layer. The potential use of those deposits in solid oxide cell is evaluated after annealing at 1100°C for 3 hours in air. Finally, cells with bilayer or gradient deposits are tested at a temperature of 800°C and at a reactive gas flow rate of 24 $NmL.min^{-1}.cm^{-2}$ on the hydrogen side of the cell. A power density of 0.94 $W.cm^{-2}$ at 700 mV in SOFC mode and a current density of -1.4 $A.cm^{-2}$ at 1.3 V in HTE mode are obtained.