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SLA 3D Printing of high-conductivity Sc-Stabilized Zirconia electrolytes for Solid Oxide Cells

The development of alternative electrolyte materials with higher ionic conductivity than conventional 8mol% yttria-stabilized zirconia (8YSZ) is of strong interest for solid oxide cells, particularly when combined with techniques such as ceramic additive manufacturing. Among these materials, ScSZ exhibits superior ionic conductivity; however, Sc-doped electrolytes been reported to promote the formation of rhombohedral phase potentially compromising long-term stability.

In this work, stereolithography (SLA) 3Dprinting was used to shape ceramic electrolytes based on 10% Sc-stabilized zirconia (10ScSZ) and 10% Sc-1% Ce co-doped zirconia (10Sc1CeSZ), with the latter investigated to enhance phase stability. Post-printing sintering was optimized for both compositions, achieving relative densities above 95% while maximizing ionic conductivity. The electrolytes were first characterized in symmetric configuration, yielding ionic conductivities of ~0.1 $S \cdot cm^{-1}$ at 800℃, significantly higher than values typically obtained for 8YSZ.

Based on these results, electrolyte-supported cells (ESC) were fabricated using LSCF-CGO oxygen electrodes and NiO-YSZ fuel electrodes. Full-cell testing on ESC, with thicknesses of ~250 µm for both materials, resulted in current densities of 0.5 $A \cdot cm^{-2}$ at 0.7 V and 800℃, demonstrating the high ionic conductivity of the 3D-printed electrolytes at the device level. In addition, ageing tests were carried out to assess the degradation behavior of both materials.

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Interest in submitting a paper in a special issue of

No interest

Invitation letter for visa

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