INFLUENCE OF ELECTROLYTE SCAFFOLD MICROSTRUCTURE AND LOADING OF MIEC MATERIAL ON THE ELECTROCHEMICAL PERFORMANCE OF R-SOC FUEL ELECTRODE

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The performance of mixed ionic electronic conductor (MIEC) electrodes can be increased using careful design of the electrode microstructure. It has been demonstrated that for infiltrated electrodes impedance has a clear dependency on the structural parameters and on porosity of support structure. Structural change results in significant change in resistance of active centers but also in low frequency i.e. concentration related resistance, especially at higher current densities [1], [2]. In this study, porous $(Sc_2O_3)_{0.10}(CeO_2)_{0.01}(ZrO_2)_{0.89}$ (ScCeSZ) electrolyte scaffolds with different porosities were prepared using various amounts of pre-calcined electrolyte powder and different pore formers (Fig.1). Furthermore, various amounts of catalytically active MIEC materials were added into scaffolds to obtain different solid oxide single cells. Pre-calcination and milling process of ScCeSZ electrolyte powder increased the average pore sizes and increased the overall porosity of scaffolds by about 10%. However, due to the use of pre-calcined electrolyte powder with increased particle sizes, specific area of electrolyte scaffolds, thus activity decreased at lower MIEC loadings. Still, highest current densities of 0.94 and 1.12 A/cm^2 (at 850 °C) for fuel cell and electrolysis modes, respectively, were measured while increasing MIEC loading for scaffold with highest open porosity prepared from pre-calcined electrolyte material.

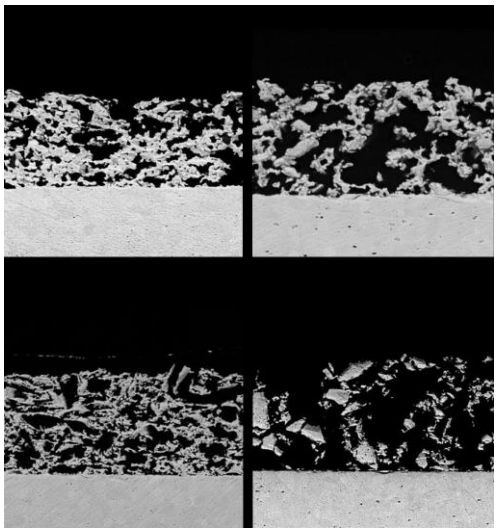

Fig.1 Selected porous electrolyte scaffolds with different pore size distributions and open porosities.

References

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