Ali Torabi, A. R. Hanifi, T. H. Etsell, P. Sarkar,

Effects of Porous Support Microstructure on Performance of Infiltrated Electrodes in Solid Oxide Fuel Cells

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Abstract: The impact of porous support morphology on the electrochemical performance of LSM-infiltrated symmetrical cells was investigated. Five distinctly different porous YSZ supports were developed using different YSZ powders (as received or calcined-milled), pore formers (polymethyl methacrylate, graphite and carbon black) and sintering conditions, while the total volume fraction of open porosity was identically kept in the range of 50–55% for all the cells. The influence of size, connectivity and distribution of the pores as well as the configuration of YSZ particles on the surface area and three phase boundary length was analyzed qualitatively by scanning electron microscopy and quantitatively by the Brunauer-Emmett-Teller technique both before and after LSM infiltration into the support. Ac impedance spectroscopy studies revealed that ohmic and polarization resistance of the cells were quite varied. It was found that a calcined YSZ-based structure had the most uniform morphology and the lowest ohmic resistance (225 m_°§ cm2 at 800◦C). Low temperature sintered cells with an as received YSZ-based structure, however, exhibited the lowest polarization resistance (60 m_.cm2 at 800◦C). The significance of using calcined YSZ-based structures in the practical development of porous YSZ supports is discussed.