Residual Stress Analysis of Co-extruded Solid Oxide Fuel Cell Platform

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A novel process for producing a solid oxide fuel cell platform has been developed where electrolyte and precursor interconnect oxide powders are co-extruded to form a hybrid 4x4 square-celled honeycomb. Upon reduction and sintering of the cell, five alternating layers of dense electrolyte and metallic interconnect are formed. Residual stresses develop upon cooling of the cell from processing to room temperature due to thermal expansion differences between the two materials. Various interconnect compositions (Fe45Ni, Fe47.5Ni and Fe50Ni) were co-extruded with a common electrolyte (8 mol% YSZ) to modify thermal expansion differences. In the present work the formed residual stresses are characterized using x-ray diffraction at room temperature. The temperature where the residual stresses build up in the studied fuel cells are determined by using an analytical model employing thermal expansion values obtained from dilatometer measurements. Residual stress trends as a function of composition and location (distribution) were evaluated.