Novel fabrication technique of hollow fibre support for micro-tubular solid oxide fuel cells

Abstract:

In this work, a cerium-gadolinium oxide (CGO)/nickel (Ni)-CGO hollow fibre (HF) for micro-tubular solid oxide fuel cells (SOFCs), which consists of a fully gas-tight outer electrolyte layer supported on a porous inner composite anode layer, has been developed via a novel single-step co-extrusion/co-sintering technique, followed by an easy reduction process. After depositing a multi-layers cathode layer and applying current collectors on both anode and cathode, a micro-tubular SOFC is developed with the maximum power densities of 440–1000 W m-2 at 450–580 °C. Efforts have been made in enhancing the performance of the cell by reducing the co-sintering temperature and improving the cathode layer and current collection from inner (anode) wall. The improved cell produces maximum power densities of 3400–6800 W m-2 at 550–600 °C, almost fivefold higher than the previous cell. Further improvement has been carried out by reducing thickness of the electrolyte layer. Uniform and defect-free outer electrolyte layer as thin as 10 μm can be achieved when the extrusion rate of the outer layer is controlled. The highest power output of 11,100 W m-2 is obtained for the cell of 10 μm electrolyte layer at 600 °C. This result further highlights the potential of co-extrusion technique in producing high quality dual-layer HF support for micro-tubular SOFC.