Fabrication and Performances of a Small SOFC Stack Using Doped Lanthanum Gallate Electrolyte

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A 4-cell tubular solid oxide fuel cell (SOFC) stack, using strontium- and magnesium-doped lanthanum gallate electrolyte, was built and electrically tested. Doped lanthanum gallate is a potential alternative to the commonly used yttria stabilized zirconia (YSZ) in SOFCs for use at intermediate temperatures (typically 600-750°C). $La_{0.8}Sr_{0.2}Ga_{0.8}Mg_{0.2}O_{2.8}$ (LSGM) powder was mixed with a polymer-based binder system and extruded into tubes. After sintering, the electrolyte tubes were approximately 6 mm outside diameter, 0.55 mm wall thickness and 100-200 mm long. The tubes were then fabricated into single SOFCs, using optimized $La_{0.6}Sr_{0.4}CoO_3$ (LSCo) cathode, $Ce_{0.8}Sm_{0.2}O_{1.9}$ (SDC) interlayer, Ni anode, and current collectors. The active length of the cell was 50 mm. The electrical performances of the single cells, as well as the 4-cell stack were tested using dry hydrogen as a fuel. A power of 2.5-3 W per cell and 10 W for the 4-cell stack were obtained at 800°C. The maximum power density of the LSGM supported single tubular fuel cell with LSCo cathode, SDC interlayer and Ni anode was 372 mW/cm^2 at 800°C. This paper will present the fabrication procedure and parameters, single fuel cell and the 4-cell stack performance.

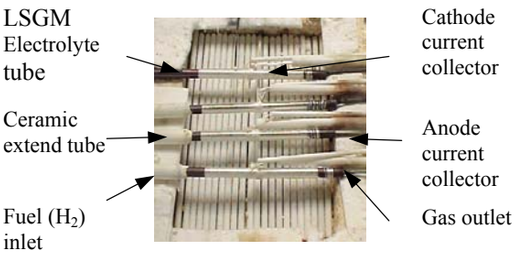

Fig. 1 Four-cell stack test setup

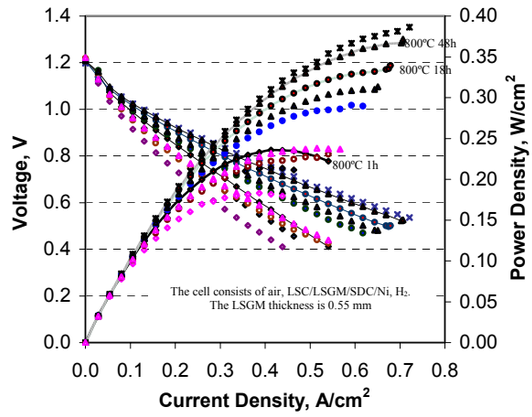

Fig. 2. Cell voltage and power density as a function of current density at various temperatures and operation time.

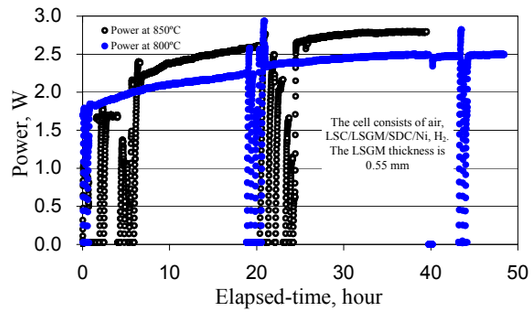

Fig.3. Cell power as a function of operation time, operated at 0.7 volt and 800°C (●) and 850°C (○).

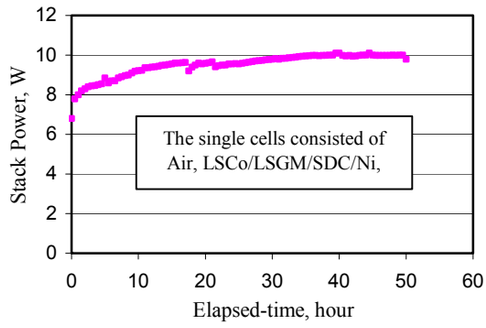

Fig. 4. A 4-cell stack performance.