**Impedance Spectroscopy Characterization of Hermetically Sealed SOFCs**

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One of the major problems facing the advancement of SOFC technology is sealing between cells in a stack [1,2]. Typical glass and ceramic seals can form reactive phases [3,4,5], leak [6] and/or degrade [5,7] over time, decreasing SOFC performance. Development of hermetic sealing between electrolyte and interconnect may lead to SOFC stacks without sealant in order to eliminate the problems associated with sealants.

The interfaces between an interconnect material and electrolyte or other cell components (anode and cathode) have been studied using electrochemical impedance spectroscopy (EIS). In particular, the interface between the electrolyte and interconnect holds the potential for eliminating gas sealants. Adjacent layers of dense electrolyte and interconnect within a SOFC should form a hermetic contact, thus preventing gas leaking.

Tape cast layers of FeNiCr oxide (interconnect) and gadolinia-doped ceria (GDC) were laminated into symmetric cells and co-sintered at 1300°C for 4 hours in 4% hydrogen. Shown in figure 1 is a cross-sectional view (SEM micrograph) of the electrolyte/interconnect interface produced by laminating tape cast layers together. Impedance spectroscopy was used to determine the effects of atmosphere, DC polarization, and temperature on the interfacial characteristics. The impedance spectra for the symmetric cell tested in air without DC polarization are shown in figure 2 for temperatures ranging from 600°C-750°C.

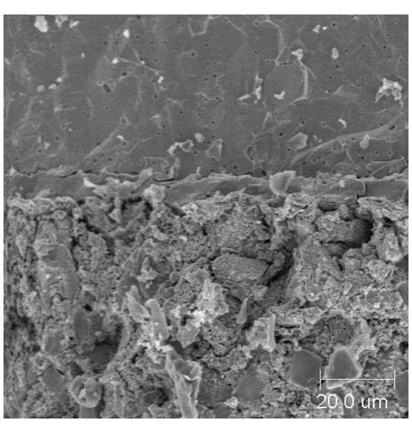


**Figure 1** – Cross-sectional view of GDC electrolyte and FeNiCr interconnect interface.

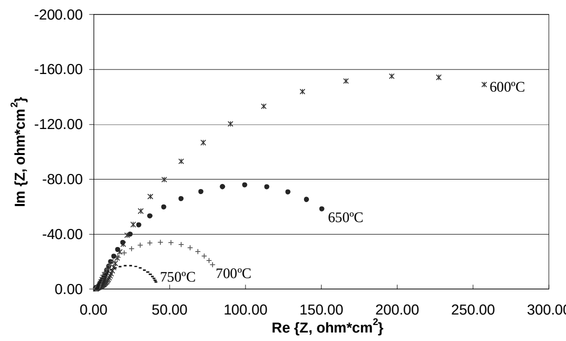


**Figure 2** – Impedance spectra for symmetric cell tested in air without DC polarization from 600°C -750°C

Shown in Figure 3 are the area-specific bulk and interfacial polarization resistances for the symmetric cell tested in both air and hydrogen. To determine the true bulk resistance of the system, an interconnect/interconnect laminate was also tested in both atmospheres and its value subtracted from that of the symmetric cell. This resulted in determination of the true bulk resistance of the electrolyte. From this graph, the transference number of the GDC electrolyte as a function of temperature and atmosphere could also be determined.

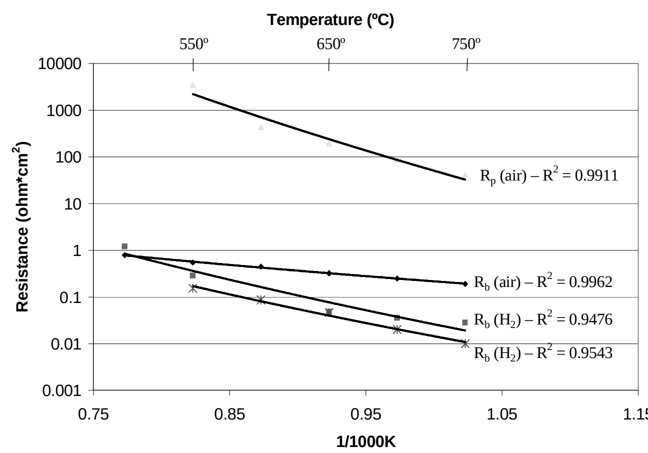


**Figure 3** – Log of area-specific polarization and bulk resistance values versus inverse temperature for the symmetric cell

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