IMPEDANCE CHARACTERIZATION OF CALCIA-STABILISED ZIRCONIA AS A FUNCTION OF APPLIED FIELD

Julia Ramírez González, The University of Sheffield
jramirezgonzalez1@sheffield.ac.uk
Anthony R. West, The University of Sheffield

Key Words: Calcia-stabilised zirconia, impedance spectroscopy, electric field effect, oxygen partial pressure.

Cubic stabilised-zirconias are well-known oxide ion conductors. They are used as solid electrolytes in oxygen sensors and in solid oxide fuel cells (SOFCs). However, it has been demonstrated recently that electronic conduction can be introduced into yttria-stabilised zirconia (YSZ), under the application of either (i) a small *dc* bias or (ii) for YSZ compositions with higher yttria content, by an increase in oxygen partial pressure (pO_2) [1]. Such electronic conduction will have implications for materials that are to be used as ionically-conducting but electrically-insulating components in fuel cells and sensors.

A drop in resistance is a characteristic feature of flash sintering (FS), especially during the flash process [2] but the role of electronic conductivity in stage (I), prior to flash, is not well understood. In order to gain further understanding of the sensitivity of materials to an electrical field and the conditions under which electronic conduction may be introduced, the electrical properties of calcia-stabilised zirconia (CSZ) ceramics were studied under the application of a *dc* bias and with different pO_2. Three electrical components were identified: bulk, grain boundary and, sample-electrode interphase, Figure 1. It was noticed that the resistance of the three components decreased in the presence of an electric field and also, with change in pO_2. A more extensive set of results will be presented and evaluated.

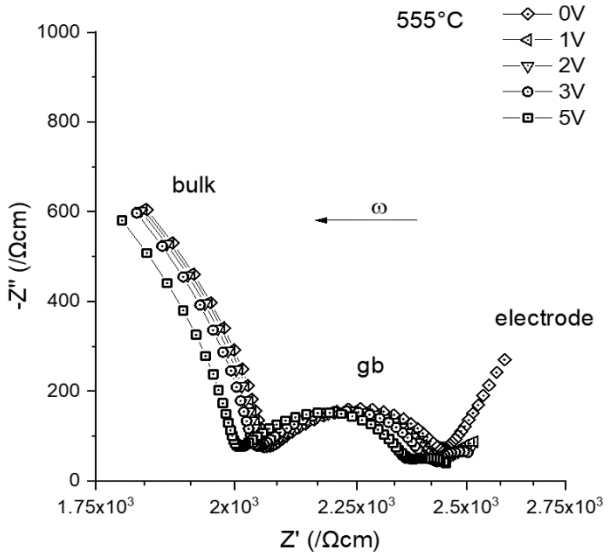

Figure 1 – Impedance complex plane of CSZ under the application of a dc bias.

References

[1] M. Jovani, H. Beltran-Mir, E. Cordoncillo, and A. R. West, "Atmosphere- and Voltage-Dependent Electronic Conductivity of Oxide-Ion-Conducting $Zr_{1-x}Y_xO_{2-x/2}$ Ceramics*", Inorganic Chemistry*, 56 [12] 7081-7088 (2017)

[2] M. Yu, S. Grasso, R. Mckinnon, T. Saunders, and M. J. Reece, "Review of flash sintering: materials, mechanisms and modelling", *Advances in Applied Ceramics*, 116 [1] 24-60 (2017)