

Samaria-Doped Ceria and Ytria Stabilized Zirconia, Interface Analysis at Different Sintering Atmospheres

A. Martínez-Amesti¹, A. Larrañaga¹, L.M. Rodríguez-Martínez², M.L. Nó¹,
J.L. Pizarro¹, A. Laresgoiti² and M.I. Arriortua¹

1. Departamento de Mineralogía y Petrología y Departamento de Física Aplicada II
Universidad del País Vasco, España, 48940-Bilbao.
2. Centro Tecnológico Ikerlan S.COOP, Parque Tecnológico de Álava, España, 01510-Álava.

ana.martinez@ehu.es

Keywords: Interlayer, Ceria-doped, reactivity

Solid Oxide Fuel Cells are electrochemical devices that directly convert chemical energy, though an electrochemical reaction between a fuel and an oxidant, into electrical energy. The basic elements of the typical fuel cell consist of an electrolyte phase in intimate contact with a porous anode and cathode.

SOFCs have exceptional potential to use as electric power generation systems, because of their high-energy conversion efficiency. In addition, SOFCs have many advantages such as multi-fuel capability or the simplicity of the system design. Actually, reasonably high power densities and long-term stability have been achieved for high temperature SOFC single cells using La(Sr)FeO₃ (LSF) as cathode and yttria-stabilized zirconia (YSZ) as electrolyte [1].

Some studies show an improved performance of the power densities with the incorporation of a Sm-doped CeO₂ layer between the Sr-doped lanthanum ferrite cathode and the YSZ electrolyte [2]. The objective of the ceria barrier layer between the cathode and electrolyte is to prevent the formation of poorly conducting secondary phases, such as La₂Zr₂O₇ or SrZrO₃ [3,4] with worse electrical behavior [5].

The multilayer structure with YSZ electrolyte and ceria doped layer on both anodic and cathodic sides is regarded as crucial for effectiveness of the SOFC cells [6]. However, between these two fluorite phases, zirconia and ceria, solid state reactions take place at high temperatures growing a new intermediate phases with poor ionic conductivity [7,8]. It has been observed that at high sintering temperatures, the Ce component migrated into zirconia lattice at ceria/zirconia interface [9,10] giving less ionic conductivity in the system. The known interlayer reactions between these two fluorite phases are particularly important to optimize the electrochemical behavior of the system.

The aim of this work is to study the new phase formation and element diffusion when samples are sintered at different atmospheres (oxidizing, inert and reducing) and temperatures (1100, 1200 and 1300°C) by XRD and SEM/EDX/WDX.

1. S.P. Simner et al., *J Solid States Ionics*. 161 (2003) 11.
2. S.P. Simner et al., *J. Power Sources*. 113 (2003) 1.
3. A. Martínez-Amesti et al., *J. Power Sources*. 185 (2008) 401.
4. S. Simner et al., *Solid State Ionics*. 175 (2004) 79.
5. K. Yang, *J. Power Sources*, 159 (2006) 63.

6. A. Tsoga et al., *Acta Mater.* 48 (2000) 4709.
7. B. Cales et al., *J. Electrochem. Soc.* 131 (1984) 2407.
8. C. Leach et al., *J. Mater. Sci.* 27 (1992) 3812.
9. H. Mitsuyasu et al., *Solid State Chem.* 129 (1997) 74.
10. H. Mitsuyasu et al., *Solid State Ionics.* 113-115 (1998) 279.
11. This work has been financially supported by the “Departamento de Industria del Gobierno Vasco/Eusko Jaurlaritza”, within the strategic actions in Microenergy (ETORTEK 2007-2009 (Genedis 3), SAIOTEK 2009 programmes). SGIker technical support (UPV/EHU, MEC, GV/EJ, European Social Fund) is gratefully acknowledged.. A. Martínez-Amesti wishes to thank the UPV/EHU for funding.