

Oxygen reduction on porous $\text{Ln}_2\text{NiO}_{4+\delta}$ electrodes

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$\text{Ln}_2\text{NiO}_{4+\delta}$ based materials where Ln is La, Nd or Pr, show very good electrocatalytic performances for SOFC cathode [1]. The oxygen diffusion coefficient D^* and the surface exchange coefficient k measured by isotopic exchange are several orders of magnitude higher than that of the standard LSM cathode material. They are good Mixed Ionic and Electronic Conductors (MIEC) due to the mixed valency of the transition metal cation M and to the presence of mobile additional oxygen atoms. Therefore the O_2 reduction should not be limited by a charge transfer process occurring usually at the one dimensional “three-phase boundary” interface between gas, electrode and electrolyte characteristic of metallic cathodes.

This study aims to characterise the reaction kinetics at $\text{O}_2(\text{g})$, $\text{Ln}_2\text{NiO}_{4+\delta}$ / zirconia porous electrodes in the temperature range $500^\circ\text{C} - 800^\circ\text{C}$, under air. In order to identify interfaces and electrode processes, a.c. electrochemical impedance spectroscopy was used under zero bias conditions with symmetrical cells. Using the Schouler method, the electrode/electrolyte interface impedance has been clearly identified as the limiting step [2]. Then, electrode properties have also been measured under non zero d.c. conditions with a three electrode cell. The polarisation curves allow to confirm that $\text{Ln}_2\text{NiO}_{4+\delta}$ oxides are promising materials for SOFC cathode. Actually, the observed over-potentials are lower than those observed for LSM under the same current and temperature conditions. Nevertheless, the interface between $\text{Ln}_2\text{NiO}_{4+\delta}$ and zirconia should be optimised by a better shaping because the interfacial resistance appears to be the most important contribution to the total impedance. Ageing tests during one month under d.c. conditions show a reduction of the polarisation resistance and no significant reactivity between $\text{Ln}_2\text{NiO}_{4+\delta}$ and zirconia.

[1] F.Mauvy, J.M.Bassat, E.Boehm, J.P.Manaud, P.Dordor, J.C.Grenier, *Solid State Ionics* 158 (2003) 17-28

[2] E.Schouler N. Mesbahi, G.Vitter, *Solid State Ionics* 9 & 10 (1983) 989-996