Layered Perovskites $Ln_2NiO_{4+\delta}$ (Ln = La, Pr, Nd) as suitable oxygen electrodes for Solid Oxide Electrolysis Cells (Oral Presentation)

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Abstract: In the last few decades, thanks to their mixed ionic and electronic conductivity (*i.e.* MIEC properties), the lanthanide nickelates, $Ln_2NiO_{4+\delta}$ (Ln = La, Pr, Nd) have attracted much attention as oxygen electrode for solid oxide fuel cells (SOFCs)[1-4]. These materials show very good electrocatalytic performances due to their high values of oxygen diffusion coefficient *D** and the surface exchange coefficients *k**, measured by isotopic exchange, are several orders of magnitude higher than that of the standard LSM and LSCF electrode materials. They are good Mixed Ionic and Electronic Conductors (MIEC) due to the mixed valence of the transition metal cation (here Ni) and to the presence of mobile additional oxygen atoms. Therefore, the O_2 reduction is not limited by a charge transfer process occurring usually at the one dimensional “three-phase boundary" interface between gas, electrode and electrolyte characteristic of metallic electrodes.

This study aims to characterise these materials as oxygen electrodes for solid oxide electrolysis cells by preparing symmetrical and single cells using electrochemical impedance spectroscopy, in the temperature range 700 – 900 °C. A single cell containing $Pr_2NiO_{4+\delta}$ electrode shows highest performance among all three nickelates. The stability tests at high current density (1 $A.cm^{-2}$) under electrolysis conditions are also investigated up to 250 h. Interestingly the lowest degradation is observed for $Pr_2NiO_{4+\delta}$ single cell. Later on, post-test analyses are performed in order to identify possible reasons for degradation. The obtained results will be presented and discussed in detail.

References:

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