Contribution ID: **38** Type: **Poster**

CGO-Cu cermets characterization by in situ scattering measurements with a dilatometer

Wednesday 21 June 2023 10:00 (15 minutes)

The long-term stability of solid oxide fuel cells (SOFC), electrolyzers (SOEC) and catalytic membrane reactors is highly dependent not only on their electrochemical properties but also on the similar thermal evolution of all their constituting parts, ensuring mechanical compatibility, i.e. electrolyte and electrodes. This kind of devices have a good performance at high temperatures. However, high temperatures and thermal cycling put strain on cell constituents, and oxidation of electrodes caused by demixing of fuels and water limit both operation and lifetime. Thus, the decrease in operation temperature is needed. Most SOFCs are based on yttrium-stabilized zirconia (YSZ) electrolyte, between a porous Ni/YSZ anode and a porous lanthanum strontium manganite cathode, which operate above 800 ℃. In order to decrease the operation temperature of these devices new electrolyte materials are under study. $Ce_{0.8}Gd_{0.2}O_{2-\delta}$ (CGO) is an ionic conductor capable to operate at 600-800 ℃, whose performance improves by decreasing thickness. Therefore, there is a need of finding compatible anode materials with enough electronic conductivity and electrocatalytic activity that are also mechanically stable to support the thin electrolyte. Cu based ceria cermets demonstrated to be advantageous in replacing Ni-cermets for the direct oxidation of hydrocarbons since, unlike Ni-containing cermets, Cu does not promote significant carbon coking. In these cermets the electrical conductivity is warranted by Cu, whereas ceria is responsible for the catalytic activity in oxidation reactions, partially compensating the Ni catalytic activity in standard Ni-YSZ electrodes. Besides, Cu is more economically viable than Ni.
In this study, we optimized CGO-Cu composites as anode materials for CGO electrolytes. Different samples with different ratios of CGO and Cu ranging from 40-60 to 70-30 vol.% were studied by high temperature in situ x-ray diffraction (XRD @P07 Desy) at the same time as the dilatometric signal was obtained. Differences in the micro (XRD) and macro (dilatometer) thermal expansion coefficient (TEC) due to the different ratios of the composites were correlated with the microstructure (SEM and XRD) and with the electrochemical properties, which allowed selecting best anode materials for high temperature green energy applications.

Primary authors: SOLIS, Cecilia; Dr BALAGUER, Maria (Instituto de Tecnología Química); KRIELE, Armin (Helmholtz Zentrum Hereon); Ms FABUEL, Maria (Instituto de Tecnología Química); Dr STARK, Andreas (Helmholtz-Zentrum Hereon); Prof. SERRA, Jose Maria (Instituto de Tecnología Química)

Presenter: SOLIS, Cecilia

Session Classification: Parallel 4