

Solid-solid interfaces of ceramics and metallic materials used in clean energies systems

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Several multi-component systems related with efficient energy transport and conversion are under study in our group, such as solid oxide fuel cells (SOFC) and superconductor cables prepared by powder-in-tube (PIT) method. Solid-solid interfaces are interesting in these systems due to the role they play in electronic-ionic transfer processes and, the chemical-structural compatibility between their components. The study of solid-solid interfaces of ceramics and metallic materials, are very important to understand the correlation between their microstructure and performance. The chemical and structural compatibility between the different materials studied are evaluated through the combination of several characterization techniques, such as electron microscopies (SEM, TEM), x-ray diffraction (XRD), chemical analysis by EDS and synchrotron radiation methods (XANES y EXAFS), used to study the oxidation states and structures present near the interfaces.

Due to the diversity of analyzed materials, in this talk I will focus in two systems. The first one involves electrolyte/cathode SOFC interfaces within symmetric cells of gadolinium doped ceria (CGO) as electrolyte and nanostructured $\text{La}_{1-x}\text{Sr}_x\text{Co}_{1-y}\text{Fe}_y\text{O}_{3-\delta}$ (LSCFO) as cathode. In this case the transport and electrochemical measurements, which take into account electrons and ions transference through the interfaces and electrode reaction mechanisms, will be correlated with the microstructure aiming to understand charge transfer and electrode reaction mechanisms. The second one corresponds to ceramic-metal interfaces, which are present in MgB_2 superconductor cables (wires and tapes). In this last case, the microstructure and phase composition of the interface between the superconductor and different metals used as sheath materials are followed during the deformation and heat treatment processes. The correlation between the superconducting properties and the microstructural characteristics is discussed.