Protective coating for the fuel-side of Solid Oxide Cell (SOC) interconnect

(preferably for students with a background or interest in material science)
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Solid Oxide Cells (SOCs) are an efficient way to convert fuel into electricity. In these cells, interconnects (ICs) connect the stacked cells and help distribute fuel and air to the electrodes. Chromium-based alloys are commonly used for these interconnects because they form a protective chromium oxide layer at high temperatures, preventing iron corrosion. However, this Cr oxide layer can evaporate and spread to the electrodes, leading to a problem called Cr poisoning, which degrades cell performance. While protective coatings have been widely studied for the *air-side* of interconnects [1], the '*fuel-side'* is often left uncoated. This study aims to develop a protective coating for the fuel side of SOC interconnects to reduce these risks.

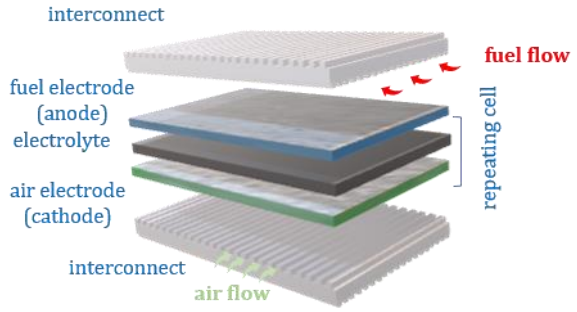

Figure 1. Schematic of a Solid Oxide Cell (SOC) with fuel-side and air-side interconnects

The project will begin with a thorough literature review to identify potential risks associated with the fuel-side interconnects and to explore suitable materials for protective coatings. Based on the findings, we will select one or two appropriate coating materials designed to reduce chromia scale growth. The experimental work will focus on powder preparation and processing. The selected powder will be either purchased or synthesized in-house and then processed to achieve the appropriate particle size distribution. This powder will be formulated into an ink suitable for inkjet printing (IJP), a wet-based additive manufacturing technique. The main characterization techniques for this project will include Thermogravimetric Analysis (TGA) for thermal stability, Scanning Electron Microscopy (SEM) for morphological analysis, X-ray Diffraction (XRD) for phase identification.

This project will provide the student with an understanding of fuel-side interconnect degradation in SOCs and the methodologies for developing protective coatings mainly using inkjet printing. The student will focus primarily on powder processing. Throughout the project, the student will receive guidance and supervision in material selection and characterization techniques.

Reference

[1] S. Daviran, "Spinel Protective Coatings for Solid Oxide Cells (SOCs) Interconnects (ICs)", PhD Thesis, Group of Energy Materials (GEM), EPFL, 2024.