# QUEST FOR NOVEL MATERIALS FOR SOLID OXIDE CELL INTERCONNECT COATINGS

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Efficient energy conversion technologies are crucial for our sustainable future, preferably based on the renewable resources. Among several prospective technologies, fuel and electrolysis cells constitute an important group of devices. Solid Oxide Cells are very promising for distributed energy generation from a small kW range to the sub-MW scale and potential energy storage applications.

Though the high temperature fuel cell technology has been developing for many years, there still are important issues hindering their commercialization. Further price reductions and lowering of the degradation rates are required for higher market penetration and higher competitiveness. The project directly relates to both these issues, addressing novel, cheaper and protective materials for the interconnects, used to separate the gas channels of the individual cells and to connect them electrically.

Interconnects with ***protective coatings*** are a critical part of Solid Oxide Cell stacks. Due to specialized ceramic coatings and complex shaping, they are roughly as expensive as ceramic cells used in stacks (volume and mass wise). Any decrease in their processing or materials costs will bring important savings. For low degradation operation, dense high quality protective coatings are required on the oxygen side of the interconnect. They prevent chromium poisoning of the oxygen electrode and possibly slow down the corrosion rate (oxide growth).

This project aims at ***elaboration and characterization of new protective materials*** for the oxygen side of the steel interconnects for Solid Oxide Cell stacks. Interconnects (ICs) constitute an integral and very important part of the stacks and are often responsible for increased degradation of the stacks due to their corrosion and possible evaporation of the volatile Cr species. In order to mitigate these negative phenomena, protective, electrically conductive ceramic coatings are deposited on their surface. Currently, the most commonly used protective material is the $Mn_xCo_{2-x}O_4$ spinel (MCO, with x most equal to 0.5 or 1). It has high electrical conductivity and good protective properties: low chromium diffusion and evaporation rates. Cobalt is regarded as a carcinogenic element, so it requires special safety features during handling and processing, which increases the overall complexity and price of the Co containing coating considerably.

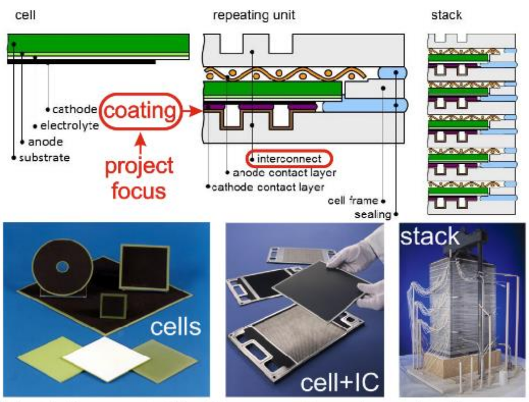


**Fig. 1.** Placement of the interconnect , coating and cell in the stack. / modified based on source: FZ Jülich

We propose ***to search for new materials, composed of abundant and cheap elements*** (Fe, Mn, Cu, Ni, Mg etc.) with protective properties comparable to the Mn-Co spinel. Materials with high electrical conductivity, low Cr diffusion coefficient and matched thermal expansion coefficient will be sought primarily within the multicomponent spinel-like solid solutions. Materials selection will be based on a detailed literature review, structural chemistry knowledge, thermodynamic and atomistic modelling methods and on the experience of the project lead investigators (Prof. Mogensen, Dr. Naumovich, Prof. Jasinski).

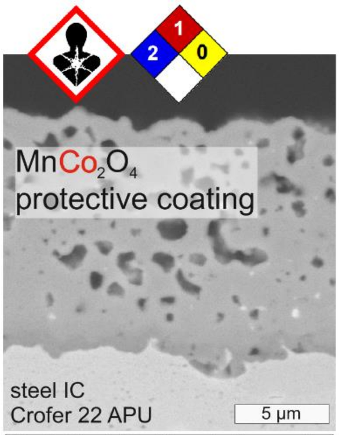


**Fig. 2.** Steel IC with protective coating.