DESCRIPTION FOR THE GENERAL PUBLIC

Objective of the project

Although generation of hydrogen via high temperature electrolysis, such as Solid Oxide Electrolysis Cell (SOEC), enables limiting losses to ca. 10%, there is still a need for further decreasing the “green” hydrogen generation price.

It has been shown in literature that operation of the SOEC can be assisted with fuel, what allows to substitute part of the needed power supply to a SOEC by some kind of fuel. Up to now, gaseous and liquid fuels have been taken into account much wider than solid fuels based on carbon, mostly because of the ease of their supply to the hot (600-900°C) anodic compartment and ease of their electro-oxidation.

The project objective is to elaborate special materials and design the geometry of the reactor to enable the comprehensive studies of anodic processes in Direct Carbon Solid Oxide Fuel-assisted Electrolysis Cell (DC-SOFEC).

The main hypothesis of the project sounds as follows:

Anodic compartment of the SOEC may be elaborated in a manner which allows sustainable supply of solid depolarizer and efficiently reduce the anodic overpotential by fine tailoring of the electrode layer and tuning of the charge-, mass- and heat- transfer processes in zone of the electrochemical reactions.

Research to be carried out

Within the project, six separate workpackages will cover the following fields of research: selection of alternative materials for SOEC anodes, mass- and heat flow analysis, simulation and elaboration of the feeding system for solid depolarizer, development of the novel anodes and characterization of the SOECs, electrochemical studies of the custom SOE cells with carbon depolarizer and, finally, development and verification of the DC-SOFEC numerical model.

Reasons for choosing the research topic

The main reason for choosing the topic is to deepen the knowledge about a process, that has neither been widely studied nore implemented. The particular processes occurring during DC-SOFEC operation as well as the sample elaboration and designing of a unique cell holder with a solid fuel feeding system are the subjects of main scientific interests for the project team.