

Electrode fabrication for Proton Conductive Ceramic (PCC) Cells via inkjet printing and/or spray coating

Master Project (30 ECTS) or Semester Project (10 ECTS)

Administrative

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Location: Sion (travel allowance offered)
Remarks: If interested, please send your CV, with a short motivation letter, to Samaneh Daviran

Project description:

Proton-conducting solid oxide cells have attracted significant attention in recent years. Their proton-conducting ceramic (PCC) electrolytes enable hydrogen ions to migrate through the solid oxide lattice at intermediate temperatures, allowing water splitting or fuel cell operation with improved efficiency and faster dynamic response compared to conventional oxygen-ion conductors. This project is part of an ongoing European project focused on developing proton conductive ceramics (PCC) for solid oxide cells (SOCs). The work concentrates on developing electrodes based on novel materials with the goal of reducing the content of critical raw materials (CRMs) for PCCs. The study focusses on developing low-cost and scalable deposition techniques: spray coating and/or inkjet printing, to achieve uniform and adherent electrode layers after deposition and sintering. The fabrication rout should be tailored for scalability and compatibility with large-scale manufacturing.

Your tasks:

The main bottleneck lies in the formulation of a stable and agglomerate-free ink for inkjet printing and spray coating. The process starts with the characterization of commercial powders in terms of particle size distribution (PSD), crystal structure (XRD) and microstructure (SEM). The ink formulation will be performed afterward, and depending on the selected deposition method, the base ink should meet specific property requirements. Rheology, sedimentation test and zeta potential will be studied to evaluate stability. The optimized ink will then be deposited onto the cell, and after sintering the resulting electrode will be characterized using SEM/EDX and XPS. The student will receive training for ink formulation and characterization and will be supervision for the SEM and XPS analyses.