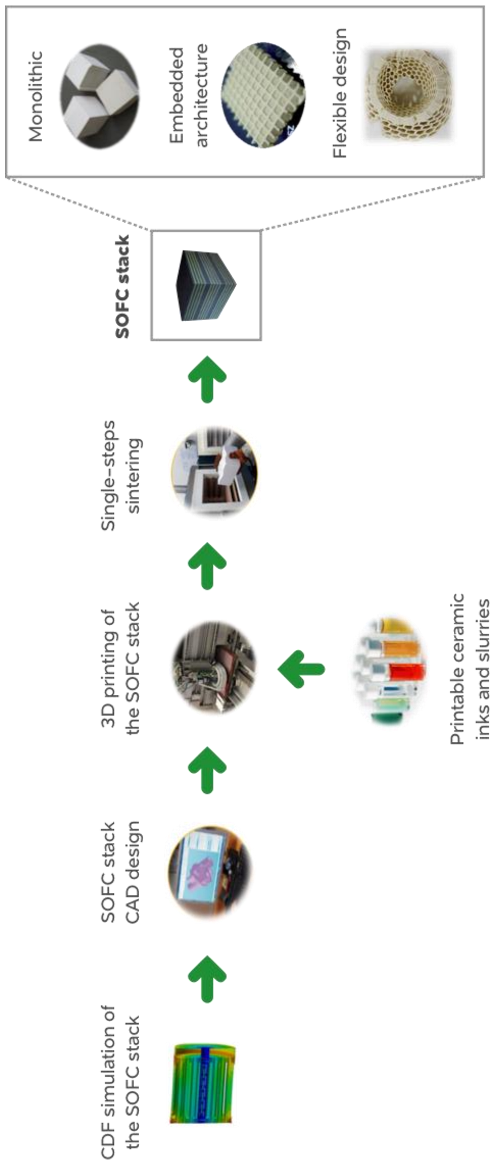
Cell3Ditor Concept



Cell3Ditor

PARTNERS

Coordinator

Fundació Institut de Recerca de l'Energia de Catalunya – ES

Participants

Danmarks Tekniske Universitet –DK
Francisco Albero, S.A. - ES
3DCeram - FR
Promethean Particles LTD – UK
Universidad de la Laguna - ES
SAAN Energi AB - SE
HyGear Fuel Cell Systems B.V - NL

Cell3Ditor

Cost-effective and flexible 3D printed SOFC stacks for commercial applications

FCH2 JU-RIA-Grant Agreement #700266

www.cell3ditor.eu

@cell3ditor

About the Project

Cost-effective and flexible 3D printed SOFC stacks for commercial applications

Call Identifier: FCH-02.6-2015
Duration: 42 months
Budget: 2,180,662.50 €

A Solid Oxide Fuel Cell (SOFC) is a ceramic-based multilayer device that currently involves **expensive and time-consuming multi-step manufacturing**. These cells are currently manually assembled into stacks resulting in extra steps for joining and sealing and introducing weak parts likely to fail.

Since current ceramics processing presents strong limitations in shape complex manufacturing (more than 100 steps), industrially fabricated SOFC cells and stacks are expensive and **present low flexibility and long time-to-market**.

The Cell3Ditor project will demonstrate the viability of 3D printing of functional ceramics as a mass manufacturing technology for high-quality and cost-effective production of flexible SOFC stacks with embedded functionality.

Compared to traditional ceramic processing, the Cell3Ditor manufacturing process presents a significantly shorter time to market (from years to months) and a **cost reduction estimated in 63%** with an initial investment below one third of the required for an equivalent conventional manufacturing plant.

Objectives

The main goal of the Cell3Ditor project is the **development of a 3D printing technology for the industrial production of SOFC stacks** by covering research and innovation in all the stages of the industrial value chain (inks and slurries formulation, 3D printer development, ceramics consolidation and system integration).

All-ceramic joint-free SOFC stacks with embedded functionality (fluidics and current collection) will be fabricated in a two-step process (single-step printing and single-step sintering) to reduce material and assembly costs while simplifying design, manufacturing and time to market.

Activities

Formulation of printable inks and slurries of SOFC materials

Printable slurries and inks based on ceramic **nanomaterials** will be developed within the project. SLA slurries will be fabricated by mixing previously synthesized powders with the organic vehicle and nanodispersions for inkjet will be prepared by **continuous hydrothermal synthesis** in a single step.
Particle size, distribution and morphology of nanomaterial and organic formulation will be tailored to reduce sintering temperature and selectively limit the grain growth throughout the parts.

Development of a 3D printer for multi-material ceramics

Within the Cell3Ditor project a **multi material 3D printer** is being developed for the fabrication of the complete SOFC stack. It is based on the **hybridization of stereolithography and inkjet printing in a single machine**.
A dedicated machine able to fabricate kW-range stacks will be built for the project, becoming the core for **mass production**.

Fabrication of SOFC cell parts by 3D printing and two-step fabrication of joint-free 3D printed SOFC stack for integration in systems

The project will study the **sintering behaviour of printed multi material parts** controlling the shrinkage and focus on the final porosity of the cell components.
Advanced microstructural analysis will help to reduce the temperature and time for full sintering of cell components and stacks. For industrial quality control a three-dimensional in-line X-ray system will be explored.

Design and optimisation of the SOFC

CFD simulations including the functionality of the SOFC will be used to **predict the performance of the complex geometry.**