Newsletter – Issue 1 – June 2012

Editorial

The 1st of December 2011 marked the start of the METPROCELL project: **Innovative fabrication routes and materials for METal and anode supported PROton conducting fuel CELLs.** It is a collaborative project funded by the Fuel Cell and Hydrogen Joint Undertaking (FCH JU) where 8 partners work together to develop a new generation of intermediate temperature fuel cells based on the Proton Conducting Fuel Cell technology.

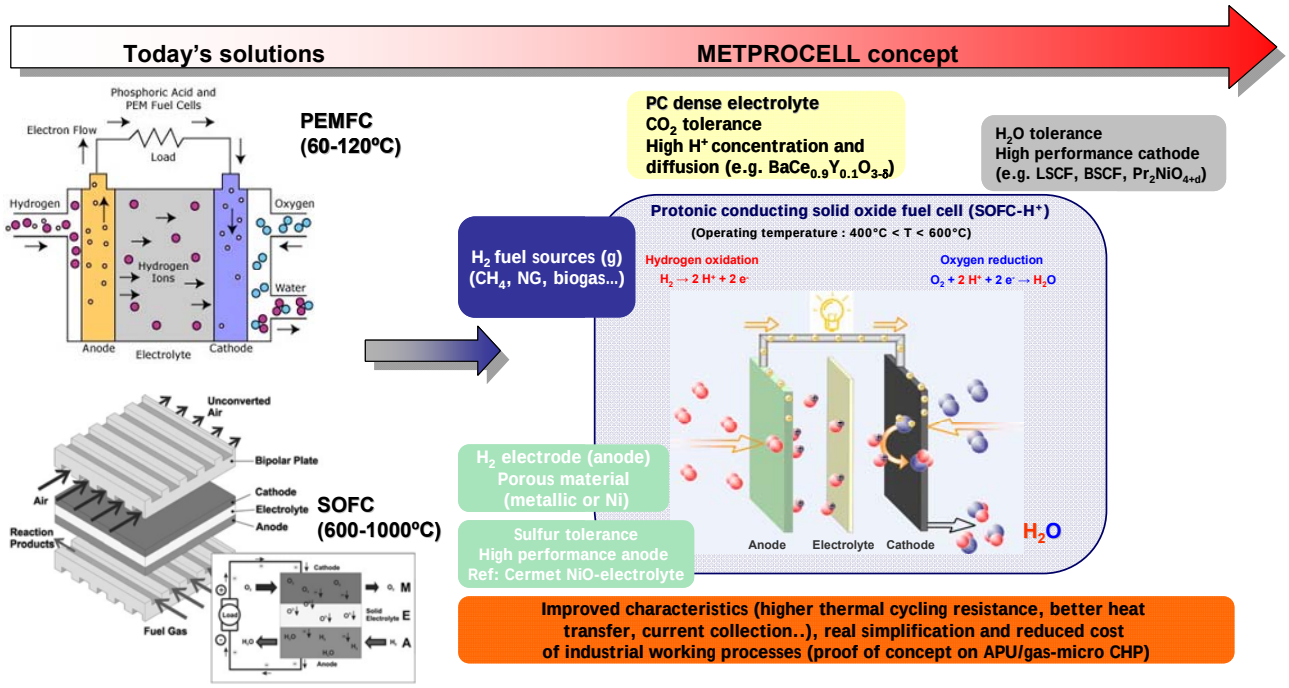
The present newsletter is the first release of the biannual letter that would be published by METPROCELL. The newsletters will have two main parts: one addressing the progress of the METPROCELL project and the second one presenting information related to the R&D field addressed by the project.

Dr. - Ing. Maria Parco
TECNALIA. Spain
METPROCELL Project Manager

Inside this issue

1. What is METPROCELL?

1.1. The concept

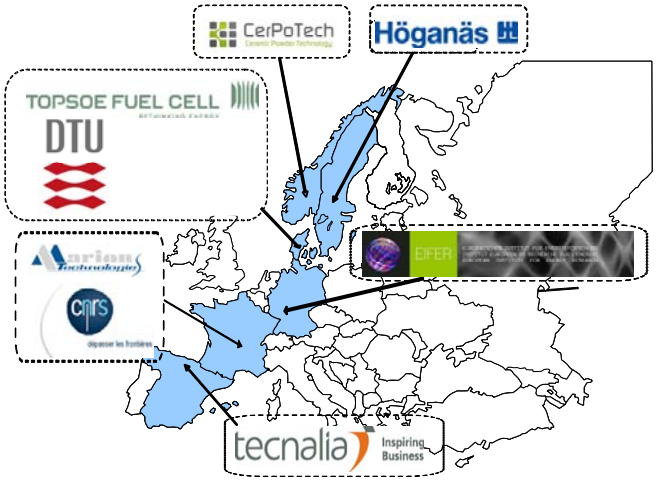


The aim of METPROCELL is to develop innovative Proton Conducting Fuel Cells (PCFCs) by using new electrolytes and electrode materials and implementing conventional as well as new alternative fabrication routes. Following a complementary approach, the cell architecture will be optimised on both metal and anode type supports, with the aim of improving the performance, durability and cost effectiveness of the cells. Moreover, METPROCELL will bring the proof of concept of these novel PCFCs by the set-up and validation of prototype like stacks in two relevant industrial power systems, namely gas/micro CHP and APU.

1.2. Partnership

The research is carried out by a Multidisciplinary and complementary team consisting of 8 top level European organisations from 6 countries: 4 Research Institutes and Universities working together with representative industries covering the whole manufacturing chain of solid oxide fuel cells (raw material suppliers, cell component manufacturers, stack cell manufacturer).

The METPROCELL consortium brings together multidisciplinary expertise of material development, single fuel cell development, stack construction and power system engineering.



1.3. Project structure

The METPROCELL project structure is broken down following the focus on material development for novel electrolytes, electrodes and supports as well as on processing methods for the deposition of thin layered cell components and shaping of functionally graded supports. The technical work of the project is based on the following stages:

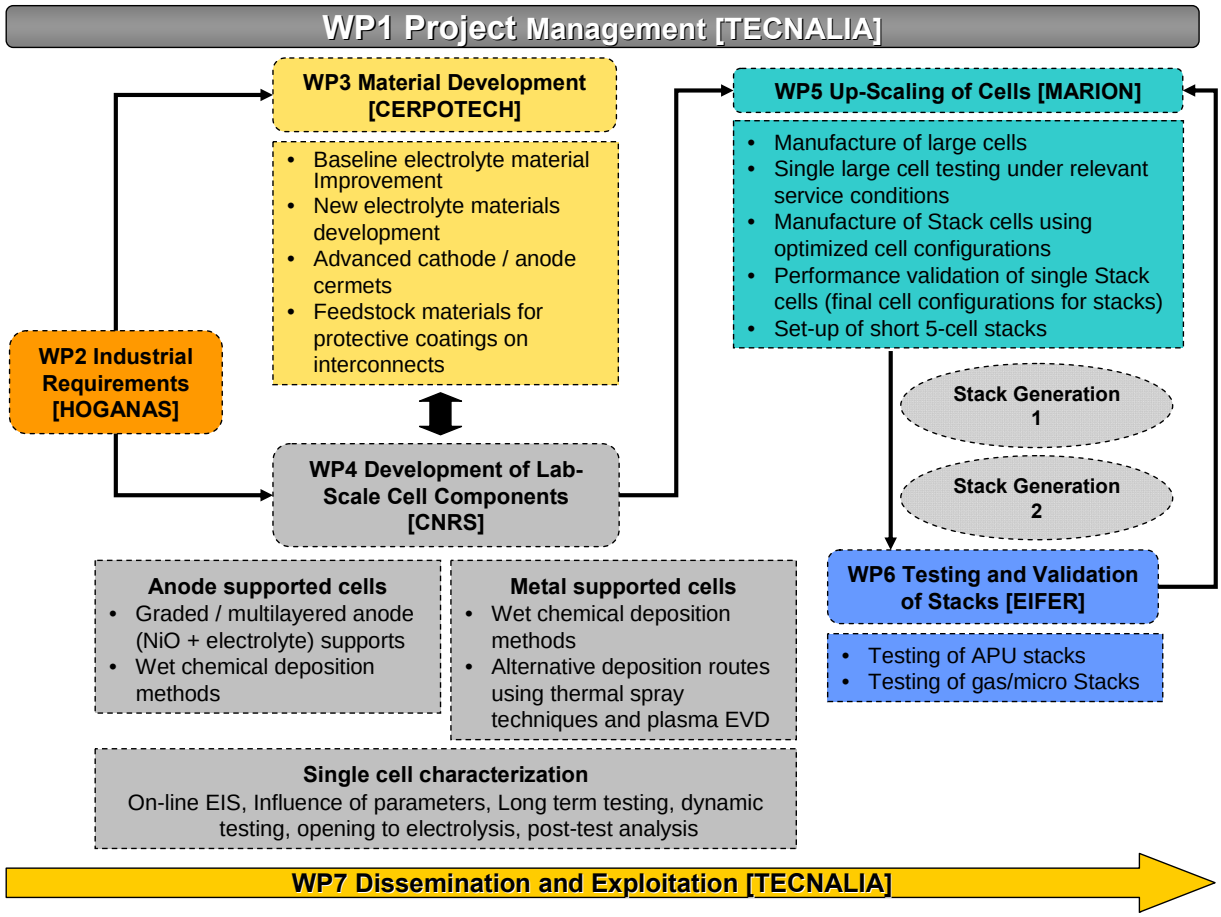
1) Collection of technical specifications for the implementation of the PCFCs in the target applications (i.e. APU and gas/micro-CHP) and definition of test protocols.

2) Development of novel electrolyte and electrode materials and the up-scaling of the manufacturing procedure of the same. One of the most important deliverables will be a new generation of electrolytes more tolerant in CO_2 and dedicated to 500-600°C.

3) Development of both novel functionally graded porous supports (anode type and metallic) and innovative manufacturing routes for the deposition of thin layered cell components without post-processing needs (i.e. thermal spraying and/or plasma EVD as alternative to conventional routes like screen printing and tape casting).

4) Up-scaling of manufacturing procedures and testing/validation of the developed PCFCs under relevant service conditions at lab-scale. The main outcome will be 2 generations of short 5 cells stacks.

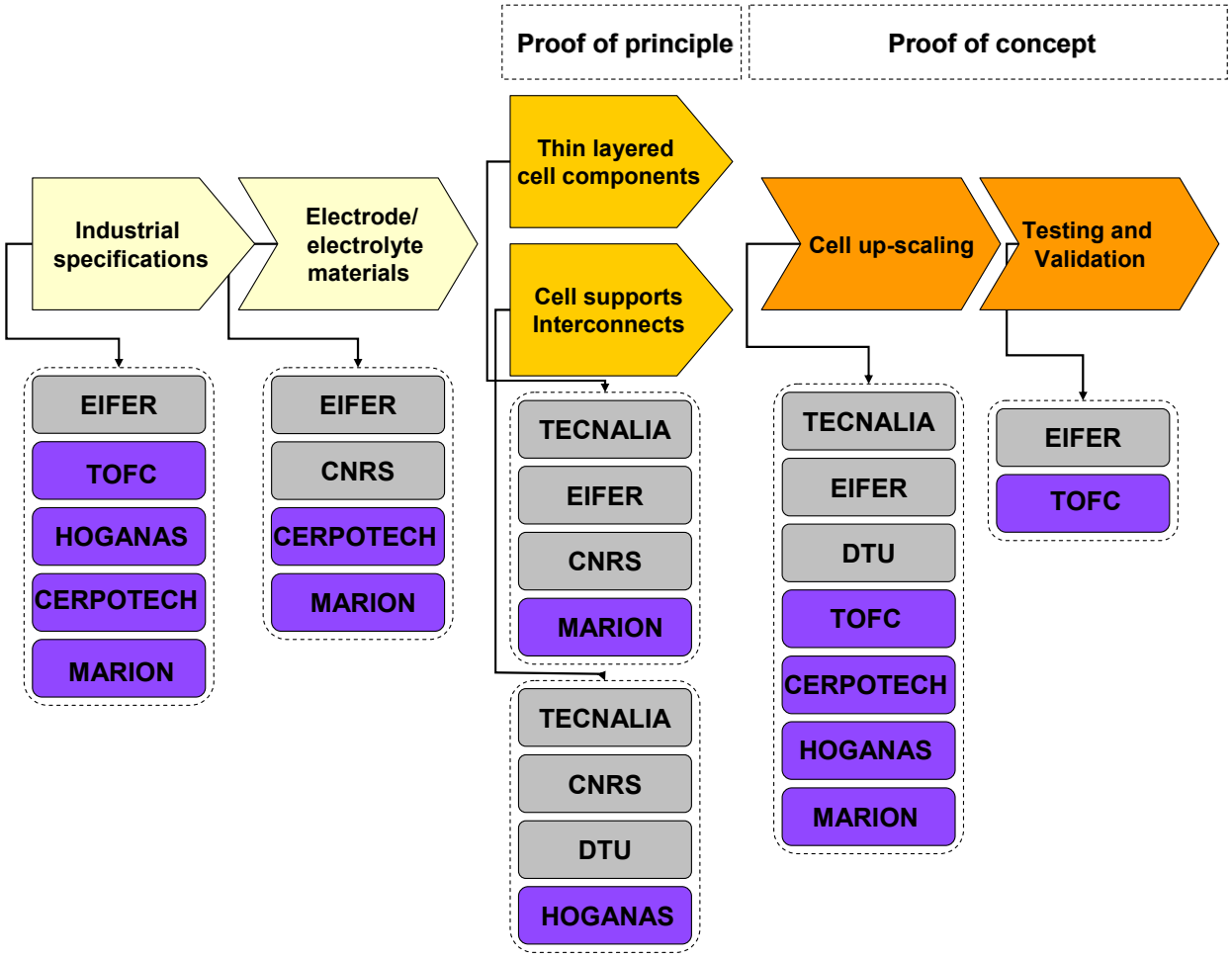
5) Proof of concept of the developed PCFCs in two industrial power units, namely an APU and a gas/micro CHP.



Overview of the work structure

1.4. Scientific and technical objectives of the project

- Gain a deeper understanding of the fundamental reaction mechanisms will be a key issue to obtain electrodes and electrolyte materials with radically enhanced properties.
- Gain a deeper understanding in how to shape electrodes and electrolytes for PCFCs using conventional wet chemical methods.
- Decrease the system costs implementing supports of common metals. The potential compositional and/or structural degradation of the support limit the implementation of conventional processing routes and makes the suppression of post-sintering steps necessary. Thus, innovative fabrication routs will be investigated, i.e. detonation spraying and/or plasma EVD to achieve gas tight electrolytes and atmospheric plasma spraying to achieve electrodes with sufficient mechanical strength.
- Asses the potential of both metal and anode supported cell architectures to obtain the next generation of PCFCs.
- Up-scale the manufacturing procedures for the production of flat Stack Cells with a footprint of 12 x 12 cm and then manufacture and test the first complete PCFC 5-cells stack unit.
- Assess the PCFCs as electrolyser.



Partnership synergies

2. METPROCELL in progress

The project was launched on 16-17 January 2012 with a KO meeting in San Sebastian (Basque Country, Spain) at TECNALIA, the host institution and project coordinator of METPROCELL. The meeting took place with representatives from all partners in the presence of the project Officer, Mr. Jean Luc Delplancke (FCH).

We are now at month 7 of METPROCELL project and the first deliverables have been submitted to the Fuel Cells and Hydrogen Joint Undertaking (FCH JU). In particular, our industrial partners contributed to define the industrial requirements for the implementation of the new developed Proton Conducting Fuel Cells (PCFCs) in the targeted power systems (i.e. APU and gas/micro-CHP). This report collects a set of requirements of the PC based SOFCs and SOECs (Solid Oxide Electrolysis cell) to compete with stat-of-the-art technology and will therefore be the basis of the research and development of lab-scale (button) and stack cells in the corresponding work packages. Additionally, all partners contributed to define the test conditions and protocols for the in-situ testing of cells at both lab-scale and industrial scale.

We are now in the production stage of reference electrode and electrolyte materials. For this purpose, the material manufacturing procedures have been established and validated at industrial scale to obtain nano-scaled particulates and to further process them in the form of granulates suitable for thermal spraying. Additionally, the first generation of advanced electrolyte and electrode formulations is under development. Special attention is also given to the development of the advanced supports (both metal and anode supports) and the feasibility assessment of the proposed deposition procedures as alternative to the most conventional wet chemical routes.

As main platform for dissemination and internal information management, the METPROCELL website with secure intranet was established (http://www.metprocell.eu). The public domain of the web site will be dedicated to promoting the METPROCELL project through relevant information including project objectives, partner backgrounds, public project deliverables, news, information relevant to the Proton Conducting Fuel Cells field, among other. Besides, a public presentation of the project as well as a brochure (see Annex) has been also prepared for helping the partners to contribute with the dissemination of the project.

3. Info of interest

3.1. Forthcoming events (next 6 months)

- *20-22/06/2012*: European Fuel Cell Forum Conference, Lucerne (CH)

  → Poster Communication on METPROCELL project by CERPOTECH (R.A. Strom)

  Link: http://www.efcf.com/

- *10-14/09/2012:* Solid State Proton Conductors Conference, Grenoble (F)

  → Invited speaker: EIFER on "Status and prospects in Proton conducting ceramic cells" (M. Marrony)

  Link: http://sspc16.weebly.com/

- *2013:* International Workshop n°2 « Prospects Protonic Ceramic Cells », Montpellier (F)

  → Organizer: EIFER (M. Marrony, J. Dailly)

  → Topics: PCC in applied research (Fuel cell, Electrolysis, Ammonia synthesis, H_2 pumping)

  → Opening Registration: At the end of 2012

  Link: www.metprocell.eu

3.2. Links of potential interest

http://www.fch-ju.eu/

http://www.new-ig.eu/

http://cordis.europa.eu/home_en.html

http://ec.europa.eu/research/index.cfm?pg=dg

Project details
Start date: 2011-12-01
Duration: 36 months
Project cost: 3.4 million euro

More information at METPROCELL website:
http://www.metprocell.eu

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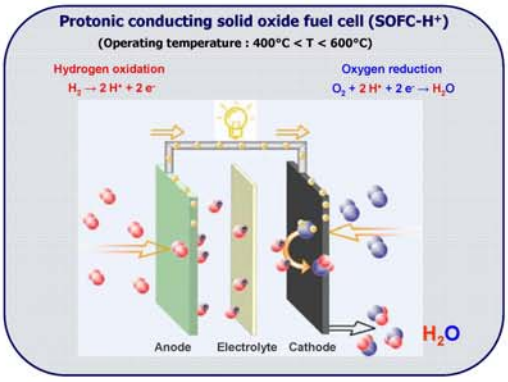
4. ANNEX: BROCHURE

Innovative fabrication routes and materials for METal and anode supported PROton conducting fuel CELLs

Summary

PCFC is one of the most promising technologies to reach the requirements related to cogeneration and back-up power applications, especially for small power systems (1-5 kWel). The investigation in the concept of advanced thin-film ceramic fuel cell technology at operating intermediate temperature between 400 and 700 °C aims at improving the characteristics (thermal cycling, heat transfer, current collection,.) as well as lowering drastically the costs of the system.

The aim of METPROCELL is to develop innovative Proton Conducting Fuel Cells (PCFCs) by using new electrolyte and electrode materials and implementing cost effective fabrication routes based on both conventional wet chemical routes and thermal spray technologies.



Specific Objectives

- Development of new electrolytes and electrodes with enhanced properties for improved PCFCs dedicated to 500-600°C.
- Suppress the post- sintering steps using alternative manufacturing routes based on thermal spray technologies and plasma EVD.
- Bring the *proof of concept* of PCFCs by the set-up and validation of short stacks for APU and gas/micro-CHP.
- Assess the potential of both metal and anode supported cell architectures to obtain the next generation of PCFCs.
- Assess the PCFCs as electrolyser.

Key milestones

- Single cells in comparison with literature. At least: 200 mW.cm-² @ 0.65V, 600°C. (target: 400 mW.cm-² at 600°C as maximum Power density).
- Elaboration of at least 22 stack cells.
- Performance validation of single stack cells in terms of degradation rate (2% or less over 500 hour long term cell testing under fuel cell and electrolysis mode).
- Manufacture of short stacks and validation of the same.

Expected Impact

- Reduction of the manufacturing steps, through the implementation of innovative fabrication routs with none post-sintering needs.
- The possibility to reduce the service temperature under 600 ºC will be notably useful to prolong the service life of the metal supports potentially beyond current benchmarks of 40.000 hours.
- The new PCFCs may offer some new further advantages for the environment such as higher fuel utilisation in comparison to the SOFC technology.
- Increase of system efficiency, through a better utilization of the heat produced and a better BoP, a lower operating temperatures down to 600 ºC, a reduction of the energy consumption of at least 7- 10% and the elimination of the fuel dilution (since water is formed at the cathode).

Partners

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