IRAFC project 245202

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Advent Technologies

Consortium

Advent Technologies (Coordinator) *Greece*

R&D and production of MEA

University of Maria Curie- Sklodowska, Department of Chemical Technology UMCS , *Poland*

Preparation, studying and characterization of catalysts

Nedstack Fuel Cell Technology BV, *The Netherlands*

Producer of PEM fuel cell stacks and systems

Centre National de la Recherche Scientifique, Laboratory of Materials, Surfaces and Catalytic Processes (LMSPC) *France*

Preparation of new catalytic materials, catalytic reactivity, kinetic studies and surface science, new energy sources,electrocatalysis and fuel cells

Foundation for Research and Technology Hellas-Institute of Chemical Engineering & High Temperature Chemical Processes, *Greece*

High and low temperature electrochemistry, heterogeneous catalysis, chemical and electrochemical kinetics and reactor design

Institut für Mikrotechnik Mainz GmbH, *Germany*

Research and development in microtechnology

Start date:01/01/2010 End date: 31/12/2012

Total budget : 2.529.625€, FCHJU contribution: 1.424.147€

The ultimate goal of the project is to deliver:

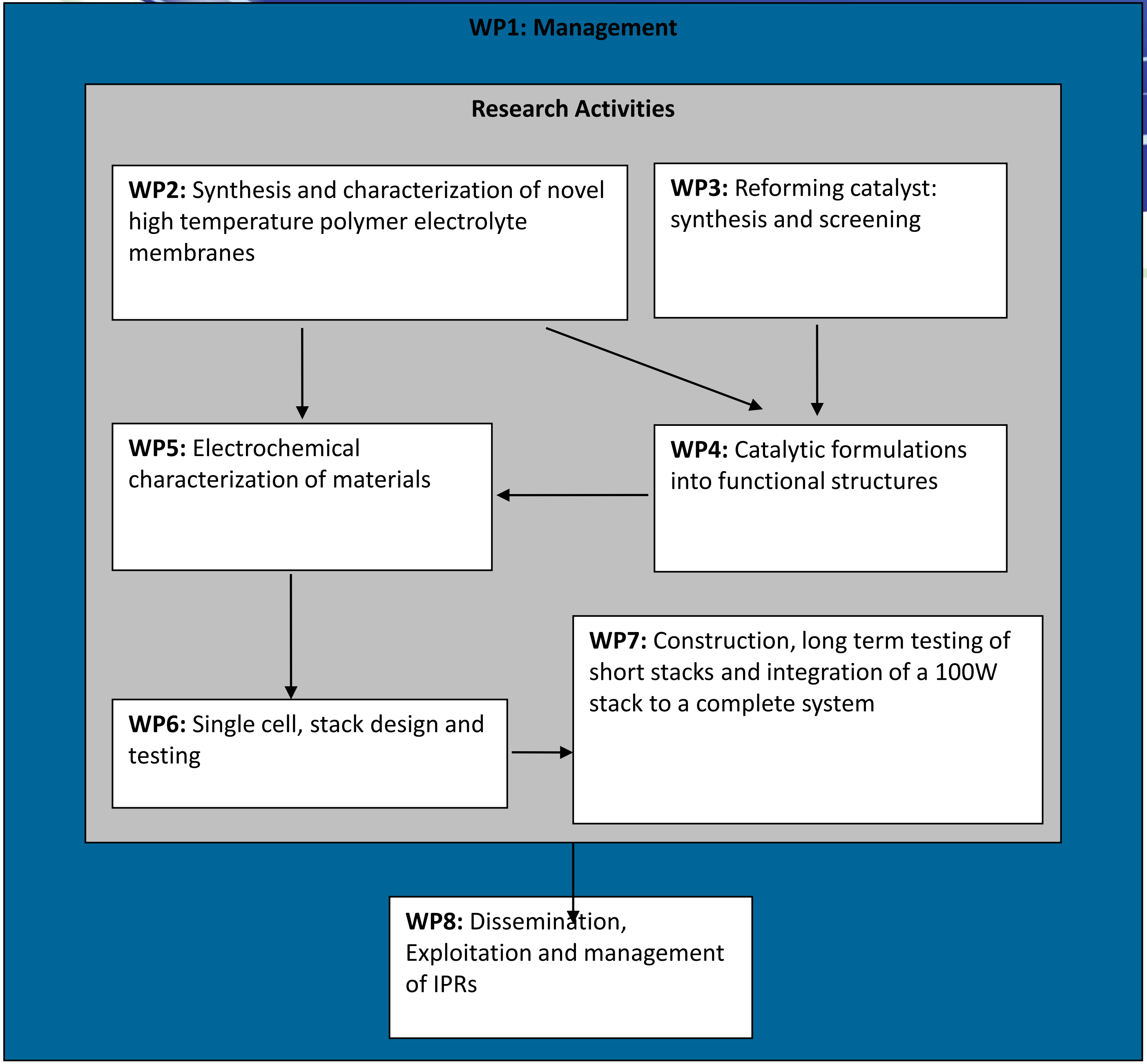
-***An Internal-Alcohol-Reforming High-Temperature PEM fuel cell*** (IRAFC) with the following characteristics:

(i) 0.15 W/cm^2 at 0.7V, operating at 220° C

(ii) Specific (W/kg) and volumetric (W/m^3) power density similar to current, state-of-the-art high-temperature PEM fuel cells operating on hydrogen.

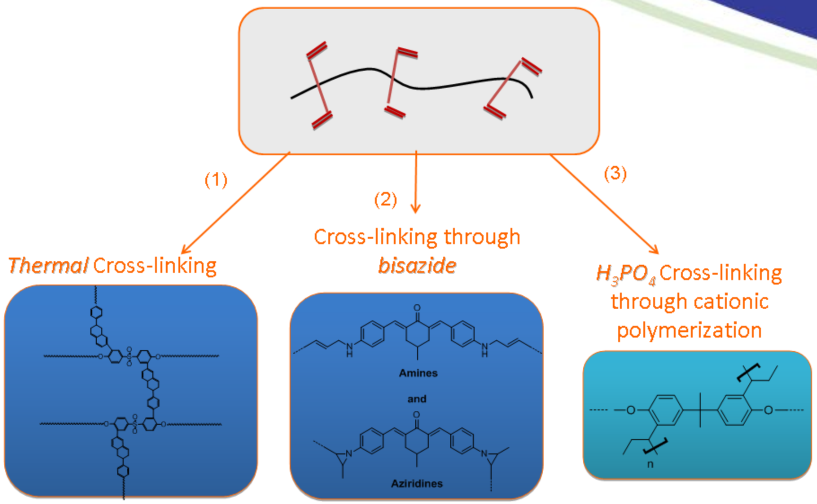
STRATEGY AND MILESTONES

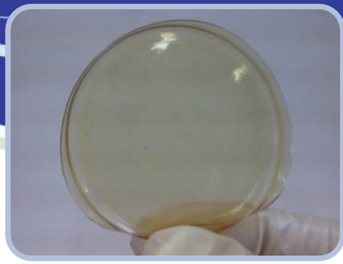
- MEA operating at temperatures 200-220° C
- Methanol reforming catalysts active at 200-240° C
- Optimum combined fuel cell and reformer stack design
- Reliable system performance at 200-220° C for 500hrs

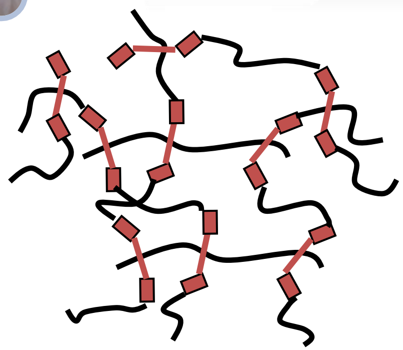


WP1: Management
Research Activities
WP2: Synthesis and characterization of novel high temperature polymer electrolyte membranes
WP3: Reforming catalyst: synthesis and screening
WP5: Electrochemical characterization of materials
WP4: Catalytic formulations into functional structures
WP7: Construction, long term testing of short stacks and integration of a 100W stack to a complete system
WP6: Single cell, stack design and testing
WP8: Dissemination, Exploitation and management of IPRs

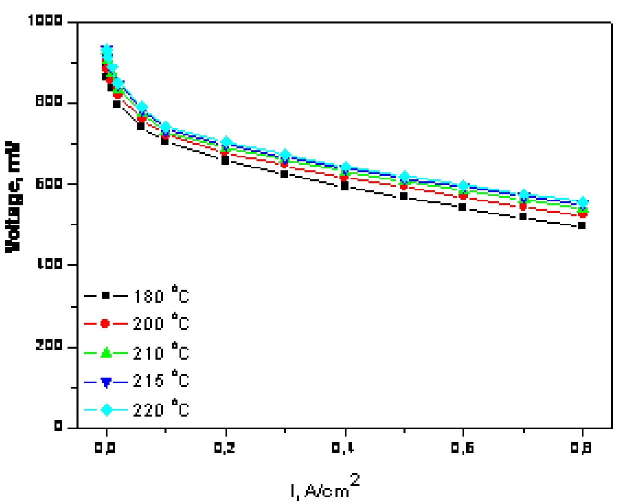
Preparation of new crosslinked membranes



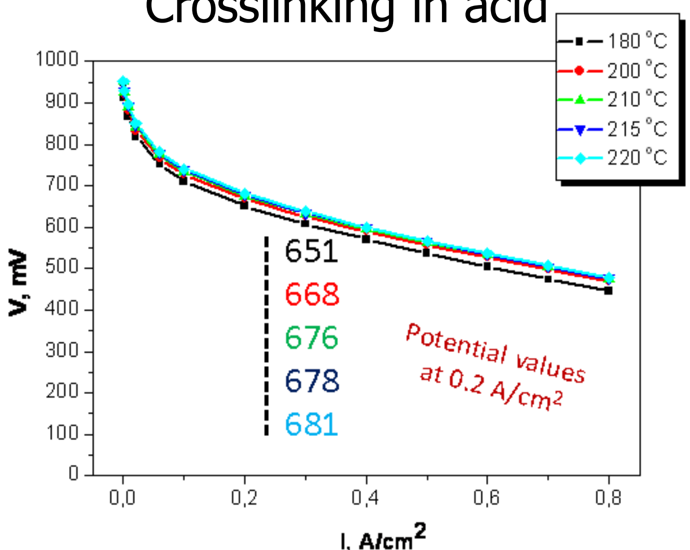




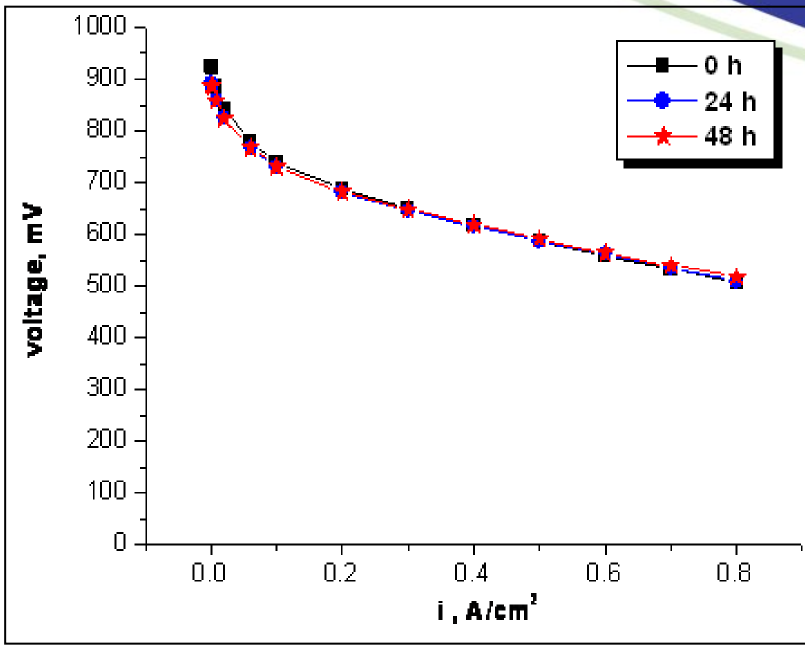
Bisazide method



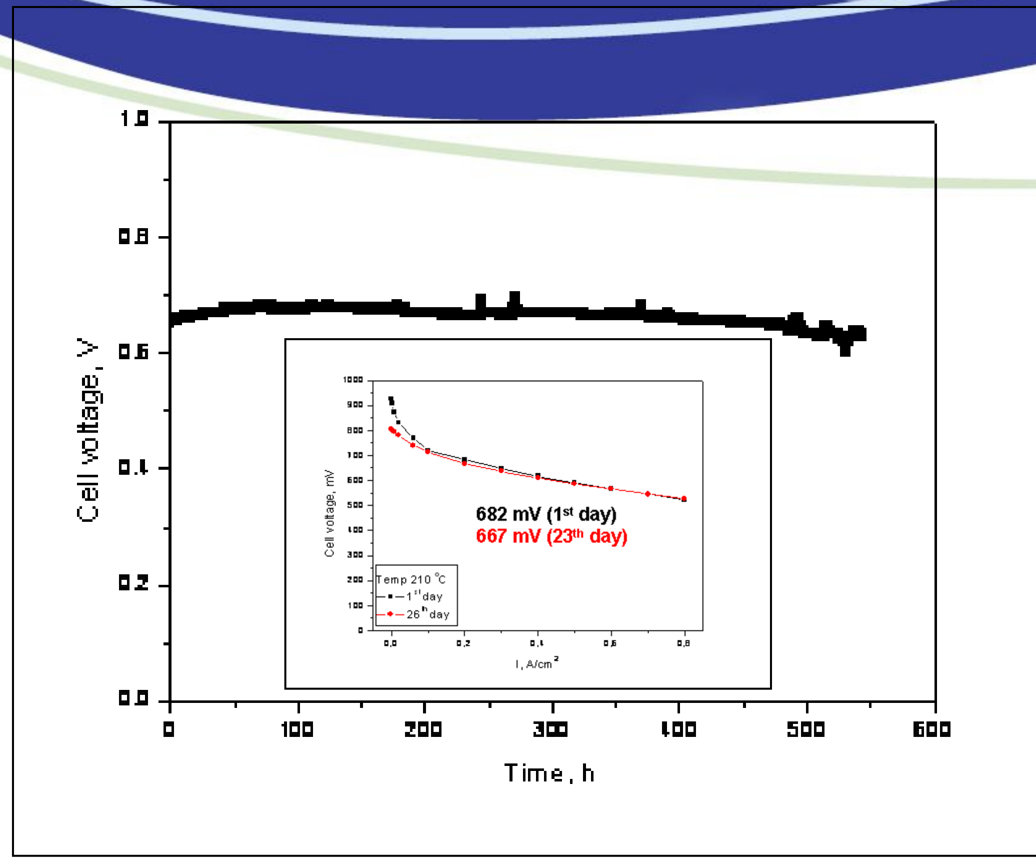
Crosslinking in acid



MEA stability test 200° C

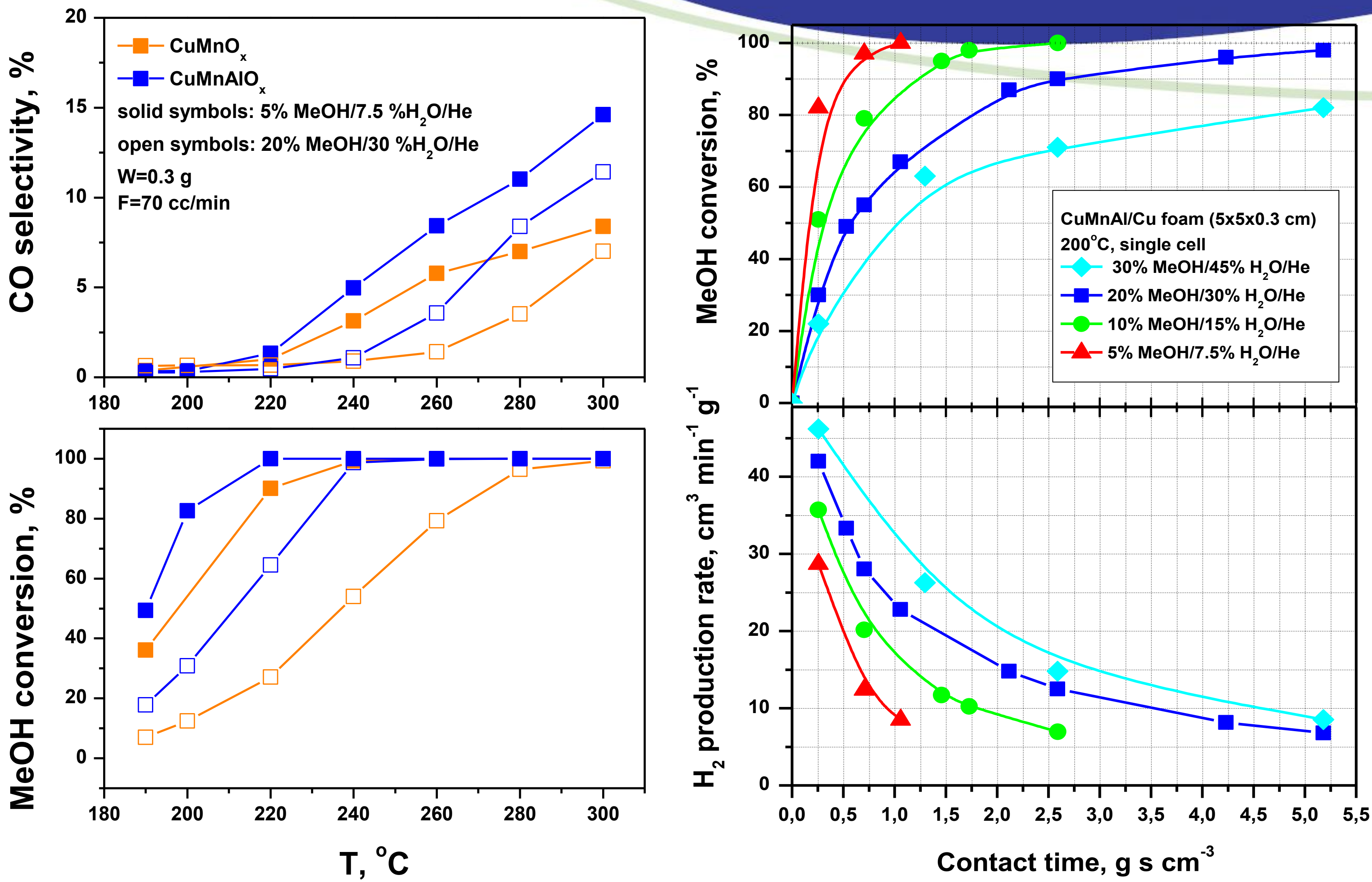


MEA stability test 210° C



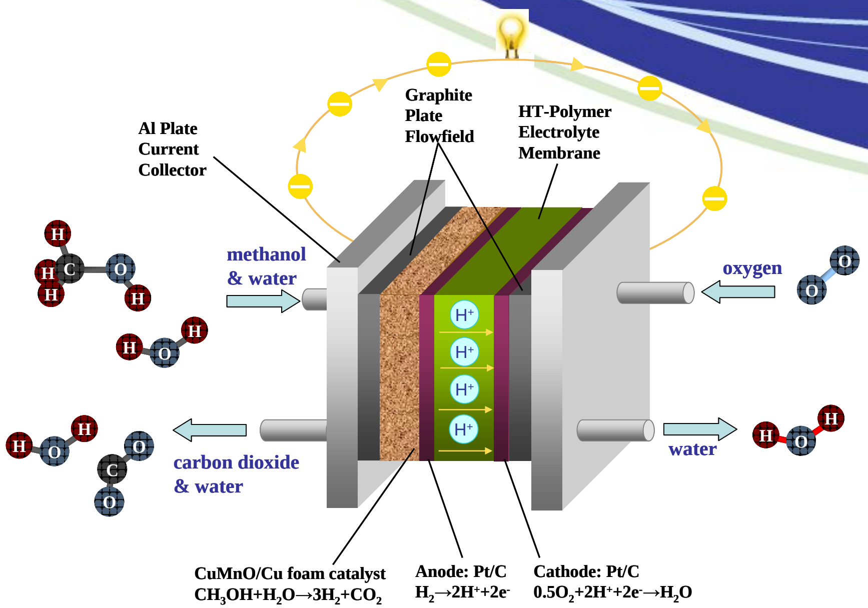
- No degradation observed at 200° C for 48hrs
- Stable performance at 210° C for 550hrs

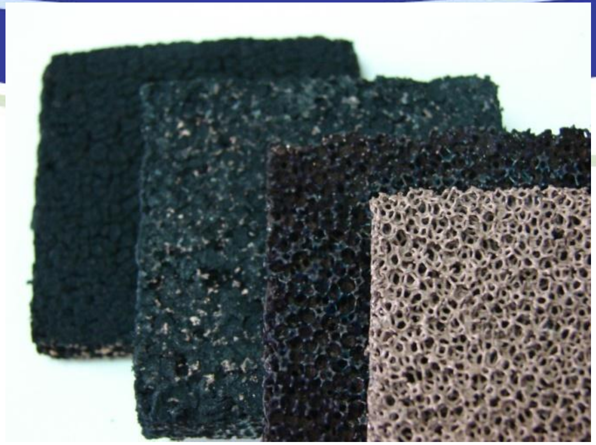
CuMnAlO results in More than threefold increase in catalytic rate than$_x$ CuMnO$_x$



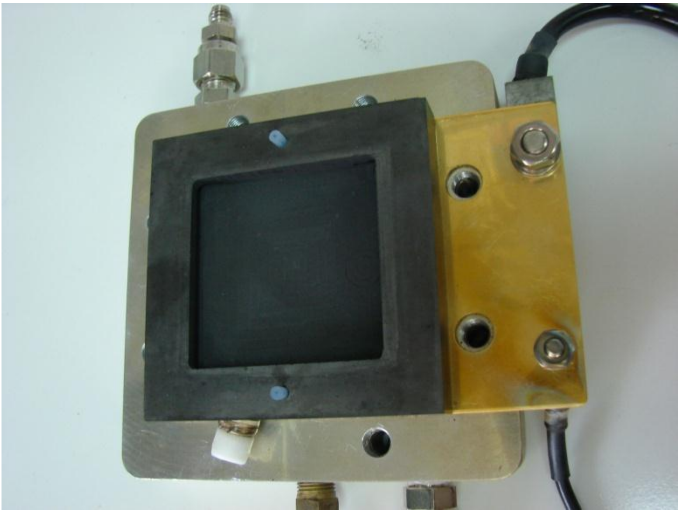
Internal reforming alcohol single cell

Different combined single cell architectures have been tested

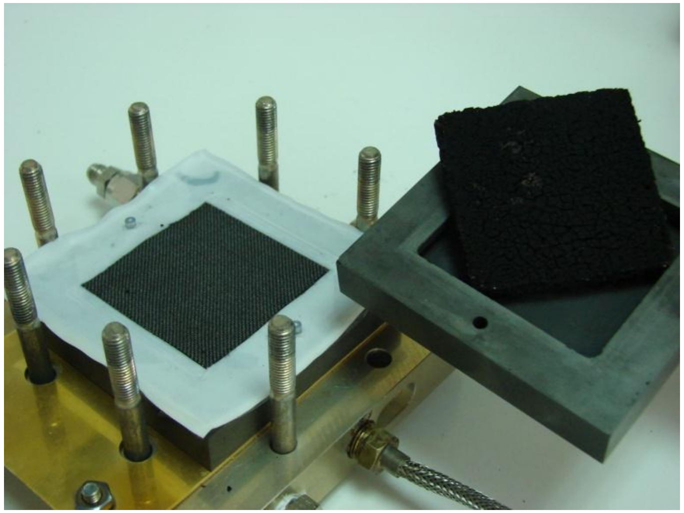




CuMnOx/Cu foam

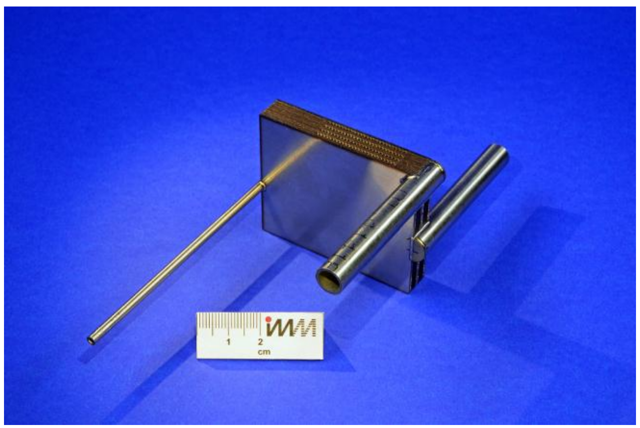


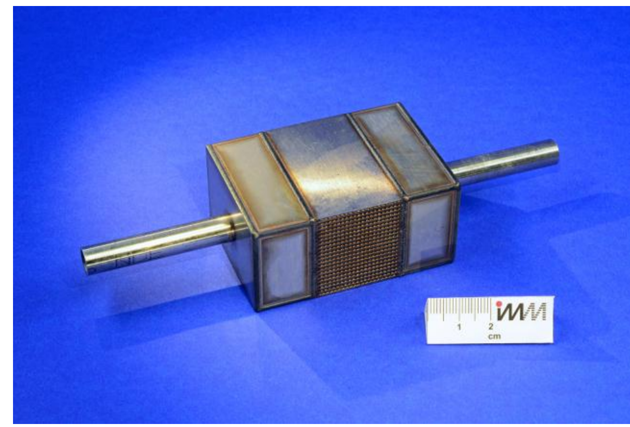
Modified Graphite Plate (Anode)

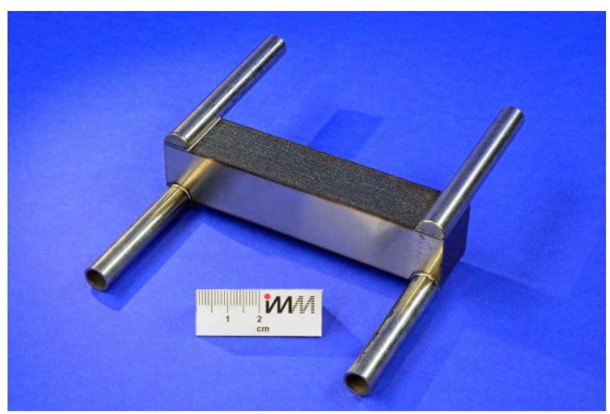


MEA and $CuMnO_x$/Cu foam catalyst

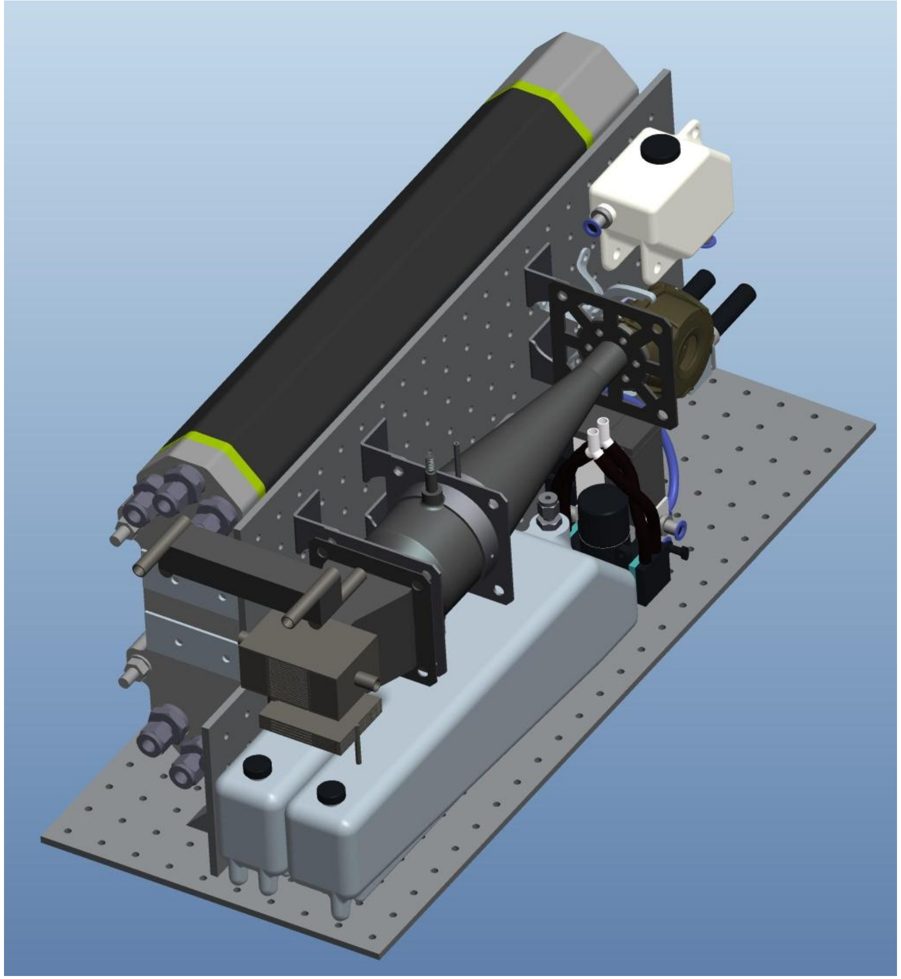
BoP components







CAD model of the final system



Dimensions:

L 600 mm
W 250 mm
H 255 mm
Volume 38.25 L
(incl. Insulation +DC/DC converter + control board)

Comparison:

On market system (250 W)
L 600 mm
W 400 mm
H 250 mm
Volume 60 L

IRAFC System advantages:

- Easy fueling
- Use of liquid fuel
- Compact design
- Combination of reformer/fuel cell
- Multi application

Application areas:

- Portable fuel cells
- Stationary Back up and UPS systems
- Remote and off grid areas

In agreement with early markets application areas goals

Technology transfer:

✓Highly interdisciplinary approach since the consortium consists of companies and academic institutes whose expertise cover a broad range of activities

✓Interface with international and national research projects, e.g.:

- DEMMEA -245156
- 09-ΣΥΝ-51-453
- Eurostars E!5094

Future perspectives:

✓Exploitation of the system application in:

- Refrigerators in remote and off grid areas
- Stationary back up power systems

Dissemination & public awareness:

- 15 publications in peer reviewed journals
- Participation in 22 conferences and events
- 1 patent application
- Website dedicated to IRAFC project (http://irafc.iceht.forth.gr/index.php)