

HY-CO ERA-NET Transnational Actions – Handbook of funded projects

14th November 2008



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Foreword

In this updated version of the Handbook, a project resulting from the HY-CO calls has been added, as the funding decision was published after the deadline for this deliverable has expired.

Hydrogen and fuel cells are considered an important long term technology contribution to a sustainable energy economy, addressing the challenges related to climate change, the diminishing reserves of conventional energy resources, and the environmental impacts of CO₂ emissions which are associated with fossil fuels. Worldwide, basic and applied R&D is necessary to make this technology competitive and thus promoting a future hydrogen economy. To reduce the deficit between the EU and its main competitors, the US and Japan, pooling of public resources through stronger transnational coordination needs to be implemented.

To address the fragmentation of European R&D public programmes, the HY-CO ERA-Net was established in 2004 to support transnational R&D coordination on programme level. This project, closely associated with the Hydrogen and Fuel Cells Technology Platform (HFP), aims at setting up a durable European Research Area (ERA) and promoting the mutual opening up of national funding programmes in this field at EU level. This project involved 24 partners from 18 countries, responsible for national and regional hydrogen and fuel cells programmes.

Beside mutual exchange of information and analysis of existing H₂/FC programmes and activities, one of the main objectives of the HY-CO project was to achieve reciprocal opening up of the public programmes, by implementing transnational activities. To foster the launch of joint transnational calls for proposals, 6 Action Groups (AG) were set up, gathering programme on a specific topic. 5 calls for proposals have successfully been launched by the HY-CO partners in 2007 and 2008, for a total funding granted of 5, 7 millions €. Since the launch of the first HY-CO transnational call in February 2007, the number of Member States and Associated States involved in the calls has constantly increased. The calls also became progressively more integrated, more elements in the national procedures being shared.

This *Handbook of funded projects* gives an overview of the technical content and partners involved in the projects that have been selected for funding within the framework of the HY-CO calls. These collaborative projects are concrete outcomes of an enhanced cooperation among public research programmes owners and managers, paving the way for a durable coordination on European hydrogen and fuel cell public R&D. Only the projects that received the final funding decision by the 30th September 2008 are included in the Handbook. For this reason, the deliverable does not mention the proposals selected under the AG4 call on PEMFC and the second call of the AG3, for they did not get the approval of all funding agencies involved.

The networking of research programmes carried out at national and/or regional level has been fostered by the HY-CO ERA-Net and the collaboration will continue after the project has expired. A new call on hydrogen production is currently in preparation by some southern European HY-CO partners. Programme owners and managers have now the experience and the tools (methodology encompassed in D.1.2 Quality Insurance Plan) to keep up the opening up of hydrogen and fuel cells R&D programmes and to launch new joint programming activities. Such transnational coordination is indeed crucial to target the development and progressive deployment of hydrogen and fuel cells technologies.

HY-CO Coordinator, on behalf of all partners



Overview of the HY-CO projects

Call	Launch of the call	Project funded	Countries involved	Funding granted
Pan-H	February 2007	MDM – MEA Degradation Mechanisms in PEMFC systems for stationary back-up applications: control, understanding and improvements	France Germany	2 065 120€
Call on hydrogen storage – Action group 3	July 2007	BTL Diesel Reformer Development and SOFC Test	Austria Germany	290 000€
Call on hydrogen storage – Action group 3	April 2007	New light metal hybrid systems for hydrogen storage	Germany Norway	1 614 000€
Call on hydrogen storage – Action Group 3	July 2007	Novel Metal organic frameworks (MOF) for hydrogen storage in cryoadsorption storage systems	Germany Norway	789 000€
Call on PEMFC/SOFC – Actions Groups 4/ 5	December 2007	Development of improved Cr barrier layer and cathode contact coatings on interconnect materials and their effect on the SOFC degradation	The Netherlands Finland	315 000€
		AccelenT – Accelerated Testing of SOFC components	Germany Finland Switzerland	759 500€
Call on Deployment Strategies – Action Group 6	December 2007	SEE- μ FC - Socioeconomic and Energy Systems Analysis of Micro Fuel Cells	Denmark France Portugal	250 100€
TOTAL				6 082 720€



French - German call

MDM – MEA Degradation Mechanisms in PEMFC systems for stationary back-up applications: control, understanding and improvements

Partners

- 1- AXANE (FR)
- 2- Air Liquide (FR)
- 3- INPG, Laboratoire d'Electrochimie et de Physicochimie des Matériaux et des Interfaces (LEPMI)- UMR 5041 (FR)
- 4- CNRS, Laboratoire Matériaux Organiques aux Propriétés Spécifiques (LMOPS) – UMR 5041 (FR)
- 5- SOLVICORE GMBH&CO. KG (DE)

Summary of the project

In the current industrialisation and deployment phase of the PEMFC technology, manufacturers need to provide life-time and performances warranties for the systems, in order to be competitive and to increase the markets size. The MEAs represent the most sensitive and the most expensive system component. MEAs life-time in laboratories is high (>15000 h), but considerably decreases in real system (~2000 h). To cover the complexity of observed phenomena (multi-physic, multi-scales, strong interactions), a complete R&D approach is needed including a MEA manufacturer, a PEMFC system manufacturer and laboratories having specific and complementary competences in MEA degradation mechanism analysis. This team is the key of the project success and will allow acquiring a in-depth understanding and control of MEA degradation phenomena. This project focuses on back-up stationary application. In order to answer to the market needs, performances and life-time targets are fixed respectively to 0,48 W/cm² and 5000 h.

Informations

Project reference
ANR-07-PANH-008

Start date
01 December 2007

Duration
36 months

Project funding
1 179 120 € from ANR (FR)
886 000 € from BMWi (DE)

Total 2 065 120€

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National programme involved	Country
ANR- PAN-H	France
5 th Energy research programme	Germany





Austrian – German – Swiss call Action Group 3 on hydrogen storage

BTL Diesel Reformer Development and SOFC Test

Partners

Partner 1 – Federal Ministry for the Environment (DE)
 Partner 2 – Austrian Research Promotion Agency (FFG)

Summary of the project

Based on previous works the aim of this project is to evaluate the use of BTL (Biomass-to-liquid) Diesel in Solid Oxide Fuel Cell (SOFC) Systems. For this purpose a BTL Diesel Reformer will be developed and tested.

In a second step this reformer will be directly coupled to a ~1kW SOFC Stack and operated under stationary and dynamic conditions. The major aim is to demonstrate a system which is able to operate with conventional diesel, BTL diesel and a mixture of both.

Informations

Start date
01.07.2008

Duration
24 month

Project cost
~ 800.000€

Project funding
290 000€ from FFG (AT)
X from BMU (DE) - Contract under negotiation.

National programme	Country
A3plus, IV2Splus	Austria
5 th Energy research programme	Germany





Norwegian - German call Action Group 3 on hydrogen storage

New light metal hydride systems for hydrogen storage

Partners

- 1- Research Centre Karlsruhe - FZK (DE)
- 2- Institute for Energy Technology - IFE (NO)
- 3- Savannah River National Laboratory – SRNL (USA)

Summary of the project

The technical target of the project is to achieve a considerable scientific and technical progress in the development of novel storage materials for Hydrogen, which is considerably beyond the state-of-the-art in the field. Nanocomposites with more than 10 mass% H content (state-of-the-art: 4.5 mass% H) will be prepared and tested. The reversible behaviour of boron-based materials will be improved by using appropriate dopants and nanotechnological methods for the preparation of different types of nanocomposites.

Informations

Project references

- NO 185 309
- HY-CO 0327797

Start date

01 February 2008

Duration

36 months

Project funding

632 000€ from BMWi (DE)
982 000€ from RCN (NO)

Total 1 614 000€

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National programme involved	Country
RENERGI	Norway
5 th Energy research programme	Germany





The Research Council
of Norway

Norwegian - German call Action Group 3 on hydrogen storage

New metal-organic frameworks (MOF) for hydrogen storage in cryoadsorption storage systems

Partners

- 1 - Technical University of Dresden, Institute for Inorganic Chemistry (DE)
- 2 - Max-Planck- Stuttgart Institute for Research on Metals (DE)
- 3 - Technical University of Trondheim, Institute for Energy and Process Technics (NO)

Summary of the project*

The following work tasks have been defined in the project:

1. Measurement and development of models for predicting the basic material quantities. Of particular interest to the Norwegian group are the thermophysical and flow related properties (e.g. effective thermal conductivity, specific heat capacity, density, porosity and permeability, as well as the kinetic properties).
2. Development of a simulation tool for hydrogen storage tanks, predicting the transient heat and mass transfer coupled with the material kinetic properties. The outcome of this will form the basis of defining and developing internal heat exchanger surfaces and cooling systems enabling e.g. fast filling of storage tanks.
3. Experimental validation. Selected materials will be tested experimentally in a relatively large (ca 9 l) cryo-storage tank, where flow, pressure and temperature distribution is mapped. Internal heat exchanger surface geometries can be fitted inside to optimize the tank behaviour. Experimental data will be used to validate the simulation tools.

The joint effort from the 3 partners in this project will provide unique information regarding MOFs, their characteristics and behavior as applied to hydrogen storage applications. The results and network resulting from this cooperative effort will be used in establishing a larger project within EUs 7th frame program.

*This summary refers to the tasks of the Norwegian partners.

Informations

Project reference
MOF 0327796 A-B

Start date
01 January 2008

Duration
36 Months

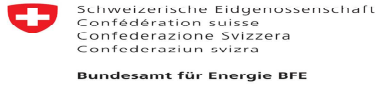
Project funding
354 000€ from BMWi (DE)
435 000€ from RCN (NO)

Total 789 000€

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National programme involved	Country
RENERGI	Norway
5 th Energy research programme	Germany





Action Group 5 on SOFC Finland – the Netherlands

Development of improved Cr barrier layer and cathode contact coatings on interconnect materials and their effect on the SOFC degradation

Partners

- 1 – ECN, Energy research Centre of the Netherlands (NL)
- 2 – VTT, Technical Research Centre of Finland (FI)

Summary of the project

Interconnects are required in SOFC stacks for the distribution of the anode and cathode gas over the cells and the electrical contact between the cells in a stack. These interconnect materials typically contain >20 wt% Cr, which prevents the metal from further oxidation by forming an electrical conductive Cr-oxide layer. Cr poisons the cathode, therefore either evaporation of Cr species or solid phase transport must be prevented by a Cr barrier layer on top of the metallic interconnect. For the electrical contact in the stack a cathode contact coating must be supplied between the Cr barrier layer and the cathode of the cell.

In this project interconnect materials, Cr barrier layers and cathode contact coatings will be developed and/or characterised for application in a stack. The operating temperature strongly determines the corrosion rate and Cr evaporation rate. VTT will focus on the development and characterisation of the materials at 750°C, the nominal operating temperature of a stack with anode supported cells, with a possible reduction in temperature in the near future. ECN develops cells with a nominal operating temperature of 600°C, which is the lower limit of a stack with a nominal operation temperature of 650°C and a temperature gradient of 100°C. Therefore ECN will focus on 600- 700°C.

Informations

Project reference
ERAHY01001

Start date
01 September 2008

Duration
18 months

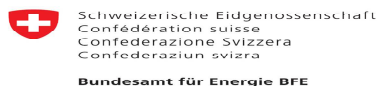
Project funding
125 000€ from SN (NL)
70 000€ from ECN (NL)
84 000€ from TEKES (FI)
36 000€ from VTT (FI)

Total 315 000€

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National programme	Country
SofcPower 2007-2011	Finland
EOS	The Netherlands





Action Group 5 on SOFC Germany – Finland - Switzerland

AccelenT – Accelerated Testing of SOFC Components

Partners

- 1 – FZJ, Forschungszentrum Jülich GmbH (DE)
- 2 – IWE (DE)
- 3 – N.N (DE)
- 4 – VTT (FI)
- 5 – EPFL (CH)
- 6 – ZHAW (CH)
- 7 – HEXIS (CH)
- 8 – HT Ceramix (CH)

Summary of the project

Solid Oxide Fuel Cells are particularly suitable for stationary power generation. To be used in this context they should attain lifespans exceeding 40,000 hours of operation. On this timescale scale it becomes unreasonable to test devices and systems in the laboratory in order to ensure system longevity. Rather, methods have to be found to accelerate the degradation of the SOFC devices over time in order to be able to predict the durability from much shorter testing periods.

This proposal intends to lay the ground for accelerated testing activities in SOFC technology. The project will do so by investigating the means to accelerate single degradation effects in isolation from the others in order to avoid overlaying effects complicating the interpretation of results. Specific experiments will be built that give full control of the operating environment and allow the investigation of the kinetic behaviour of single mechanisms. From these studies, it will be learned how phenomena can be accelerated and correlated with the effects ensuing from 'normal' operation of an SOFC device. In order to reliably speed up the testing time it is necessary to ensure that the accelerated testing results fully correspond to the effects seen after standard operation. Models will be used to plan the experiments and compare the outcome to the expected results.

Due to the budget constraints, the project will concentrate on few single effects and explore the possibilities and limitations of accelerating these mechanisms. The project consortium gathers some of the most experienced companies and research institutions in Europe with a remarkable track history in SOFC engineering, characterisation and testing.

Informations

Start date

01 September 2008

Duration

24 months

Project funding

497 500€ from BMWi (DE)
112 000€ from TEKES (FI)
150 000€ from BFE (CH)

Total 759 500€

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National programme	Country
5 th Energy Research programme	Germany
SofcPower 2007-2011	Finland
Programme SFOE PL – HFC	Switzerland





Action Group 6 on deployment strategies Denmark – the Netherlands – Slovenia – Norway – France - Portugal – NER

SEE-μFC - Socioeconomic and Energy Systems Analysis of Micro Fuel Cells

Partners

- 1 - Risoe, Technical University of Denmark (DK)
- 2 - EDF-EIFER (FR)
- 3 - Simbiente, Environmental Engineering and Management (PT)

Summary of the project

Technical issues are not the only barriers for the widespread deployment of fuel cell based micro CHP systems. In this project, core goals necessary to ensure the successful deployment of fuel cells will be identified and the most efficient promotion schemes to achieve these goals will be found.

Central questions that will be answered are:

- Which kind of promotion scheme will be the most efficient in the deployment of fuel cells in micro combined heat and power?
- How will specific national regulatory frameworks interact with promotion schemes and operational strategies?
- How will different kinds of ownership structures interact with different promotion schemes?
- How will different operational strategies influence the economy of the individual owners and overall energy systems aspects, including environmental issues?
- Which stakeholders should be involved in fuel cell based micro combined heat and power promotion? What will be the impacts on these players?

Informations

Start date
01/09/08

Duration
24 months

Project funding
150 000€ from DEA (DK)
61 200€ from ADEME (FR)
38 900€ from FCT (PT)

Total 250 100€

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Pablo Kroff
Simbiente

National programme	Country
R&D Strategy for hydrogen	Denmark
ADEME	France
FCT	Portugal

