

GRANT AGREEMENT: **N° 213389**
Project Acronym: **IDEAL-Cell**
Project Title: **Innovative Dual mEmbrAne fuel-Cell**

Funding Scheme: **Collaborative project**
Small of medium-scale focused research project

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For the RTD and Management activities on the:

IDEAL-Cell project

Project funded by the European Commission within the Seventh Framework Programme: 2008-2012

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Logo of the project:



1. Publishable summary

The IDEAL-Cell project is funded by the European Commission within the Seventh Framework Programme (FP7; 2008-2012). Among the 328 projects proposed in the topic Energy, only 2 on high temperature fuel cell were accepted including the IDEAL-Cell project. Taking into consideration the 17 Future Emerging Technology (FET) projects which were proposed in 2007, IDEAL-Cell is the only one that has been accepted and funded. This innovation IDEAL-Cell is based on what was patented in 2005 by ARMINES with an international extension in 2007 for Europe, US, and Japan. The project brings together a consortium of 9 European partners, academic as well as industrial, in Italy, Germany, Bulgaria, Poland and France. All included, there are 475 person-months that are rallied to work on this project, which correspond to 11 persons working full time for 4 years.

The structure of the IDEAL-Cell project is composed of six Work Package (WPx) (see annex A – Description of Work [DoW]), five of them being directly involved in the first two years before a GO/NO GO decision takes place. The IDEAL-Cell project proposes to bring a noteworthy innovation to the field of high-temperature oxide fuel cell technology for stationary application. The final objective of the project is ***the fabrication of a dual membrane cell short-stack, with optimized properties and operating conditions in the temperature range of 600-700 °C under hydrogen and air, via low cost forming process***. The short-stack will consist of two full dual IDEAL-Cells integrated in a dedicated interconnect architecture that will be specifically designed to take advantage of the concept of three independent chambers.

In the first part of the project, the essential goal consists in proving the IDEAL-Cell concept. For that purpose, the consortium principally focuses its technical and modelling activities in WP2 (Oxygen Electrode Assembly Development), WP3 (Proton Electrode Assembly Development) and WP4 (Dual Cell Realization). WP4 will be obviously critical for the GO/NO decision in the sense that it is dedicated to the core of the concept, that is the mixed conducting and porous central membrane. In addition, since the concept will clearly allow for innovative cell and stack architecture designs, it seemed reasonable to anticipate the work on interconnects, which requires on the one hand long term testing regarding ageing and reactivity, and which, on the other hand, must be thoroughly associated with any reflection about the architecture design of the central membrane. Therefore, substantial part of WP5 has already started during this first period.

These activities have been enriched with management actions in WP1 and communication tools as well as knowledge dissemination actions in WP6.

The present report gives the advances of the IDEAL-Cell project for the first year; it establishes a quantitative account of the progresses made by the consortium in the diverse WPs activities, which are summarized below:

- Concerning WP1, active works were carried out among them the finalization of the Consortium Agreement (sent in August 2008 [month 8]), the amendment of the DoW (technical as well as administrative and financial aspects), the planning of meetings for the second year (dates are already fixed), the writing and approbation of the 6-month and non-mandatory intermediate reports, the creation of efficient management tools for internal products and deliverables monitoring (the WPs Roadmap and e-management platform created by ARMINES specifically conceived for the IDEAL-Cell project) (task 1.1 [start month m1]), the purchase of a set of domain names based on "ideal-cell" or "idealcell", the financial (per WP/participant) and administrative resources (PM/participant/WP allocated resources with regard to the scheduled ones) day-to-day supervision (tasks 1.2, 1.3 and 1.4 [start month: m1]), the conception of the IDEAL-Cell logo (figure p.s), the register of apparatus coming from each institution, and the preparation of the monthly news (starting-up from the 5th of March). All scientific, technical, legal and administrative issues were discussed and recovery actions were taken in the case of workplan deviations;
- Activities in WP2 and WP3 were mainly focused on powders synthesis and characterization (tasks 2.1 and 3.1 [start month: m1]), shaping processes preliminary work (tasks 2.2 and 3.2

[start month: m3]) leading to the first tests for the fabrication of symmetrical cell (tasks 2.3 and 3.3 [start month: m6]). As regards to tasks 2.1 and 3.1, some difficulties were encountered for the first six months in the sense that powders did not completely correspond to the specification required for the diverse shaping processes in view. However, rescue actions were undertaken in order to satisfy all partners requirements. After six months, convincing information was obtained on the capability of the consortium to shape both cathodic and anodic parts of the IDEAL-Cell. The set-ups for electrochemical testing (tasks 2.5 and 3.5 [start month: m8]) were also developed in order to characterize electrical response of symmetrical and pseudo-symmetrical half-cells (from tasks 2.3 and 2.4 in WP2 and tasks 3.3 and 3.4 in WP3). According to the Gantt chart, tasks 2.6 and 3.6 haven't started yet, although some discussions already took place during the first year in order to anticipate them (to increase the adhesion between each layer by improving the quality of interfaces);



Figure p.s. Design of the logo of the IDEAL-Cell project.

- Regarding WP4, activities on modelling (task 4.1 [start month: m1]), on reactivity of materials (task 4.2 [start month: m3]) and on central membrane fabrication (task 4.3 [start month: m3]) gave rise to promising results. As first interesting results, modelling activities in task 4.1 focus on the water pressure drop and elimination process within the central membrane, and it was shown that probably large planar standard cell geometries will not allow to get rid of the water satisfactorily; new designs are probably needed. Moreover, reactivity tests (task 4.2) carried out in vigorous conditions showed that components do not react with each other. In task 4.3, first tentative central membranes samples could be prepared with varying porosity. Results show that a good control of the porosity was easily obtained by adding pore formers to the starting slurry. The consortium also considers that this work is also part of the expected task 5.1. Regarding task 4.4, which is about to get going, alternative and promising attempts were carried out, such as the first metal supported green IDEAL-Cell fabricated by tape casting;
 - The activities in WP5 have undoubtedly begun insofar as first tentative results on central membrane optimization (task 5.1 [start month: m25]) (see results in task 4.3), interconnects design (task 5.3 [start month: m25]), a design for ASR measurements (Real Life Tester) and some elements for their integration into a short-stack (task 5.4 [start month: m25]) came out eight months ago;
 - The design and the implementation of a public IDEAL-Cell website (task 6.1 [start month: m1]), of an internal one for the management (task 6.2 [start month: m1]), a draft of the organization of the "2009 Advanced Materials and Innovations in SOFC" workshop in Sofia (task 6.3 [start month: m1]) and the dissemination of internal knowledge (task 6.4 [start month: m1]) correspond to the most important results obtained in WP6.
- ⇒ Address of the external website: www.ideal-cell.eu
 ⇒ Address of the internal website: www.ideal-cell-team.eu