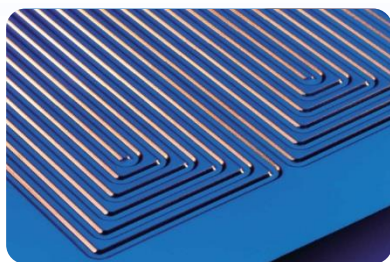




Innovative COatings for BipolaR plates



The research leading to these results has received funding from the European Union's Seventh Framework Programme (FP7/2007-2013) for the Fuel Cells and Hydrogen Joint Technology Initiative under grant agreement n° 621193



The COBRA project is supported by the 7th Framework Programme of the European Commission in the context of the Fuel Cells and Hydrogen Joint Undertaking (FCH-JU) public private partnership. It has a budget of €3.8 million over 3 years and the consortium comprises the following 6 organizations:

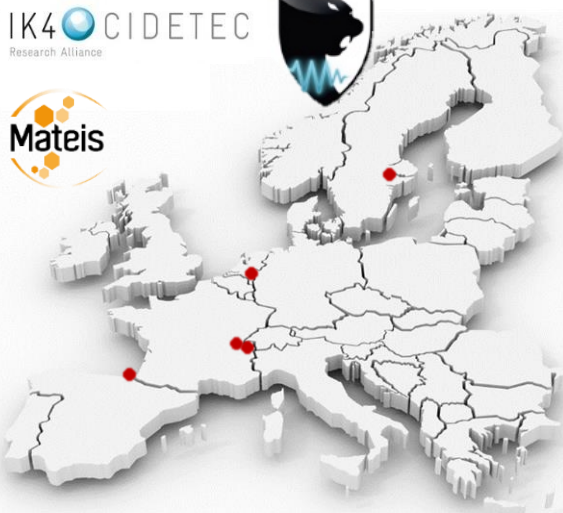
- Commissariat à l'Énergie Atomique et aux Énergies Alternatives (CEA), France
- Borit NV, Belgium
- Impact Coatings AB, Sweden
- SymbioFCCell SA (SFC), France
- IK4-CIDETEC, Spain
- Institut National des Sciences Appliquées de Lyon (INSA Lyon), Université de Lyon, France



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<http://www.cobra-fuelcell.eu/>
fabrice.micoud@cea.fr

COBRA, consortium of European industrials and scientists, has been focusing on **new manufacturing methods for bipolar plates and innovative and low cost coating concepts** to demonstrate their interest **from laboratory up to real field testing**.

The COBRA project represents a mature approach towards reaching the technical and commercial targets of bipolar plates for automotive stack development based on the FCH-JU 2013 AIP targets.

The COBRA project is providing the following specific benefits:

- Bipolar plate specifications based on agreed **OEM system requirements**;
- Performance and durability compatible with the **stringent requirements** of the automotive industry;
- **Post-mortem studies**, phenomena modeling and ageing simulation;
- **Development tested in operating conditions** and verified in detail on component, cell, and stack level by highly skilled research institutes and industrial partners;
- On-field tests on **Marine and Automotive** conditions with operating fuel cell systems.

First year Results

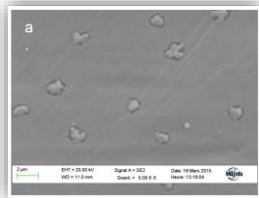
- Complete batch of gold coated **reference bipolar plates** was produced.



- Reference materials were analyzed and dedicated **characterization methods** were developed.
- Field tests were performed in **marine conditions**.



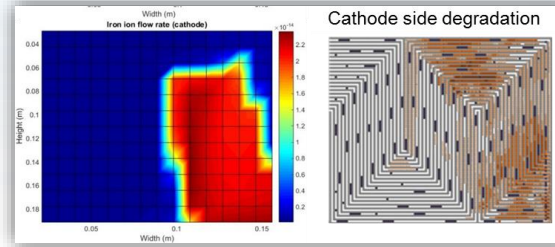
- Post-mortem analysis** was done on aged reference gold coatings.



- Points of **improvement of the process** were proposed.
- The release of cationic pollutants from metallic bipolar plates during PEMFC operation was studied.
- In-situ & ex-situ tests** were performed and contamination model was proposed.

Second year Results

- The **development of model** for membrane degradation and correlations with post-mortem observations were done.



- An **ageing test protocol** was also proposed at stack level to evaluate coatings in representative conditions.
- New protective coatings, using 3 different approaches, were developed and studied:
 - ✓ **Application of sol-gel coatings** based on silanes doped with different additives for enhancing their conductivity.
 - ✓ **Gold, Silver and Nickel coatings** obtained by electrodeposition.
 - ✓ **Ceramic MaxPhase™, TiC-based and NbC-based coatings** obtained by PVD.



- 4 promising coatings** were selected to be evaluated in fuel cell conditions.
- Hydroforming** bipolar plates production process was improved.

Last year Results

- Testing of the innovative coatings** in PEMFC short stacks



- Selection** of the best promising coating **MaxPhase™** for the production of medium batch of plates (200 pieces) using the up-scaled processes developed in the project.
- Validation in a 5 kW stack used as range extender in a Hy-Kangoo vehicle** followed by post-mortem analysis of the degradation modes. Comparison between lab test bench and real operation configurations.



- Cost analysis for the evaluation of both manufacturing and coating solutions.