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Improved electrolysis for distributed hydrogen production

GA No. 700008

### **High Performance PEM Electrolyser for Cost-effective Grid Balancing Applications**



### **HPeM2GAS - Deliverable report**

**D 3.3 Final report on the manufacturing of the  
catalysts including recombination catalysts meeting the  
specifications and scale-up to kg batches**

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## Summary

Main scientific and technical achievements for catalyst development in WP3 were concerning with the development of designed anode and cathode electro-catalysts capable of achieving the targeted electro-catalytic activity under specific operating conditions according to the project milestones. Other relevant aspects were the reduction of the noble metal loading versus baseline formulations, the development of cost-effective formulations based on Pt/C catalyst for the cathode and Ir-Ru oxide catalyst for the anode with high performance characteristics. Excellent catalytic activity for a recombination catalyst has been demonstrated. Carbon black supported nanosized Pt (CNR-ITAE) and IrRu-oxide electrocatalysts (CNR-ITAE) with enhanced mass activity have been developed for hydrogen and oxygen evolution reactions (HER and OER), respectively, in PEM electrolyzers. At 25 °C, the overpotential for the OER vs. the thermoneutral potential (1.48 V) at 3 A cm<sup>-2</sup> was 153 mV (IR-free). This value represents a significant improvement over the state of the art and even better than the project milestone (MS4) regarding anode performance.

Whereas for the HER the recorded overpotential at 3 A cm<sup>-2</sup> was about 80 mV vs. the reversible hydrogen potential that is comparable to the quantitative project target for the cathode (MS2). The developed electrocatalysts were assessed in terms of performance and stability in single cell and down-selected for use in the stack.

Scaling up of the down-selected formulations have been addressed with the production of hundreds grams of anode and cathode catalysts to cover the MEA and stack development and assessment activity. The selected electro-catalysts have been provided to WP4 for large area MEAs manufacturing.

Recombination catalysts based on Pt-Co and Pt-Ru have been developed at CNR-ITAE and assessed in catalytic and electrochemical tests. The Pt-Co oxidation (recombination) catalyst shows excellent catalytic activity for H<sub>2</sub> and O<sub>2</sub> recombination to water under gas phase operation and promising performance during in situ assessment.