

PEMFC based on platinum group metal free structured cathodes (PEGASUS)

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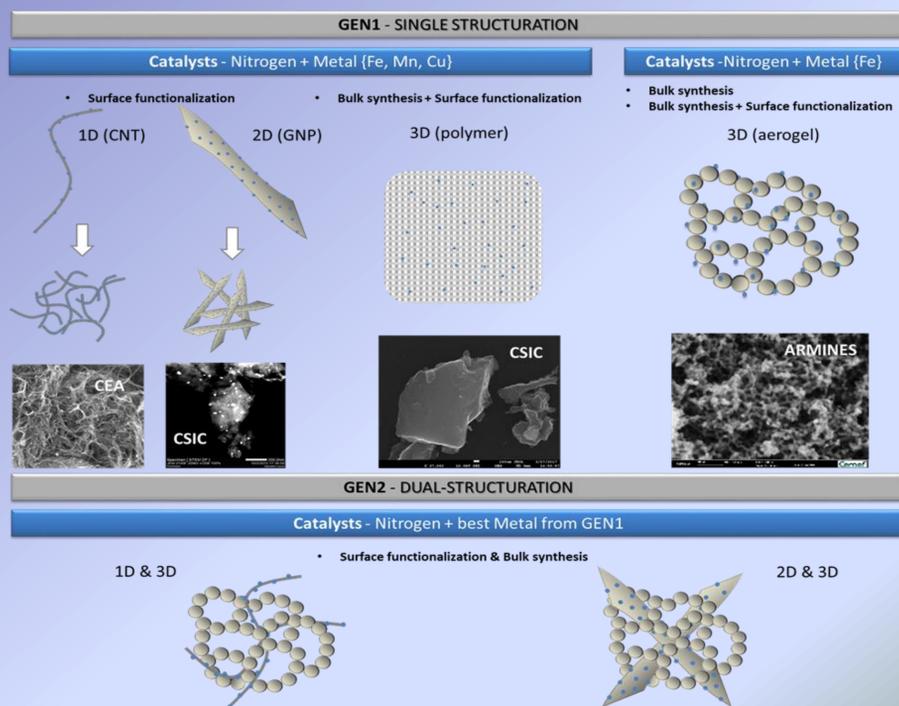
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Summary. PEMFC is the fuel cell predilection technology for automotive applications with a large deployment horizon by 2025-30. However, the increasing use of fuel cell electrical vehicles is expected to lead to a quickly growing demand for Platinum Group Metals. PGM production is not only itself related to negative environmental impacts but also raises questions of long-term availability due to the limitation of reserves and Europe's economic dependence on the countries of the materials' origin. Hence, it is of strategic importance that the transition to PGM-free catalysts is made as quickly as possible to ensure Europe's competitive position and to reduce market pressure on the use of scarce noble metals. **PEGASUS is a European project (to be implemented from 2018 to 2021) supported by the FCH Joint Technology Initiative, which will explore the removal of Pt and other critical raw materials and their replacement by non-critical elements enabling efficient and stable electrocatalysis for performing and durable PEMFCs.** The overall aim of the project is to bring up the experimental proof of concept for novel catalysts with five underlying objectives supporting a full validation at single cell scale with a focus on the cathode side: 1) High performance, 2) durable and 3) low cost MEA using non-PGM catalysts-based cathode; 4) Robust test protocols for catalysts screening and 5) Understanding of degradation and prevention & mitigation strategies through a MEA design-driven approach. PEGASUS will benchmark (Metal-Nitrogen-Carbon) materials with variants of Carbon supports and Catalyst Layer designs in order to reach the best compromises between chemical activities and mass/charge transfer with the support of intensive experimentation and modelling. Two generations of non-CRM catalysts will be proposed. GEN1 will implement metals {Fe, Mn or Cu} with Nitrogen onto (1D, 2D and 3D) structured carbon support (single structuration). GEN2 will investigate the enhancement of dual-structuration (1D+3D and 2D+3D) on catalyst activity, stability, reactant availability and water management.

WP1. Development and engineering of catalytic materials

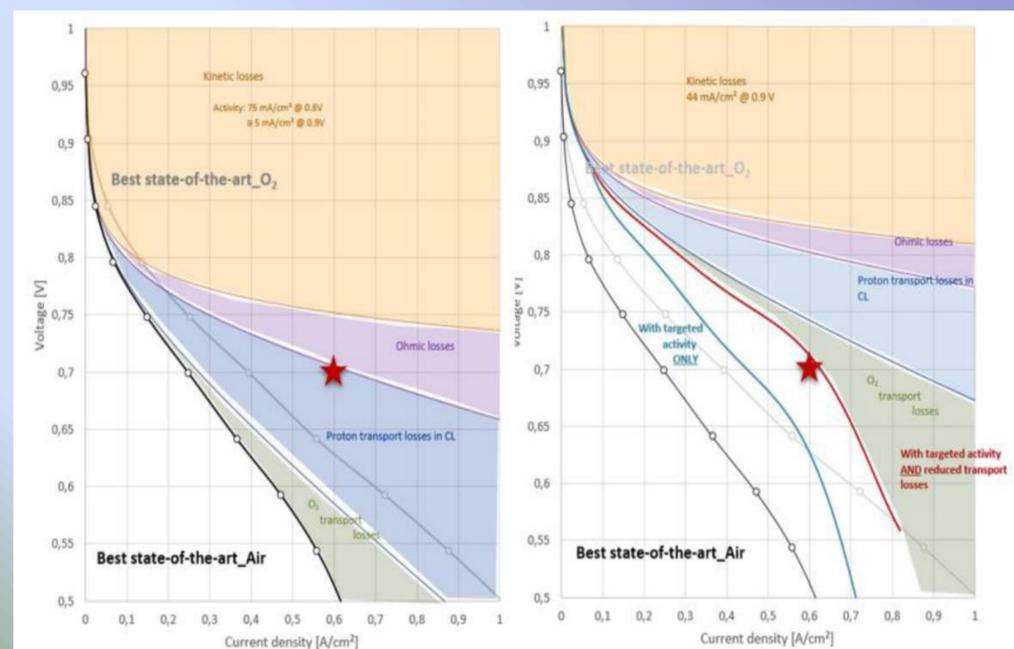
Design, synthesis, characterization and benchmarking of different solutions of PGM-free catalysts with high activity and durability for the ORR in acid electrolyte.



WP2. Cathode integration of catalysts for single PEMFC cell testing.

Objectives:

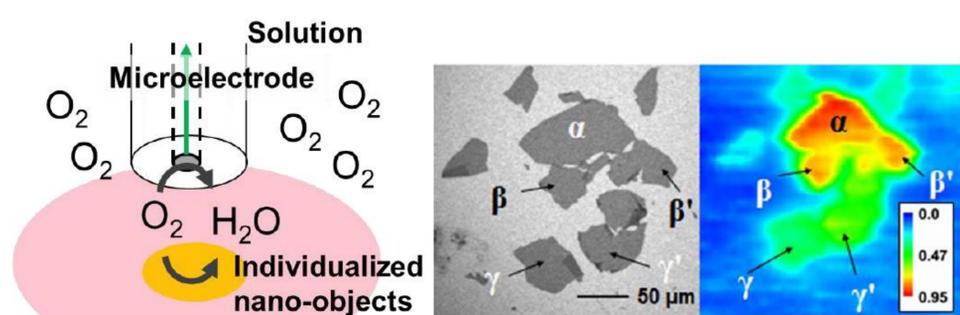
- Integration of WP1 catalysts inside a cathode/MEA.
- Testing at the PEMFC single-cell scale.



WP3. Development of tools and methodology for the screening of catalytic materials and designing of active layers

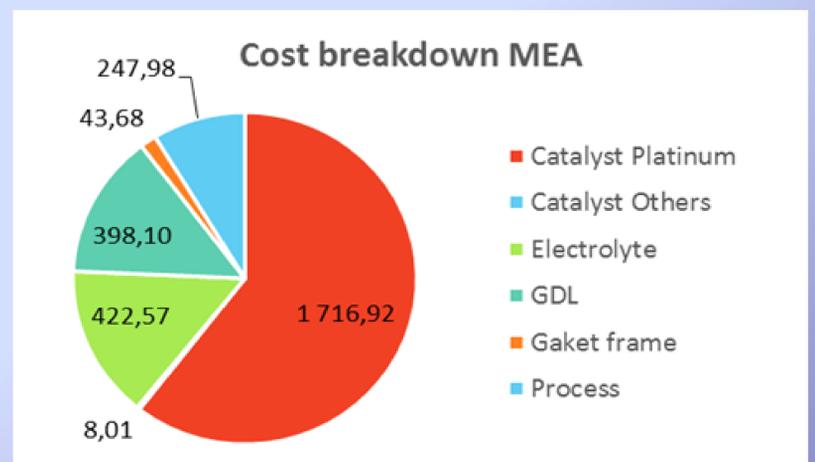
Objectives:

- Identify / verify state-of-the-art techniques to acquire relevant information about catalysts (activity, stability)
- Characterize structural and intrinsic activity properties of non-PGM catalysts
- Establish design-driven approach for MEAs by modelling



WP4. Life Cycle Assessment sustainability and techno-economic assessment

Objective: Assess the production potential and the environmental impact of the novel catalysts for use in PEMFC fuel cells in transport markets by Life-cycle assessment, Techno-economic assessment and Upscaling assessment



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Disclosure: The present publication reflects only the author's views and the FCH JU and the Union are not liable for any use that may be made of the information contained therein.

