MAST3RBoost

Hydrogen storage advances
for Europe's decarbonization

Maturing the Production Standards of Ultra-porous Structures for High Density Hydrogen Storage Bank Operating on Swinging Temperatures and Low Compression

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Expected outcomes

- Development of **standards** for the repeatable and scalable production of **ultra-porous structures** with controlled textural and chemical profiles
- Prototypes of at least **4 densified ultra-porous materials** from the carbon and MOF families
- Creation of **harmonized data management standards** to enable the application of high throughout Machine Learning to further develop porous materials for hydrogen storage via **Open Research strategies**
- Development of an ad-hoc and **cost-efficient Wire Arc Additive Manufacturing (WAAM)-process** using materials suitable for cryogenic temperatures and coatings to cope with chemical compatibility
- Design and manufacturing of **a pressure vessel for the storage of 1 kg of H2 at 100bar** and main components
- Qualification of **demonstrator for high density storage system** including TPS asset for H2 release at ΔT=80 K and 5 bar
- Protection of new foreground with an effective **knowledge transfer**
- Providing common space for **discussion and training with the complete value-chain** including end-users
- Promoting **new policy making and standards** with a solid **EU-based benchmark** for further innovation

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The concept

Mast3RBoost aims to provide a **solid benchmark for cold-adsorbed hydrogen storage** at low compression (100bar or below) This will be achieved by the maturation of a new generation of **ultra-porous materials** (Activated carbons, ACs, and Metal Organic Frameworks, MOFs) for mobility applications

The Machine Learning-improved ultra-porous materials developed by MAST3RBoost project can help **increasing the hydrogen storage capacity of on-board Fuel Cell and Hydrogen (FCH) batteries**, used in electric vehicles and help rise their market penetration

MAST3RBoost will enable a disruptive path to meet the industry goals by developing **the first worldwide adsorption-based demonstrator at the kg-scale**, contributing to the goal of a carbon neutral Europe by 2050

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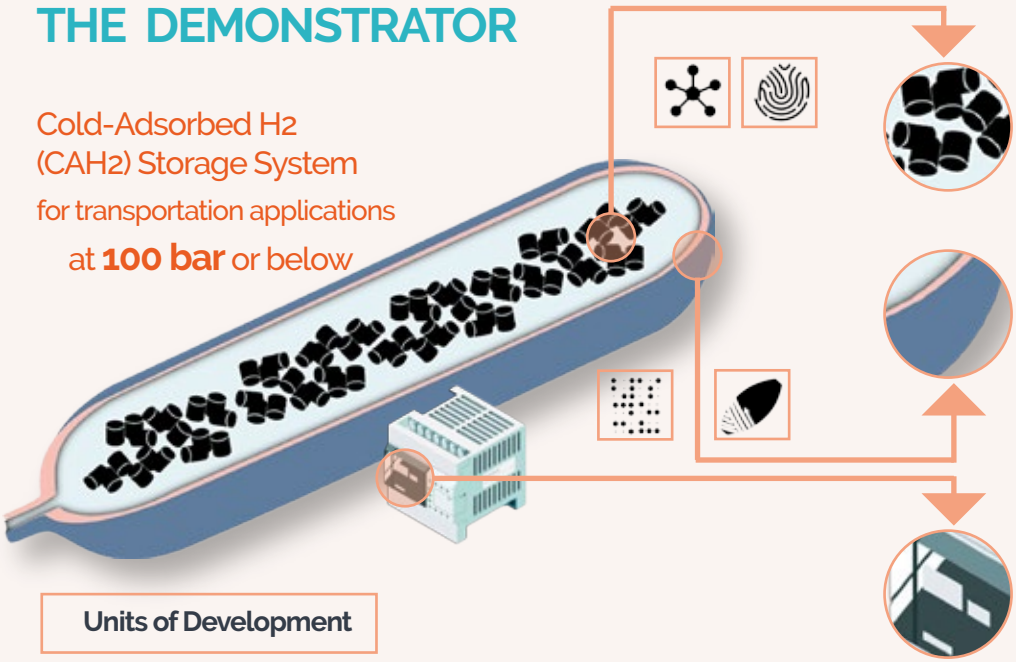
THE DEMONSTRATOR

Cold-Adsorbed H2
(CAH2) Storage System
for transportation applications
at **100 bar** or below



Units of Development

Activated Carbon | MOF | Al/Mg - AM | Controls | Vessel | Storage system

>10 kg
densified ultraporous materials

20+ litre scale
dedicated vessel shape

Built-in **active temp. swing**
ΔT > 80 K

1 kg CAH_2
33 gH_2/l^{sys}

The problems

The **state-of-the-art technology** for Hydrogen storage on board based on compression at 700bar, has reached 25 gH_2/L^{sys}

The **market-entry goal** is to fit 5 kg of H_2 in a gasoline equivalent tank (80 kg/90 l)

Complexities associated to an efficient H_2 storage are causing a very **slow penetration of Fuel Cell Electric Vehicles** (FCEVs)

Mast3RBoost solutions

- Machine Learning-improved ultra-porous materials – such as Activated Carbons (**ACs**) and high-density **MOFs** (Metal-organic Frameworks)
- **Lightweight vessels** embedding the ultra-porous manufactured with **recycled raw materials** from waste agroforestry biomass and from solid urban waste
- To **reach at least 33** gH_2/L^{sys} to help providing the market with an actual FCEV alternative to the current internal combustion engines
- **Life Cycle thinking strategies** to minimise overall environmental impacts and improve economic performance of the hydrogen storage system from the design phase
- **New benchmark for hydrogen storage** showcasing EU's cutting edge technology

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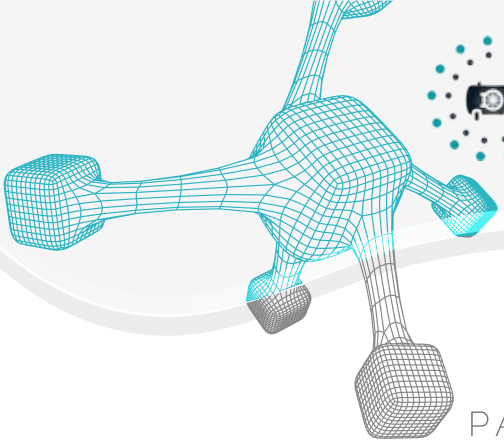

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HYDROGEN
ZERO EMISSION

The step towards the future of clean energy

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