

The challenges

The **state-of-the-art technology** for Hydrogen storage on board based on compression at 700bar, has reached 25 gH₂/L^{sys}

The **market-entry goal is to fit 5 kg of H₂ in a gasoline equivalent tank** (80 kg/90 l)

Complexities associated to an efficient H₂ storage are causing a very slow penetration of Fuel Cell Electric Vehicles (FCEVs)

Mast3rBoost Solutions

Synthesis of ultraporous materials from agricultural waste and mine residues.

Lightweight vessels embedding the ultra-porous manufactured with **recycled raw materials** from waste agroforestry biomass and from solid urban waste using Machine Learning to maximize the H₂ adsorption

To **reach at least 33 gH₂/L^{sys}** to help providing the market with an actual FCEV alternative to the current internal combustion engines

Creating a **new hydrogen storage benchmark** with at least 33 gH₂/L^{sys} and improve economic performance of the hydrogen storage system from the design phase

Using **Life Cycle thinking strategies** to minimize environmental impact and maximize economic performance

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 @mast3rboost_HE

 MAST3RBoost HE project



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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



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 throughput 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

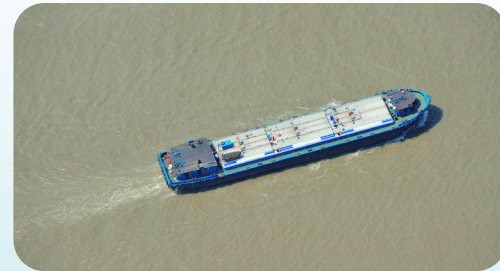


- Design and manufacturing of a **pressure vessel for the storage of 1 kg of H2 at 100bar** and main components
- Qualification of **demonstrator for high density storage system** including TPS asset for H2 release at $\Delta T = 80$ K and 5 bar
- Providing common space for **discussion and training with the complete value-chain** including end-users
- Promoting **new policy making and standards** with a solid **EU-based benchmark** for further innovation

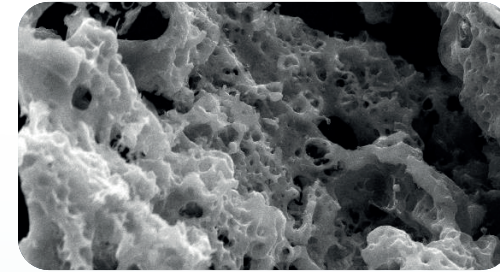


The concept

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



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



The Machine Learning-improved ultra-porous materials developed by **MAST3RBoost** project will help **increase the overall hydrogen storage capacity** to help in the decarbonization of trucks, buses, ships, trains...



THE DEMONSTRATOR

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



Units of Development



>10 kg densified ultraporous materials

20+ litre scale dedicated vessel shape

Built-in **active +temp. swing** $\Delta T > 80$ K

1kg CAH₂ 33 gH₂/[sys]