



Design, production and evaluation of advanced alloys and metallic structures under service conditions with hydrogen.

PROJECT DESCRIPTION - KK-2024/00021

The H2MAT+ project aims to advance knowledge and the development of metallic materials and structures capable of operating safely and efficiently in hydrogen-exposed environments. To this end, robust capabilities and methodologies are being developed for the design, manufacturing, and evaluation of these materials, with a special focus on their behavior in terms of permeation and mechanical properties in the presence of hydrogen. This research, framed within a technology readiness level (TRL) of 3–4, represents a significant qualitative leap in the field of advanced materials, which are essential to support the transition toward a low-carbon, hydrogen-based economy.

Among the main lines of work are the study of high-entropy alloys, both commercial and developed by the consortium itself, as well as different types of steels. Additionally, microstructural optimization of hybrid joints between these materials is being investigated using technologies such as NSF, centrifugal casting, co-fusion, and HIP. In parallel, the influence of heat treatments on hydrogen behavior is also being analyzed. All of this is complemented by a techno-economic evaluation of the proposed solutions, comparing them with the steels currently used in hydrogen transport and storage, as well as with new generations of emerging materials.

In this context, TUBACEX INNOVACIÓN plays a key role thanks to its extensive metallurgical expertise. The company is leading the characterization of stainless steels, high-entropy alloys, and hybrid joints, in addition to thoroughly analyzing the mechanical behavior of selected stainless steels when exposed to hydrogen, providing strategic value to the development of technologically viable and safe solutions.

CONSORTIUM

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- UPV/EHU
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- CEIT
- TUBACEX INNOVACIÓN S.L.
- CLUSTER DE ENERGÍA
- VICINAY MARINE INNOVACIÓN

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