MaxH2DR newsletter

July 2025

ISSUE n°V

—

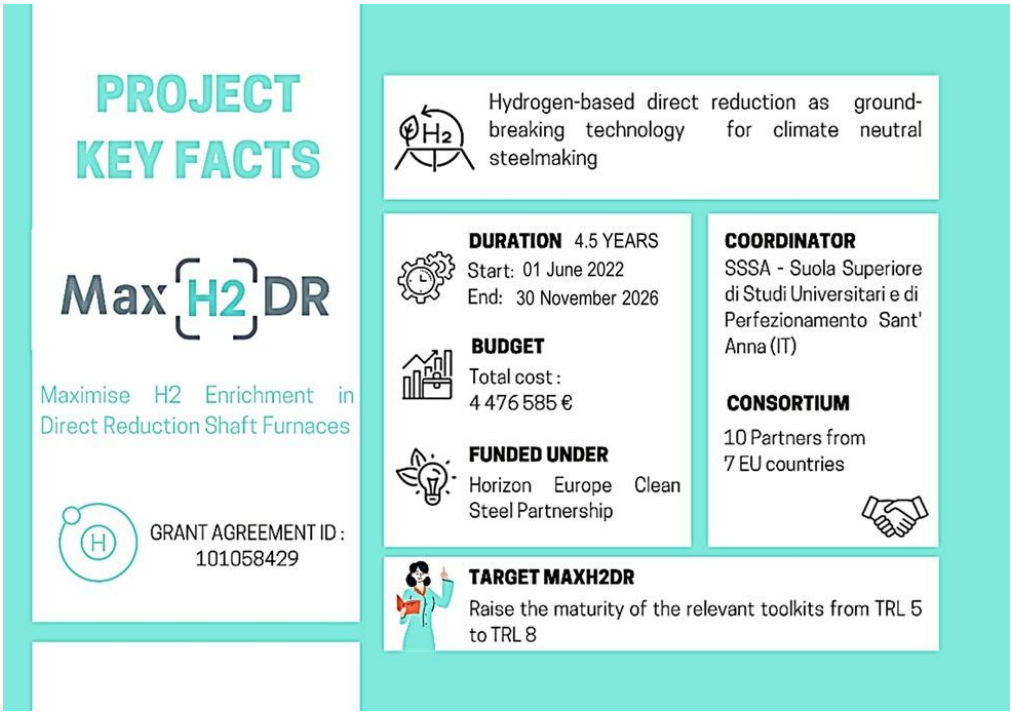
Maximise H2 Enrichment in Direct Reduction Shaft furnaces

The project falls under the funding programme of Horizon Europe – Clean Steel Partnership.

The call topic is related to Carbon Direct Avoidance in steel: electricity and hydrogen-based metallurgy.

—

This project has received funding from the European Union under grant agreement n°101058429



Understanding How Iron Pellets Behave in Hydrogen-Based Furnaces

One of the key goals of the MAxH2DR project is to better understand how solid materials — mainly small iron ore pellets — behave during the steelmaking process when hydrogen is used instead of traditional fossil fuels.

How do iron ore pellets move in an Hydrogen based furnace?

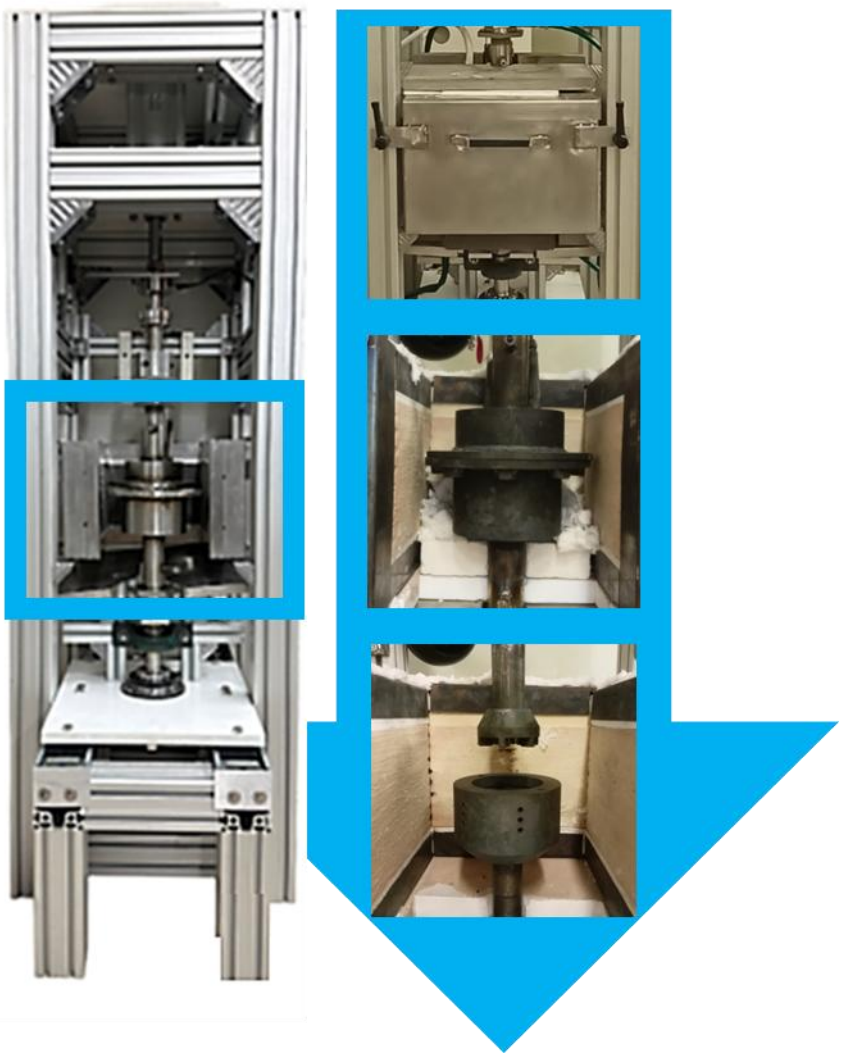
In hydrogen-based shaft furnaces, these pellets are loaded from the top and slowly move downward due to gravity. At the same time, a stream of hot hydrogen-rich gas flows upward, reacting with the iron ore to remove oxygen and produce pure metallic iron. This process, however, is not just chemical — it also causes physical changes in the pellets. They soften, stick together, and their movement becomes harder to predict. Until now, it has been very difficult to measure exactly how and why these changes happen.

To explore this, researchers at the University of Salerno have built a special laboratory device that can recreate the extreme conditions found inside these

furnaces. The setup can reach temperatures up to 1000 °C, apply strong stresses, and simulate the hydrogen-rich atmosphere of a real furnace. It also measures how much force is needed to make the pellets slide past each other — a way to track how their surface properties change during the reaction.

The data collected from this setup is essential for creating accurate digital models that predict how the materials behave during the process. This helps engineers design more efficient furnaces and avoid costly problems that might happen if these changes are ignored..

Testing at high temperatures, stresses and in the reactor atmosphere provides the data for the correct process design and optimization



Initial tests have demonstrated that the setup is effective and can accurately simulate the flow of granular materials, such as iron pellets, under extreme environmental and stress conditions. Experiments on this setup play an important role in improving the control and efficiency of hydrogen-based steel production — a major step toward greener, low-emission steelmaking.

Stay updated by following the MaxH2DR project on LinkedIn and Twitter