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An integrated approach to steelmaking decarbonization: HYDRA project. Description of the innovative open platform and first results

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Steel production decarbonization requires innovative technologies to reduce (up to eliminate) fossil materials in the whole chain. This implies alternative iron ore reducing process, new operating practices in the Electric Furnace, new combustion technologies in the downstream processes.

A RINA-CSM project “Hydrogen: innovative plants and related processes for the production of green steel in Europe - HYDRA IT06” was awarded, authorized by the European Commission, and financed by the Ministry of Enterprise and Made in Italy. The activities are distributed throughout six years for about 88M€ budget and aimed at steel production decarbonisation in a DR-EAF route, mostly promising in CO₂ abatement potential, using hydrogen also concerning its production, transport and distribution infrastructures issues to boost hydrogen utilization in industry. The project main lines are:

1. study/development of methodologies for testing and qualification of materials/components for H₂ local transport, storage and utilization,
2. set up of an innovative hydrogen-powered direct reduction pilot plant (DRP),
3. set up of a pilot electric furnace (EAF) to DRI obtained with Hydrogen, producing “green” steel,
4. hydrogen use in reheating and heat treatment furnaces, improving hydrogen combustion knowledge.

The project also targets coal substitutes use in a logic of circular economy. Advantages of this experimental platform are:

- being a unique opportunity to benefit from synergy among labs and pilot plants,
- being flexible and adaptable to innovative systems, and to fit operating practices to production and quality needs.

Pilot plants and labs will be ready within 2025, with commissioning at early 2026. The operating phase started with modeling of the integrated process, (hydrogen production, iron ore pellets direct reduction, and subsequent melting), as well as parallel lab testing of hydrogen use to reduce iron ore pellets of different quality. The effect of hydrogen combustion on steel surface quality is being assessed as well.

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