

Electrifying Syngas production from CO₂ and green hydrogen: from lab to pilot

Rosetti Marino SpA

With the aim of valorizing captured CO₂, Rosetti Marino is developing a novel reactor system for the performance of high-temperature endothermic reactions, as RWGS (Reverse Water Gas Shift), which converts CO₂ and H₂ into syngas. Producing syngas in a more efficient manner will contribute to turn sustainable the long value chains of its several derivatives, making worth the innovation efforts and the risk of travelling unknown routes.

The innovative reactor concept for RWGS was born in the Laboratory of Catalytic and Chemical Processes of Politecnico of Milano and, by the end of 2023, was recognized by Rosetti Marino as a technology with significant potential for scalability. The novelty relies on the electrification of the reaction, replacing conventional heat sources as hot fluids or furnaces, through the exploitation of the Joule Effect in highly engineered materials for the internal elements.

After the validation of the technology at the lab scale (TRL 3), the reactor was scaled up by 4 and 25 times and Rosetti invested in its multi-disciplinary knowledges and capabilities to achieve the construction of the first prototypal reactor (TRL 6) capable of producing 40 Nmc/h of syngas, currently being tested in a pilot plant located in Ravenna, Italy.

Engineering efforts as well as development of new materials represented a challenge worth being taken in exchange for promising projections of intensification and energy efficiency that the electrified reactor may bring when compared to traditional processes. Indeed, overall CO₂ emissions and space footprint are drastically reduced.

Therefore, innovative technologies may still play a role in syngas production, not only in shifting from traditional fossil sources, but also in the reduction of consumptions and assets complexity.

Rosetti Marino will bring to surface insights obtained from the pilot plant experimental campaigns, outlining challenges and criticalities encountered, together with the implications of both operating the electrified reactor for hundreds of hours and managing transients and novel materials.

Projections for a commercial scale e-RWGS plant for methanol production will also be presented and compared to conventional processes to highlight the opportunities ahead of this innovative piece of technology.