

***Coal gasification experimental plant
for a CO₂-free hydrogen production***

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Abstract

The possibility to have a large scale hydrogen production from coal through zero emissions power generation plants is being more and more interesting for its implications from the economic and environmental points of view. However, the application of these technologies is subject to the high capital and operative costs. This need a great scientific and technical effort in order to optimize the processes and the equipments, thus reducing the hydrogen production cost.

In this field, Sotacarbo has build up a pilot platform for a combined production of hydrogen

and electrical energy from coal. The platform includes two different units: a 5 MW_{th} demonstrative plant (with a fuel capacity of 700 kg/h of coal) and a 200 kW_{th} pilot plant (feed with 35 kg/h of coal). While the main goal of the demonstrative plant is the optimization of the gasification process, the pilot plant has been designed to develop and optimize the syngas treatment line for hydrogen production and power generation, with CO₂ separation.

This paper reports a description of the overall experimental equipment, with particular reference to the pilot plant (which includes a fixed-bed up-draft gasifier, a syngas depulveration system, a cold and hot gas desulphurization processes, an integrated CO-shift and CO₂ absorption system, a PSA section for hydrogen purification and a syngas-feed internal combustion engine for power generation).

A critical analysis of the main results obtained in the first experimental campaign in the pilot plant has been presented, together with a global hydrogen and carbon balance. Moreover, the results of a preliminary test carried out in order to evaluate the possibility to operate coal gasification with mixtures of oxygen and carbon dioxide as oxidant agent has been reported.

These results allowed to obtain useful indications to improve the plant performances and to optimize each syngas treatment and hydrogen production process.

Keywords: coal-to-hydrogen, carbon capture and storage, CO₂-free, experimental plant.

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