

***An overview about current and future experimental activities
in a flexible gasification pilot plant***

Alberto Pettinau^(*), Francesca Ferrara, Carlo Amorino

Sotacarbo S.p.A. – Grande Miniera di Serbariu, 09013 Carbonia, ITALY

Abstract

In the field of hydrogen production through coal gasification for distributed power generation, Sotacarbo, an Italian limited company which operates in the field of clean coal technologies, is developing different research and development projects for the tuning of a coal-to-hydrogen process configuration. Toward this goal, a flexible pilot platform was built in 2007-2008, and it is currently in operation. In particular, the platform includes demonstrative and pilot air-blown fixed-bed gasifiers, the latter equipped with a flexible syngas treatment line for a combined power generation and CO₂-free hydrogen production.

This chapter presents a detailed description of all the experimental equipment and the main results obtained during the first 700 hours of tests in the pilot unit. In particular, the optimum operating conditions with a low sulphur South African coal have been defined, with a syngas production of about 43 Nm³/h (from the gasification of 8 kg/h of coal), characterized by a lower heating value of 4.5 MJ/kg, and a high cold gas efficiency, of about 97%.

A series of experimental tests has also been carried out in order to assess the plant performance under different operating conditions and the effects of the main parameters, such as air/fuel and steam/fuel mass ratios and oxidant composition (air, eventually enriched in oxygen, or mixtures of oxygen and carbon dioxide). Moreover, a series of preliminary tests has been carried out in order to evaluate the gasification performance with a portion of high sulphur Sulcis coal or biomass (wood pellets) in the fuel blend.

The experimental results obtained in syngas treatment processes show a very efficient removal of pollutants (in particular, a final concentration of sulphur compounds lower than 10 ppm, in volume, can be obtained, even with high sulphur coal in the fuel blend) and the possibility to reduce carbon dioxide emissions of about 90% by using a single-stage amine-based carbon capture system, which assures a CO₂ absorption efficiency of about 99%.

Finally, the guidelines of the future research activities are described in this chapter, with particular reference to the further optimization of both gasification and syngas treatment processes in different operating conditions.

Keywords: Coal gasification; Pilot Plant; Coal-to-hydrogen; Syngas treatment

Book available on www.novapublishers.com

* Corresponding author:

email: apettinau@sotacarbo.it
phone: +39 0781 670444
fax: +39 8781 670552