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Coal gasification experimental tests in a pilot up-draft fixed-bed gasifier

Alberto Pettinau(*), Caterina Frau, Francesca Ferrara

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

Abstract

Large-scale hydrogen production through near zero emissions coal gasification plants represents a reliable technology characterized by a very low environmental impact and it is being more and more interesting for its potential implications from the economic point of view. However, the application of these technologies is currently 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 context, Sotacarbo, through different research projects regarding hydrogen production mainly for distributed power generation, is studying several integrated gasification and syngas treatment process configurations for a CO_2-free combined production of hydrogen and electrical energy, to be used in medium and small-scale commercial plants. To this aim, a flexible and fully equipped pilot platform has been built up in the Sotacarbo Research Centre in Carbonia (South-West Sardinia, Italy).

The platform includes a demonstrative and a pilot fixed-bed coal gasifiers, both based on the up-draft air-blown Wellman-Galusha technology; in particular, the latter is equipped with a flexible and complete syngas treatment process for the production of hydrogen and electrical energy.

This paper reports an analysis of the main gasification results obtained during the first phase of an experimental campaign which is currently under development in order to define the optimal operating conditions of the plant. Moreover, the global plant performance (based on the experimental results obtained in each plant section, processed through a simulation model for the evaluation of the material balances) has been presented, with particular reference to hydrogen, carbon and pollutant emissions. Finally, a hint about the future development of the experimental activities (as for gasification process and syngas treatment line) has been reported.

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