Replacement of PCI with hydrogen and its impact on blast furnace internal conditions

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ABSTRACT

The steel industry is a significant producer of CO_2 emissions, with the majority of these emissions being produced in the blast furnace. As the furnace is approaching optimal operation with coke, alternative operating conditions are required to further decrease greenhouse gas emissions. Because of this, hydrogen has been proposed as a reducing agent in the blast furnace. Injection of hydrogen through the tuyeres was assessed using a comprehensive 2-D blast furnace model. An Australian blast furnace with pulverised coal injection (PCI) was used as a base case, and various approaches to hydrogen injection assessed, with a particular focus on displacing PCI. The maximum hydrogen injection rate was limited by decreases in the raceway adiabatic flame temperature and top gas temperature. Internal blast furnace conditions, such as temperature, gas composition and pressure, and reduction degree were output in the form of 2-D contour plots. Holistic analysis was performed to approximate the effectiveness of hydrogen injection on greenhouse gas emissions. From these results, the changes in blast furnace operation and emissions under hydrogen injection was discussed.

Keywords: Blast furnace, Hydrogen, Greenhouse gas emission, PCI, Modelling