Iron and Steel production – blast furnace Process Gas Analyzer

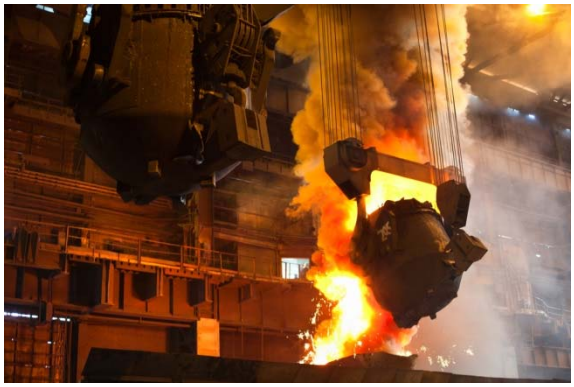
Basics and background

Iron and steel are still important materials in the modern world and steel manufacturing is a dynamic industrial sector. Modern blast furnaces strive for reduction of operational costs and improvement of efficiency with the aid of online process gas analyzers. The reduction of emissions, safety and healthy work environments also play an important role. The steelmaking process has undergone many changes and modifications for thermal efficiency – also in the use of furnaces.

Process analytical instrumentation, mainly continuous process gas analyzers, support the iron and steel making production.

Basically 4 steps are involved:

- preparation of fuel/electricity, iron ore and reducing agents,
- conversion through reduction / high temperature,



- raw steel from pig iron with oxygen to remove carbon and other components
- raw steel is further treated.

For reduction a blast furnace, direct or smelt reduction is used. Then for steel production a Basic Oxygen Furnace (BOF) or an Electric Arc Furnace (EAC) follows for carbon reduction. Further treatments are in place to reduce carbon, nitrogen, hydrogen etc.

Tasks and objectives

During iron and steel production the use of process gas analyzers is required at several locations with different objectives. For economic efficiency continuous monitoring of all steps helps optimization. The safety of personnel, avoidance of danger of explosion, and environmental protection are all issues.

Solutions – Use of process gas analyzers

The flue gas exiting from the top of the furnace has a high CO and CO_2 content indicating blast furnace efficiency and the measurement of these plus CH_4 help to regulate the process. The hydrogen content of the flue gas can be analyzed by a thermal conductivity analyzer such as the CONTHOS 3 – TCD using analog inputs from NDIR measurements of CO, CH_4 and CO_2 for cross compensation. For early detection and to avoid explosion risk H_2, CO, CH_4 and CO_2 are also analyzed by TCD and NDIR after dust bags.

When high carbon is converted into low carbon, large amounts of CO, H_2 and O_2 are generated. H_2 and O_2 can be measured with the CONTHOS 3 – TCD/PMD while CO and CO_2 are measured with NDIR. This provides information about the slagging process helping to identity the endpoint of decarburization.

At the coking gas outlet CO/CH_4 with NDIR and O_2/H_2 can be measured with CONTHOS 3 – TCD/PMD.

Conclusions

The combination of NDIR analyzers for CO, CO_2, and CH_4 in conjunction with the CONTHOS 3 – TCD/PMD for H_2 and O_2 helps to optimize the iron and steel production process in terms of efficiency, completion of decarburization, control oxygen injection process and safety.

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