FACTORS AFFECTING COKE RATE IN A BLAST FURNACE

A blast furnace (BF) is a multi variable system which is subjected to a large number of inter-influencing variables affecting its performance: productivity and coke rate.

A world class blast furnace operation demands the highest quality of raw materials, operation, and operators. Coke is the most important raw material fed into the blast furnace in terms of its effect on blast furnace operation and hot metal quality. A high quality coke should be able to support a smooth descent of the blast furnace burden with as little degradation as possible while providing the lowest amount of impurities, highest thermal energy, highest metal reduction, and optimum permeability for the flow of gaseous and molten products. Introduction of high quality coke to a blast furnace will result in lower coke rate, higher productivity and lower hot metal cost.

Coke rate is the parameter for the consumption of BF coke which is measured in kilograms of BF coke consumed per ton of hot metal produced.

Blast furnace (BF) coke is a key material for BF iron making, acting as a major energy source (fuel), a reductant, a carburization agent and a permeable structural support. There is no other satisfactory material available, which can replace, fully or partially, BF coke as a permeable support of blast furnace charge.

A good quality coke is generally made from carbonization of good quality coking coals. Coking coals are defined as those coals that on carbonization pass through softening, swelling, and re solidification to coke. One important consideration in selecting a coal blend is that it should not exert a high coke oven wall pressure and should contract sufficiently to allow the coke to be pushed from the oven. The properties of coke and coke oven pushing performance are influenced by following coal quality and battery operating variables: rank of coal, petrographic, chemical and rheologic characteristics of coal, particle size, moisture content, bulk density, weathering of coal, coking temperature and coking rate, soaking time, quenching practice, and coke handling. Coke quality variability is low if all these factors are controlled. Coke producers use widely differing coals and employ many procedures to enhance the quality of the coke and to enhance the coke oven productivity and battery life and the performance of the Blast Furnace.
- Decreasing of fines content in the charge materials improves the coke rate of the blast furnace in the range of 0.4 % to 0.7 %.
- High top pressure also reduces the coke rate in the blast furnace. With every increase of top pressure of the blast furnace by 0.1 kg/sq cm there is a reduction of around 0.1 % in the coke rate.
- Properties of slag have considerable effect on the coke rate. Lower specific volume of slag of lower viscosity improves the coke rate of the blast furnace.

- Automatic process control improves the furnace productivity since it minimize consumption of reluctant, avoids furnace process disturbances such as hanging, slipping, scaffolding, gas channeling etc through an immediate counteraction by the system, stabilizes hot metal and slag parameters etc. The effect of automatic process control on the blast furnace coke rate is in the range of 3 % to 5 %.
- Control of burden distribution plays an important role in the reduction of the coke rate in a blast furnace. The burden distribution control ensures a stable burden descent, adjusts the flow of gases in the wall (this avoids high heat loads without generating inactive zone) and helps in achieving a good solid gas contact.

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