Silicon prediction model to ascertain the thermal stability of furnace in BF

About Blast Furnace Department:

The Department is engaged in production of hot metal from its three Blast Furnaces having useful volume of 3800 m3, each capable of producing 2.5 MT of hot metal per year. Most of the Hot metal is sent to SMS, remaining is sent to PCM/hot metal dump yard. Pig iron from PCM, processed iron from metal dump yard and granulated slag generated during production is sold by Marketing Dept. All furnaces are equipped with state of the art technology like Level-2 Automation, PaulWurth Top Charging system, slag granulation system; flat bed cast house, hydraulic Cast House equipment etc. Department produces most of the tap hole mass required to run furnaces.

Inside Blast Furnace, the iron ore is reduced to form hot metal and slag, which collects in the hearth. From there, Hot metal and slag is periodically tapped through tap holes. Hot metal is channeled via tilting runners into torpedo ladle cars, which carries it away. Slag is granulated in the slag granulation plant, dewatered and subsequently carried away by a conveyor to slag storage yard. The Blast Furnace top gases enter into the dust catcher for primary cleaning and then to annular scrubber for final cleaning. Cleaned BF gas is then passed through Turbine Stations (GETS/TRT) to convert the pressure energy into electrical energy. After this BF gas is diverted to mix gas lines for use as fuel throughout the plant.

Problem Description and Solution Desired:

The blast furnace is typically chosen as the reaction vessel to create molten iron in the manufacturing of iron and steel. When the blast furnace system is in operation, intricate physical and chemical processes take place in various parts of the furnace, from top to bottom. These processes are characterized by high temperatures, high pressures, multiphase coupling, and the presence of many physical forms. The stability of blast furnace temperature is an important condition to ensure the efficient production of hot metal. Accurate prediction of silicon content in hot metal is of great significance to the control of blast Furnace temperature in iron and steel plants. Silicon in hot metal depends on input raw material chemistry, burden composition and operating parameters like, top pressure, blast temperature, steam etc. As the silicon in hot metal is directly related to overall thermal condition of furnace, the Silicon prediction model will ascertain the thermal stability of a blast furnace, and it will identify potential issues before they become critical and will help in taking proactive steps to maintain the furnace's stability and efficiency.