Raw Material Strength in a Blast Furnace at Operating Temperature

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This paper presents simulative tests in a continuous hot model of the lumpish zone in a blast furnace. Samples after reaction were analysed in compression tests and a relationship between reaction degree and temperature in a blast furnace was derived. Compression strengths of coke, pellets and sinter with different reaction degrees were measured at relevant temperatures using a high temperature compression testing machine with adjustable atmosphere. Based on the results, the regulation of strength variability and the mechanism of breakage of raw materials in blast furnaces were researched. As an effect of the increases of temperature and carbon loss rate, the strength of coke had a negative linear relationship with the temperature in the indirect reduction zone in a blast furnace. The carbon loss rate of coke in the stock column of a blast furnace is about 36% and the strength can be decreased by more than 90%. A practical way to save coke strength is to reduce the carbon loss rate. The strength of pellets was decreased by about 60% to 70% in the lumpish zone. If the original strength of pellets was higher than 2000 N, the high temperature strength roughly kept at a coordinative level over 1000 N and was sufficient to avoid damage in the blast furnace. Due to the reduction of hematite and disappearance of calcium ferrite, the strength of sinter showed a strong decline when the reduction degree reached 10%. The value at the top of the cohesive zone was only about 15% of that on the charging bank. Powder from sinter was easily produced at these two places.

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