Carnegie Mellon

Materials Science and Engineering Seminar Series

Materials Research at Carnegie Mellon

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"Mixed Burden Softening and Melting Phenomena"

Friday, November 4, 2005
10:30 A.M. Refreshments, 11:00 A.M. Seminar
Singleton Room, Roberts Engineering Hall (REH)

The blast furnace (BF) is the major iron producing unit and will remain same for the foreseeable future. The cohesive zone in the BF is affected by the high temperature properties of ferrous materials. Minimizing the width of this zone will improve the productivity and efficiency of the BF. In addition, it is considered that the use of pre-reduced ferrous burden and direct reduced iron (DRI) and hot briquetted iron (HBI) decreases the coke rate in the BF. This work is designed to improve the current understanding of the fundamentals of high temperature properties of ferrous materials and their impact on the cohesive zone in the BF. The first part of this research was focused on the study of the oxidation behavior of DRI and HBI in upper shaft of the BF. This was followed by testing of DRI and HBI for its use as a potential blast furnace burden. Furthermore, X-Ray fluoroscopy technique was used to observe the undergoing softening and melting phenomena. The research was expanded to study the phase relations which affect the softening and melt exudation mechanism in ferrous materials. The material characterization techniques were employed to formulate a likely mechanism of the process. The laboratory results were verified by conducting industrial tests. It is found that DRI/HBI shows superior properties in comparison to traditional BF raw materials in terms of minimizing coke rate, melting of burden and deepening of cohesive zone. It was also found that interaction between individual ferrous components in a mixed burden plays a role in melt exudation. A theoretical investigation of phase diagrams suggested that the addition of magnesia in lieu of lime is more beneficial to burden properties.

Pallava Kaushik received his Bachelor of Technology degree in Mineral and Metallurgical Engineering from Indian School of Mines, India in 2002. He received his MS in Materials Science and Engineering from Carnegie Mellon University in June 2003. He is currently a graduate research assistant in the Center for Iron and Steelmaking research group and working towards his PhD project entitled "Mixed Burden Softening and Melting Phenomena" under the guidance of Prof. R. J. Fruehan.