0033 Pulverized Coal Injection (PCI) Coal Combustion Behavior And Residual Coal Char Carryover In The Blast Furnace During PCI At High Rates

Benefits

- Increased cost savings on coke consumption and improved energy efficiency
- Estimated $5 per ton of hot metal can be saved at high PCI rates (200 kilograms per ton of hot metal)
- Optimization of PCI operation
- Extended coke oven life due to decreased coke demand
- Increased recycling of plant solid wastes (flue dust and sludge)

Applications

The outcome of this project could be used as a standard procedure for all steel plants to determine the char carryover during PCI in the blast furnace. It could be used as one of the indicators to monitor PCI performance in operating the blast furnace. The annualized benefit when the technology "PCI at high rates" is in widespread commercial use could be estimated from the replacement of coke by injection of coal, thus reducing costs by millions of dollars for a steel plant.

Assessment Of Coal And Blast Furnace Performance During Pulverized Coal Injection Will Benefit The Steel Industry In Terms Of Cost Savings And Energy Efficiency Improvement

In the last decade, fuel injection techniques, such as pulverized coal injection, have been optimized on many aspects, but further understanding on some fundamental issues is still needed before the optimum operating conditions of the blast furnace could be maintained.

During pulverized coal injection in a blast furnace, the unburnt char could accumulate in the raceway region. Such an accumulation of char would eventually be entrained into the gas flow and carried up to the blast furnace stack, and therefore could impact burden permeability. Char consumption in the blast furnace involves the reaction between char and slag, gas, and hot metal. The investigation of char combustion behavior is a necessity for the fundamental understanding of the pulverized coal injection operation. On the other hand, the extent of unburnt char carryover in the off gas can be used to determine constraints on an operating furnace. Knowledge of the char portion will assist with the selection of coal type and optimum pulverized coal injection practice.

This American Iron and Steel Institute (AISI) Technology Roadmap Program project is based upon the ongoing trend to reduce the consumption of coke in steel companies due to economic, environmental, and raw material constraints. The aim is to assist the steel industry with the assessment of coal and blast furnace performance during
pulverized coal injection.

Project Description

Goal: To assist the steel industry with assessment of coal and blast furnace performance during pulverized coal injection. The work will be conducted using the newly developed approach at the University of New South Wales (UNSW) in Australia. By using this approach, project partners will analyze the actual blast furnace samples captured during pulverized coal injection -- samples include blast furnace dust and sludge samples to determine the proportion of residual char. The investigation will also determine the combustion performance of the coals. This will be the first time that a parallel investigation of coal combustion in a laboratory and actual blast furnace sample analysis will be conducted.

Progress and Milestones

Specifically, the program will include the following tasks:

- Project start date, May 2001.
- May 2001 -- May 2002: Investigate the thermal annealing effects on char and coke structure.
- Analyze coal combustion and char carryover of a set of blast furnace samples, including PCI coal, coke, sludge, and flue dust from each company.
- May 2002 -- May 2003: Analyze and study blast furnace samples obtained under new operation conditions and/or new raw materials, another set of PCI coal, coke, sludge, and flue dust samples from each company. Both coal combustion and char carryover analysis will be conducted at UNSW. Investigate the reactivity of char and coke provided by American companies.
- Project completion date, May 2003.

Total Project Cost/Duration

$278,000/2 years

Research Organization

University of New South Wales
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Industry Participants

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