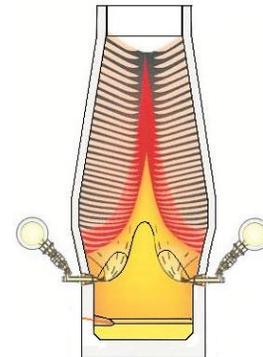




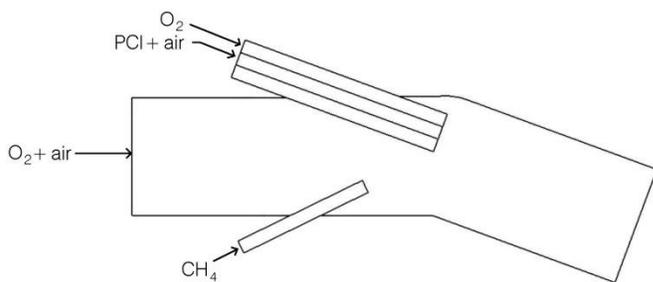
CFD Model for Blast Furnace Pulverized Coal Injection and Coke Combustion Model

THE PROBLEM

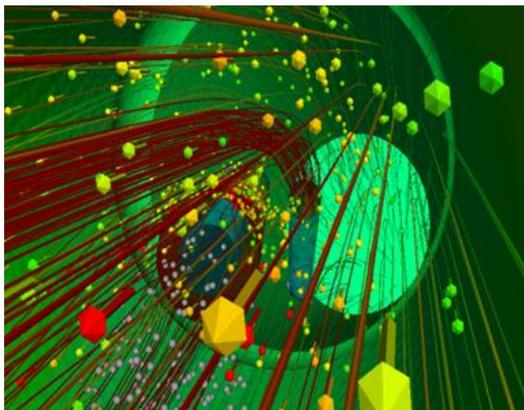
High rate pulverized coal injection (PCI) has been recognized as an attractive technology in the iron-making process. However, high PCI rate may be limited because of incomplete coal burning and other technical barriers. Understanding of the essential behavior and the combustion process of pulverized coal with natural gas co-injection is very important. Due to the difficulties in measurements, such knowledge can be most readily obtained through the computational fluid dynamics (CFD) numerical simulations. The simulation results will aid in the process optimization and enhancing the PCI performance.



Blast furnace process



Schematic of the injection system



Temperature distribution inside the injection system

THE PROJECT

Research efforts between the Canadian government (CANMET), CIVS and the American Iron and Steel Institute (AISI) were conducted in CFD, modeling the blowpipe and tuyere of the blast furnace. The technology being applied by CIVS is a powerful tool and provided detailed information of flow streams that were previously very difficult to measure. The CFD model is used to simulate PCI with natural gas co-injection in the lance, blowpipe and tuyere. Effects of operating parameters such as blast temperature, natural gas flow rate, oxygen enrichment, and PCI carrier air rate are investigated.

THE OUTCOME

Results were used to stop cold oxygen flow injection through the oxy-coal co-axial lance. Significant downtime avoidance by half, due to fewer failures of penstock and fuel lances. The process change realized a coke savings of 15 lbs/NT hot metal, resulted in a yearly potential cost avoidance of \$8.5 million yearly at full production.

“...a real paradigm change in operating philosophy... this process change realized a coke savings of 15 lbs/NT hot metal that resulted in a yearly potential cost avoidance of \$8.5 million at full production using today’s spot market price for purchased coke.”

John D’Alessio, Manager,
Blast Furnace Engineering & Technology, Stelco Inc.

Sponsor: AISI, 21st Century Research & Technology Fund
Student: William Walker

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