



CanmetENERGY

Leadership in ecoInnovation

PULVERIZED COAL INJECTION

Pulverized coal injection (PCI) is an effective way to reduce coke consumption in blast furnace ironmaking. On account of the extremely short residence time of the injected coal particles in the tuyere, the combustion capacity of coal at this location is a critical parameter that dictates its suitability for injection.

Natural Resources Canada's Metallurgical Fuels Laboratory at CanmetENERGY-Ottawa has constructed and is operating a PCI simulation rig for studying coal behaviour in a combustion environment similar to that of an industrial setting. Combining the simulation rig with the newly developed carbon type differentiation thermogravimetric analysis technique, the transformation of carbonaceous materials upon rapid heating can be examined.

PCI SIMULATION RIG

PCI Simulation at CanmetENERGY-Ottawa enables studying the extent of coal combustion at different levels of blast oxygen enrichment. Blast gas is prepared by mixing air, oxygen and nitrogen and heating them to 900 °C via two preheating furnaces in series. A pulverized coal sample of known size distribution is fed into a pneumatic transportation system and carried by nitrogen injecting to the pre-heated blast at the inlet of the reactor.

The estimated residence time of the coal particle in the reacting chamber is about 100 ms. The coal particle rapidly undergoes devolatilization and combustion inside the reaction chamber. The uncombusted particle exiting from the reaction chamber is water quenched and



collected for further analysis, including its chemical composition for determination of burnout and TGA for quantification of carbonaceous material transformation.

RESEARCH ACTIVITIES

The injection simulation rig combined with various analytical techniques enables the development of a fundamental understanding of coal combustion behavior in the tuyere. A number of research topics are being conducted using the PCI rig simulation in the following areas:

- Combustion behaviour of coal and solid biocarbon
- Transformation of carbonaceous materials
- Effect of blast oxygen enrichment, coal particle size and injection rate on combustion behavior and carbon conversion
- Relationship between fundamental properties of coal and combustion behaviour
- Coal grindability
- Co-injection of coal and natural gas

FOR MORE INFORMATION

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of energy S&T solutions for the environmental
and economic benefit of Canadians.*