

9953 Suspension Hydrogen Reduction of Iron Oxide Concentrate

Benefits

- ❖ Reduction or elimination of CO₂ generation in the ironmaking process
- ❖ Reduction of iron oxide waste.

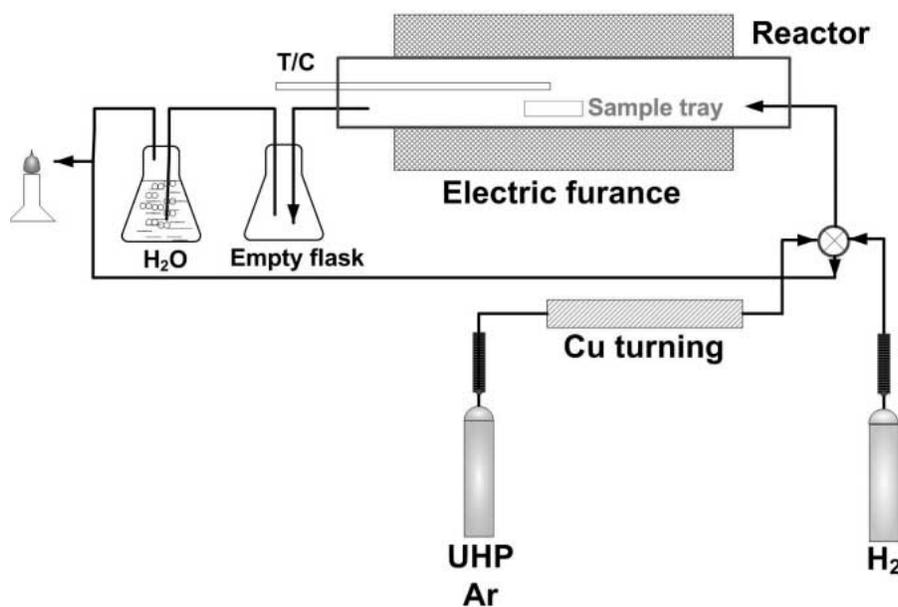
Applications

To use hydrogen to reduce iron ore to the steelmaking process, eventually replacing the blast furnace and other carbon-based ironmaking processes that generate large amounts of CO₂.

Hydrogen is currently cost prohibitive as a reducing agent as well as a fuel. However, the U.S. and other industrialized countries are devoting large efforts and resources toward developing hydrogen energy to replace fossil energy. As a result, large quantities of inexpensive hydrogen are expected to become available. Hydrogen produces only water vapor and no other gaseous byproducts when used as a reducing agent or a fuel. This project will investigate the feasibility of producing iron by a suspension reduction technology that uses hydrogen as the reducing agent and fine iron oxide concentrates in a suspension reduction process, with the ultimate objective of eliminating or drastically reducing the generation of CO₂ in the steel industry.

The process may be a part of an overall continuous direct steelmaking process, in which case the product from this process is collected in molten state, or the product may be collected in solid state (e.g. reduced iron pellets or briquettes).

Experimental Set-up (for Early Experiments)



Project Goal: To overcome several technical hurdles, before an industrially viable process can be developed. The following tasks are planned:

- ❖ Perform a detailed material and energy balances, especially paying attention to carbon dioxide generation from the possible use of carbon-containing fuels (natural gas or coal) for external heating.
- ❖ Perform thermochemical and equilibrium calculations to evaluate the behavior of impurities such as sulfur and phosphorus at various hydrogen and water vapor partial pressures.
- ❖ Determine the complete kinetics of hydrogen reduction of iron oxide concentrates as a function of particle size (less than 37 μ m (-400 mesh)), temperature, and hydrogen and water vapor concentrations.
- ❖ Carry out bench-scale test work on a simulated suspension reduction process by the use of a large laboratory flash reactor (24 cm diameter, 1.4 m high, max. 1100 $^{\circ}$ C).

Progress and Milestones

- ❖ Project start date: March 2005
- ❖ Construct bench-scale test facility: September 2005
- ❖ Evaluate impurity behavior: September 2006
- ❖ Material and energy balances: January 2007
- ❖ Determination of kinetics of hydrogen reduction: January 2007
- ❖ Bench-scale test work on simulated reduction process: February 2007
- ❖ Project completion date: March 2007

Total Project Cost \$527,213

Duration 2 years

Research Organization

University of Utah
Salt Lake City, UT

Industry Participants

Dofasco Inc.
Hamilton, ON, Canada

Gallatin Steel
Ghent, KY

Hylsa
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