

New Ironmaking Processes —A Global Business

New ironmaking processes are being sought as a result of the tight supply of steel raw materials and soaring prices. Kobe Steel, which has pioneered the development of direct reduction and next-generation ironmaking processes, which do not rely on blast furnaces, has an extensive global track record in these areas.

- MIDREX® Direct Reduction Plant Distribution

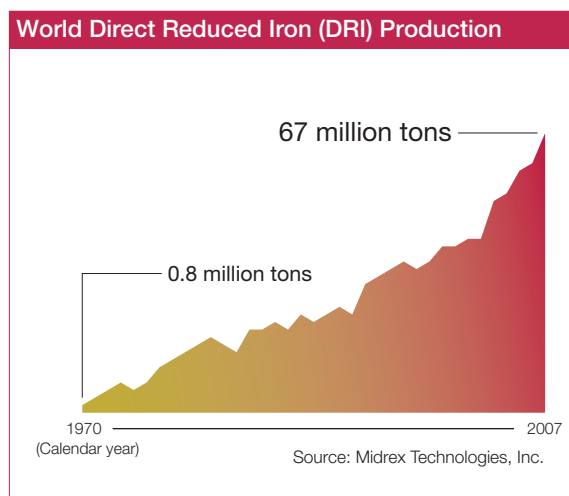
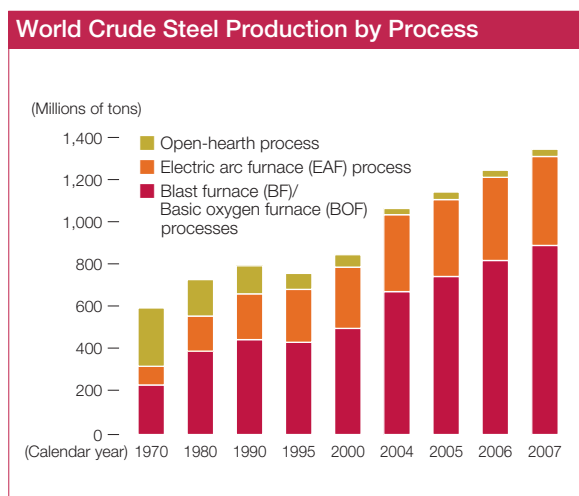


Direct Reduction Processes

Growing Demand for Direct Reduced Iron

Direct reduced iron (DRI) is a raw material used in steelmaking. It consists of more than 80% iron that results from removing oxygen from iron oxide, the primary constituent of iron ore. As a substitute for high-quality scrap, DRI is primarily used as a raw material in electric arc furnace (EAF) steelmaking. In recent years, EAF steelmaking has been rising alongside a constant upward trend in world crude steel production. With high-quality scrap becoming difficult to obtain, there has been rapid growth in demand for DRI.

Kobe Steel owns two DRI processes, the MIDREX® Direct Reduction Process and the FASTMET® Process, which respectively use natural gas and coal as reductants. We are aggressively promoting these technologies.



MIDREX® Direct Reduction Process

Using natural gas as the reductant, the MIDREX® Direct Reduction Process was developed by Midrex Technologies, Inc., a wholly owned U.S. subsidiary of Kobe Steel.

World DRI production was approximately 67 million tons in 2007 (a 49% increase over 2002), with 60% of this total being produced by the MIDREX® Process. Kobe Steel is the process owner and its DRI business is centered on plant supply, process licensing, and the production and sale of DRI.

At present, the MIDREX® Process is used in 64 plants in 21 countries around the world, in regions with abundant natural gas resources, including Central and South America, the Middle East, Southeast Asia, and North America. From 2006 through 2010, we will construct and start up 11 plants, with an annual total production capacity of 15 million tons. Business inquiries continue unabated from all over the world.



A direct reduction plant using the MIDREX® Process for the Lebedinsky Mining and Processing Integrated Works in Russia

Feature 2 New Ironmaking Processes—A Global Business

FASTMET® Process

Developed by Kobe Steel and Midrex Technologies, Inc., FASTMET® is a direct reduction process that utilizes a rotary hearth furnace. The process uses iron units (iron ore fines or steel mill dust) as the raw material and low-grade coal (steaming coal), which is produced over a relatively wide geographical area, as the reductant. The iron units and pulverized coal are formed into pellets, which are then placed in the rotary hearth furnace. High-quality DRI with a metallization of 85%–92% can be produced in approximately 10 minutes. In the FASTMELT® Process, hot metal can be produced in one hour by melting the DRI in a melter.

The main applications for FASTMET® are in: (1) recycling blast furnace (BF) dust; (2) recycling EAF dust; and (3) producing DRI from iron ore. BF dust is being commercially recycled at Nippon Steel Corporation's Hirohata Works and Kobe Steel's Kakogawa Works using FASTMET®. Furthermore, with a grant from the Ministry of Economy, Trade and Industry, Kobe Steel has conducted EAF dust recycling viability tests at its Kakogawa Works with positive results, including high reduction and dezincification rates as well as low dioxin emissions.



A FASTMET® plant at Nippon Steel Corporation's Hirohata Works

ITmk3®—Next-Generation Ironmaking Process

Overview of ITmk3® Process

ITmk3® (Ironmaking Technology Mark Three) is a proprietary, next-generation ironmaking process developed by Kobe Steel. The ITmk3® Process produces high-grade iron nuggets in just 10 minutes from iron ore fines and uses steaming coal as the reductant. The current mainstay process, combining the BF and basic oxygen furnace (BOF) processes, is considered the first generation of ironmaking. The MIDREX® and other direct reduction processes is the second generation. ITmk3® is considered a revolutionary third-generation process.

Process	Reductant	Reduction Time	Pig Iron Production Time	Main Applications	Optimum Siting
Blast furnace	Coke	—————>	8 hours	BOF steelmaking	Coastal areas
Direct reduction	MIDREX® Process	Natural gas	6 hours	EAF steelmaking	Natural gas-producing areas
	FASTMET®	Steaming coal	10 minutes	Dust recycling	Steelworks
	FASTMELT®	Steaming coal	10 minutes → 1 hour	BOF steelmaking EAF steelmaking	Alternative to BF, supply of hot metal to EAF
ITmk3®	Steaming coal	—————>	10 minutes	EAF steelmaking	Iron ore and coal-producing areas

ITmk3® Process Features

The ITmk3® Process offers the following advantages over the BF process:

- (1) Enables use of low-grade iron ore fines and steaming coal
- (2) Can cut CO₂ emissions by approximately 20% (when comparing BF/BOF processes with ITmk3®/EAF processes)
- (3) Keeps capital investments down and simplifies operations

In addition, the iron nuggets produced by ITmk3® are of a high grade (metallic iron content: 96%–97%, without slag) and comparable in quality to pig iron produced in a blast furnace. Easy melting and continuous input contribute to improved EAF productivity, and because the high-density nuggets are produced without reoxidation or pulverization, transport and handling are easy.



Iron nuggets

First Commercial Project

Developing the ITmk3[®] technology since 1996, Kobe Steel tested its viability at the Kakogawa Works' pilot plant and at a pilot demonstration plant in Minnesota, USA, and continued focusing on the technology's commercial application. Consequently, in November 2007, Kobe Steel reached an agreement with Steel Dynamics, Inc. (SDI), a U.S.-based EAF steelmaker, to construct an ITmk3[®] plant. The plant, which is currently under construction in Minnesota, is scheduled to commence operations in mid-2009.

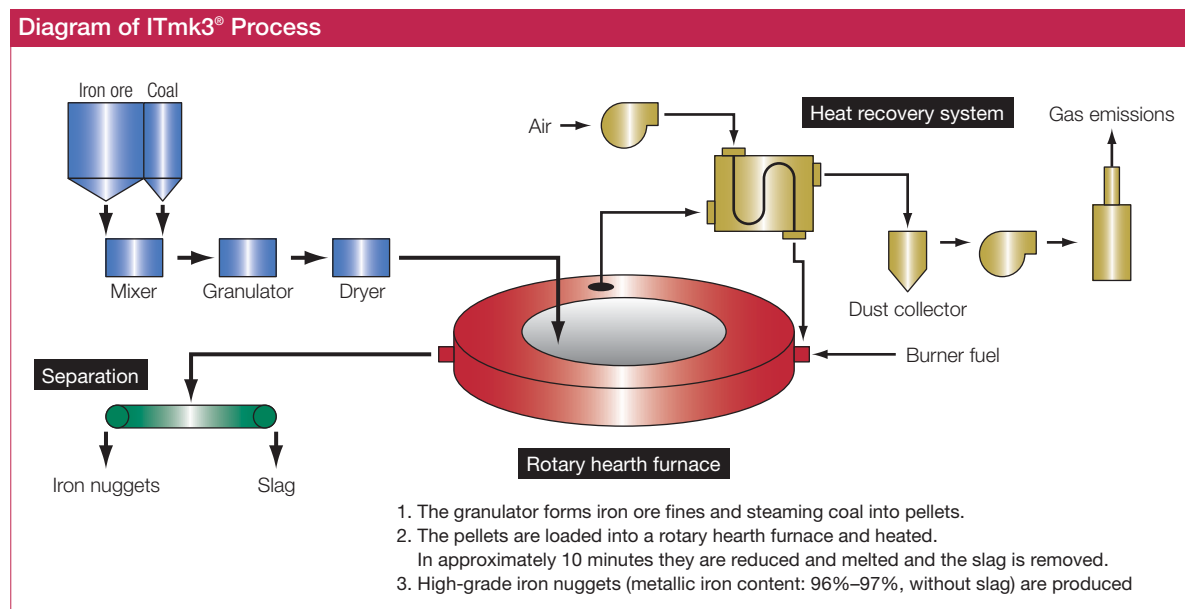
Under this project, Mesabi Nugget Delaware, LLC, was established as a joint venture company between Kobe Steel and SDI to operate and manage the ITmk3[®] Plant and sell the iron nuggets. Kobe Steel is licensing the ITmk3[®] Process, providing engineering services, key equipment, and technical support. Meanwhile, SDI will take iron nuggets produced at the plant and use them in its steel mills.



Construction of the first commercial ITmk3[®] plant in Minnesota, USA

Future Developments

Kobe Steel is seeking the early implementation of a proposed joint venture project with U.S.-based Cleveland-Cliffs Inc., and, having received inquiries from India, Ukraine, Vietnam and other countries, is aggressively pursuing new projects.



Column



Associate Director and Head of Iron Unit Division
Shohei Manabe

With its long history in the DRI field, Kobe Steel has been involved in a range of important events, from the construction of the MIDREX[®] Direct Reduction Plant in Qatar in the 1970s to the acquisition of Midrex Technologies, Inc. Today, the Iron Unit Division of Kobe Steel and Midrex Technologies, Inc. have secured a preeminent position in this field.

Kobe Steel established the Iron Unit Division in 2004 as a strategic organization within its corporate head office and began to more actively promote this business. With the steel industry facing new problems, including environmental issues and soaring raw material costs, Kobe Steel has set its sights on expanding sales of direct reduction plants, including ITmk3[®], which produce economical iron nuggets that are eco-friendly.

Just as Kobe Steel established the DRI market through its hot briquetted iron (HBI) business in Venezuela, the Company hopes it can contribute to the development of the steel industry by supplying iron nuggets—a new iron source—to the market.