

DIRECT FROM MIDREX

2ND QUARTER 2005

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MIDREX TECHNOLOGIES, INC.



Commentary

China - The Dragon Rules

One very quickly runs out of superlatives trying to describe the phenomenal growth of the iron and steel industry in China.

There has never been anything quite like it!

According to IISI data, China currently produces over 40% of the world's hot metal; 330 million tons per year out of the world total of about 780 million tons per year (see graph). (IISI data for April 2005 shows China producing 27.2 million tons of hot metal out of a world total of 65.2 million tons.)

It is hard to visualize numbers on this scale. For instance, the mass of the iron structure of the Eiffel Tower is 7,340 tons. "Every 12 minutes China produces enough iron to build an Eiffel Tower."

Another way to represent China's massive annual steel production is to determine the length of a two meter wide by 25cm thick slab of steel. According to China's current output, the slab of steel when stretched would wrap around the equator more than two times!

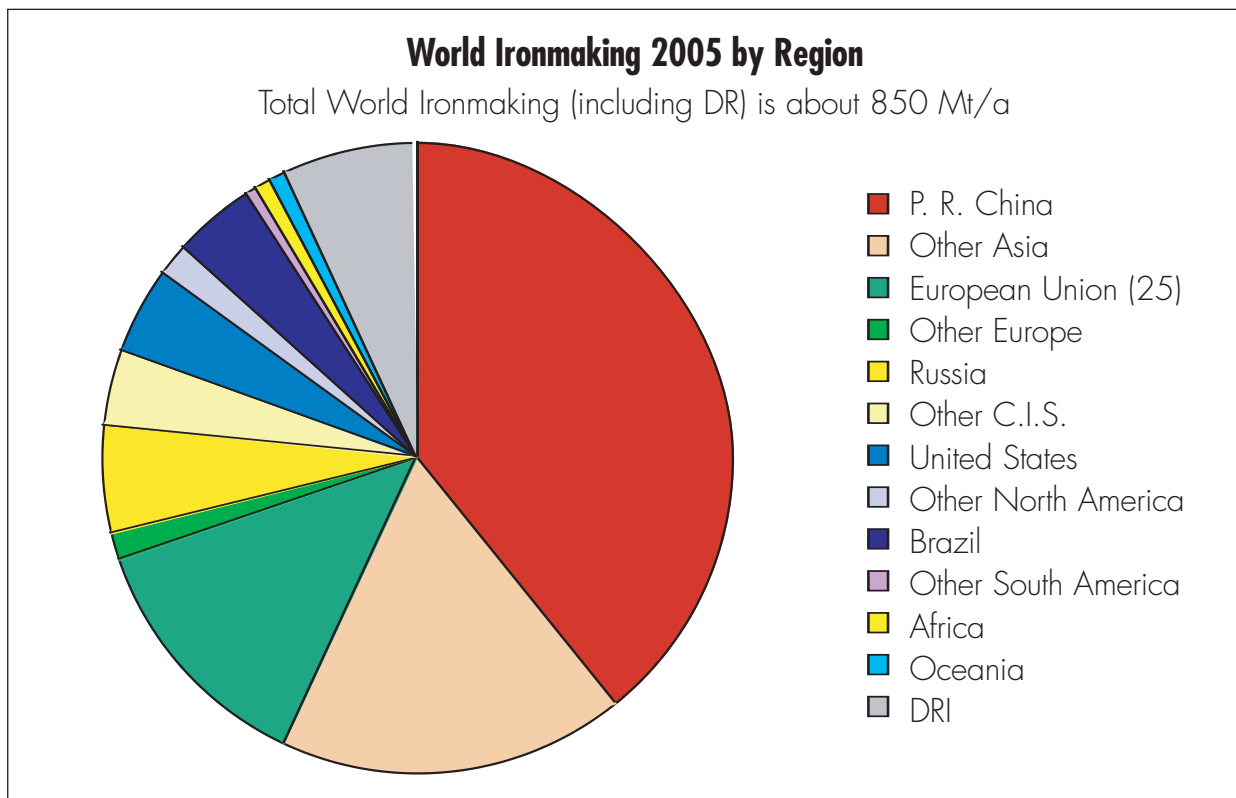
While traveling through China a few months ago, I visited more blast furnace capacity within three days than is currently operating in the entire United States.

The truly remarkable fact, however, is the speed at which the steel industry has grown in China. When I entered third grade in 1959, the entire world was producing less than 330 million tons of steel per year. At that time, numerous movie documentaries extolled the prodigious worldwide steel industry. Now China singularly produces that much steel, with industry growth that's exponential. Every year, its steel production is more rapid than the year before.

The acceleration of growth is as difficult to fathom as the overall volume. At the current rate of increase, China is adding the blast furnace capacity of a moderate-sized integrated works (about three million



*Robert Hunter
Product Marketing and
Applications*



tons per year of hot metal) every two to three weeks! They're adding the entire blast furnace production of the United States approximately every six to eight months.

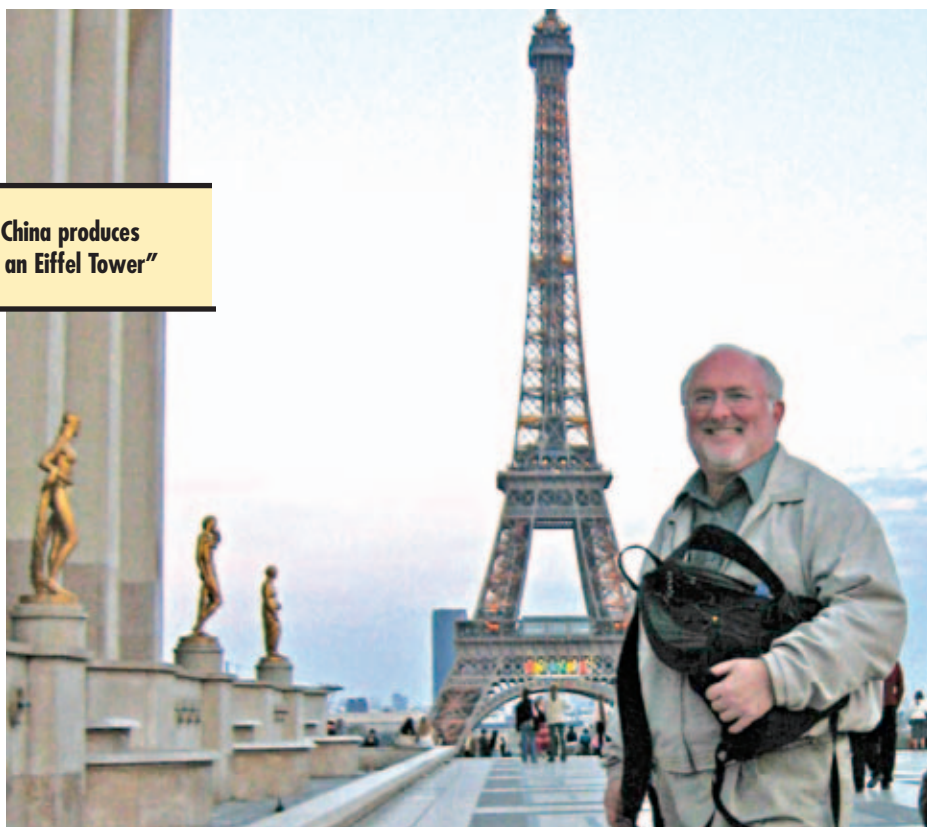
What does this new reality mean to the rest of the world?

For the remainder of our careers, China will be the world's dominate iron and steel producer. It will be a major supplier to almost every region, and it will also be a major customer.

In this issue of *Direct From Midrex*, we pursue this bright future with a story on Shijiazhuang Iron & Steel Company Ltd.'s interest in FASTMELT® from Midrex/Kobe Steel Ltd. We also devote much of the issue to an exciting new and innovative approach to integration with steelmaking processes known as KWIKSTEEL®.

In addition, over the next few months, look for new changes in www.midrex.com and *Direct From Midrex* as Midrex continues to grow and execute new projects worldwide.

"Every 12 minutes China produces enough iron to build an Eiffel Tower"



MISSION STATEMENT

Midrex Technologies, Inc. will be a leader in design and integration of solids and gas processes. We will meet or exceed performance expectations, execute projects on time, enhance existing product lines, and provide value-added design, procurement, logistics and field services to our clients. We will develop new business opportunities that will challenge our employees and maintain the economic vitality of our company. Our employees are the key to our success, and we are committed to encouraging them to grow professionally and personally.

Christopher M. Ravenscroft: Editor

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Optimum Utilization of Hot DRI:

KWIKSTEEL®

An Innovative Approach to Integration with Steelmaking Processes

By Robert M. Klawonn, VP - Commercial
Glenn E. Hoffman, Manager - Product Development
Midrex Technologies, Inc.

Gas-based, shaft furnace-based direct reduction has evolved successfully over the course of the past four decades. Some of the technology enhancements to gas-based direct reduction during the evolutionary period include larger capacity shaft furnaces, in-situ reforming, increased heat recovery, improved reformer catalysts, and hot briquetting. The most recent improvements include increased reduction temperature, energy efficiency and other process/equipment improvements that will be implemented in the current modules under construction and will have corresponding benefits. While there is still room for further optimization of gas-based DR technology and greater productivity through optimization of the current state-of-the-art features, new and significant advancements will be increasingly difficult to implement.

DRI product applications, however, are tremendous and substantially untapped sources of improvement. Issues such as DRI-to-liquid steel yield, chemistry, nitrogen reduction, carbon content and temperature can be improved much further as the links between DR plant and melter are optimized. The current focus of Hot DRI (HDRI) for continuous transport and charging will result in a significant step forward for mills wishing to boost throughput and reduce operating costs. Numerous projects are underway or planned to take advantage of continuously fed 700°C HDRI in adjacent EAF melt shops. Hot transport options by conveyor, container and gravity (HOTLINK®) will assure that nearly all configurations will find a solution, whether brownfield or greenfield.

The next frontier for gas-based direct reduction looks beyond conventional discontinuous liquid steelmaking. The most promising application of Hot DRI is to integrate it with a continuous steelmaking operation such that the best features of gas-based direct reduction technology and advanced rotary hearth technology are melded into a new process. By feeding the 2-3%

carbon hot DRI from a MIDREX HOTLINK® module directly to an ITmk3®-type Rotary Hearth furnace as the “finisher,” it should be possible to produce a continuous stream of high temperature steel nuggets made from virgin iron ore and natural gas. This patented process technology by Midrex is known as KWIKSTEEL®.

The first generation of KWIKSTEEL® should be able to efficiently convert iron ore pellets/lump to produce a merchant steel nugget. Future generations of KWIKSTEEL® will have developed a continuous link of hot steel nuggets into a custom melter for continuous production of liquid steel without the need for oxygen or a strong power grid. Currently test work is being conducted at Midrex's Research and Development Center in Charlotte, with plans to introduce the KWIKSTEEL® technology commercially by the end of the decade.

SHAFT FURNACE DRI TECHNOLOGY – An Evolutionary Process

The single most important factor contributing to the success of the MIDREX® Process has been the continual ramping up of shaft furnace productivity in the production of a highly metallized low sulfur direct reduced iron (DRI) product. Historically, the major challenge has been to improve the rate and degree to which CO and H₂ are consumed in the shaft furnace, which in turn exerts a strong influence on productivity and energy efficiency. Utilization of these gaseous reductants in MIDREX shaft furnaces has increased more than 25% over the last 30 years, and has been achieved due to improvements in raw material quality and by improving uniformity of solid/gas contact, as well as by increasing the reduction temperature. The original operating practice in the 1970s focused on processing 100% iron ore pellets at low reduction temperatures (~780°C). This practice was later augmented in the 1980s to include the processing lump ore, which resulted in an increase of reduction temperatures from 780 to 850°C, and ~13% increase in shaft furnace productivity. Oxide coating of oxide feed materials was adopted in the 1990s, allowing plant operators to increase reduction temperatures ~900°C.

OXY+[®] Center Injection

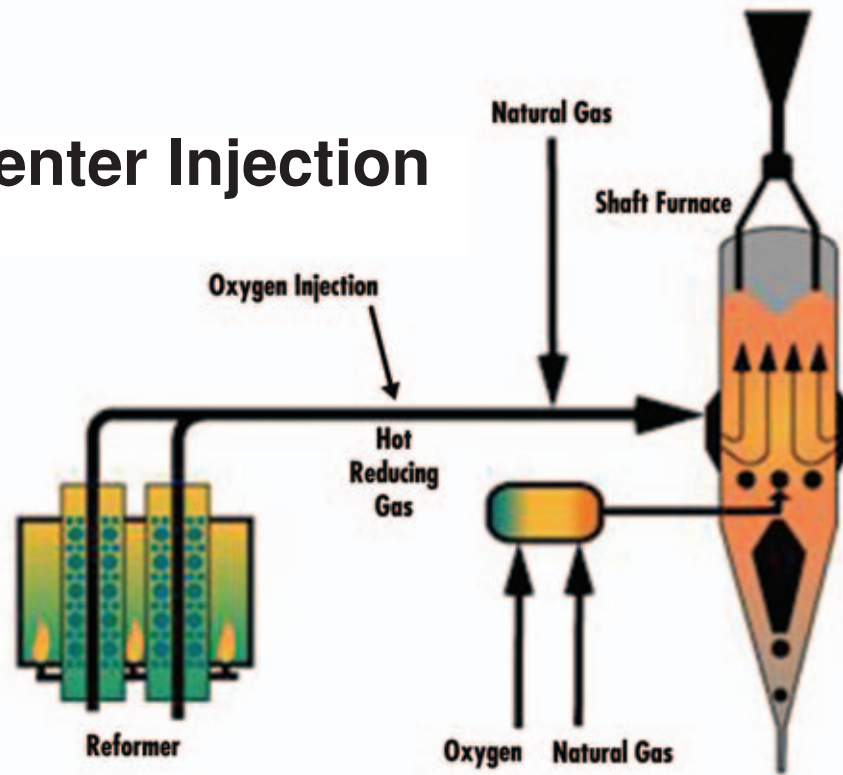


Figure 1 - Oxygen injection and OXY+

This practice improved productivity by an additional 11% and interestingly enough, all of these improvements were accomplished with no major capital investment or major modifications to the equipment in the typical MIDREX Plant. In addition, the quality of the reducing gas (ratio of CO+H₂ / CO₂+H₂O) as it enters the furnace was held nearly constant, while the temperature to the shaft furnace increased.

More recent enhancements to shaft furnace technology have focused on increasing reducing gas temperature by using oxygen. The practice of oxygen injection (12~20 Nm³/t-DRI), where high purity O₂ is introduced into the flow of hot reducing gas, became commonplace in the late 1990s and resulted in reducing gas temperatures in excess of 1,000°C and burden temperature of more than 900°C, thereby increasing shaft productivity up to 12%. In 2005, the practice of oxygen injection was augmented by OXY+[®] where a supplemental hot reducing gas is produced by controlled partial oxidation of natural gas with oxygen in a separate combustion chamber. The ability to generate additional CO and H₂ reductant gases by implementing OXY+, for additional opportunity to boost productivity without expanding the traditional reformer. Optimum productivity for gas-based direct reduction is achieved by maximizing the reducing gas temperature of the burden and the quality of the reducing gas entering the shaft fur-

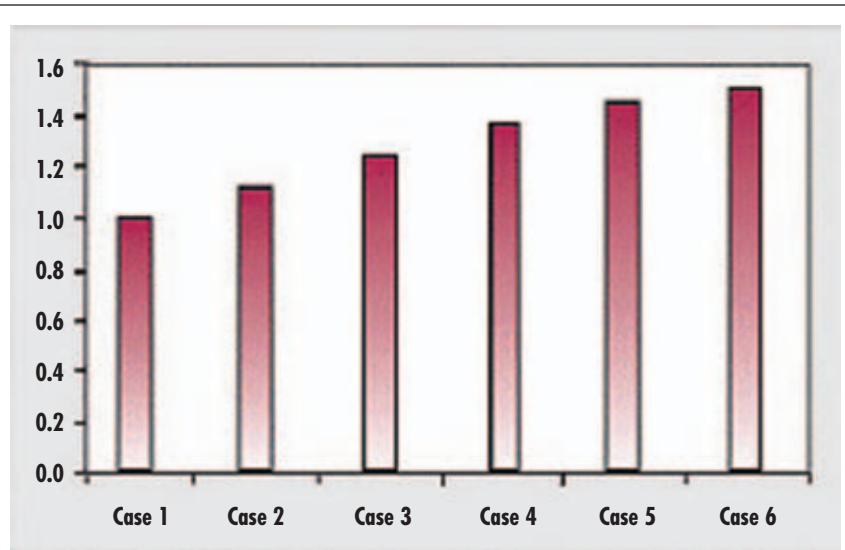


Figure 2 - Increasing shaft furnace productivity comparison chart

nace. It is possible to afford the greatest process flexibility by utilizing a combination of the oxygen injection and OXY+ practices, as well as natural gas injection in the reducing gas stream, such that independent control of shaft furnace burden temperature and reducing gas temperature are achieved. Figure 1 shows the gas-based DR process schematic for the most advanced technology, and Figure 2 shows production comparison: Increasing shaft furnace productivity.

Case	DRI Production (t/h)	DRI Production Ratio From Case 1	Enrichment Natural Gas (%)	Reducing Gas Temp (°C)	Burden Temp (°C)	O ₂ Addition (Nm ³ /t)	Natural Gas Flow (Nm ³ /t)	Electricity (kWh/t)
1	88.8	1.000	4.5	780	789	0.0	268.6	135
2	100.3	1.130	3.5	850	814	0.0	262.3	120
3	110.2	1.241	3.5	918	834	0.0	257.9	109
4	121.5	1.368	4.5	1050	860	17.5	260.3	99
5	129.2	1.455	3.0	961	857	30.2	265.8	93
6	133.6	1.504	3.0	1050	898	41.2	264.6	90

Key

Case 1 - Original practice – 1970s

Case 2 - Practice using lump ore – 1980s

Case 3 - Practice using coating of oxide feed materials – 1990s

Case 4 - Oxygen injection practice – late 1990s

Case 5 - OXY+ practice – 2000

Case 6 - Combined practice with oxygen injection & OXY+ - Future

Table 1 - Evolving Shaft Furnace Production Data

Table 1 summarizes shaft furnace production data for all of the previously discussed cases concerning evolution of shaft furnace process technology.

HOTLINK® – The Evolution of Hot Charging

Hot DRI produced by a MIDREX Shaft Furnace can be integrated with downstream steelmaking processes by three preferred methods: gravity feed (HOTLINK), hot transport by transfer vessels, or hot transport by mechanical conveyor. Pneumatic transport is another option; however, the need for a high temperature carrier gas, excessive fines generation from particle/particle interactions, higher energy costs, and the relatively low delivery temperature make pneumatic transport less attractive. Of the three preferred methods, HOTLINK provides a simple, reliable and economical means for charging HDRI at temperatures at or above 700°C from a MIDREX® Shaft Furnace to an adjacent electric arc furnace through its use of gravity.

Some hot transport systems, although proven to work, can influence the quality of the DRI in chemistry, physical size and temperature so significantly that they do more harm than good. Brownfield or existing sites are forced to choose such systems because a close arrangement is not physically possible. Midrex designed HOTLINK as a system to reliably deliver HDRI to an EAF (or similar melter), using gravity as the principal method of transport. This system is primarily intended for greenfield sites and results in lower specific power and electrode consumption, higher EAF productivity and higher yield than can be realized by all other methods of hot charging.

Unlike other methods of transporting HDRI from a direct reduction furnace, gravity transport is the simplest, most reliable, and requires the least maintenance. The HDRI arrives at the EAF without metallization loss at maximum temperature and in better physical condition than cold DRI stored in conventional

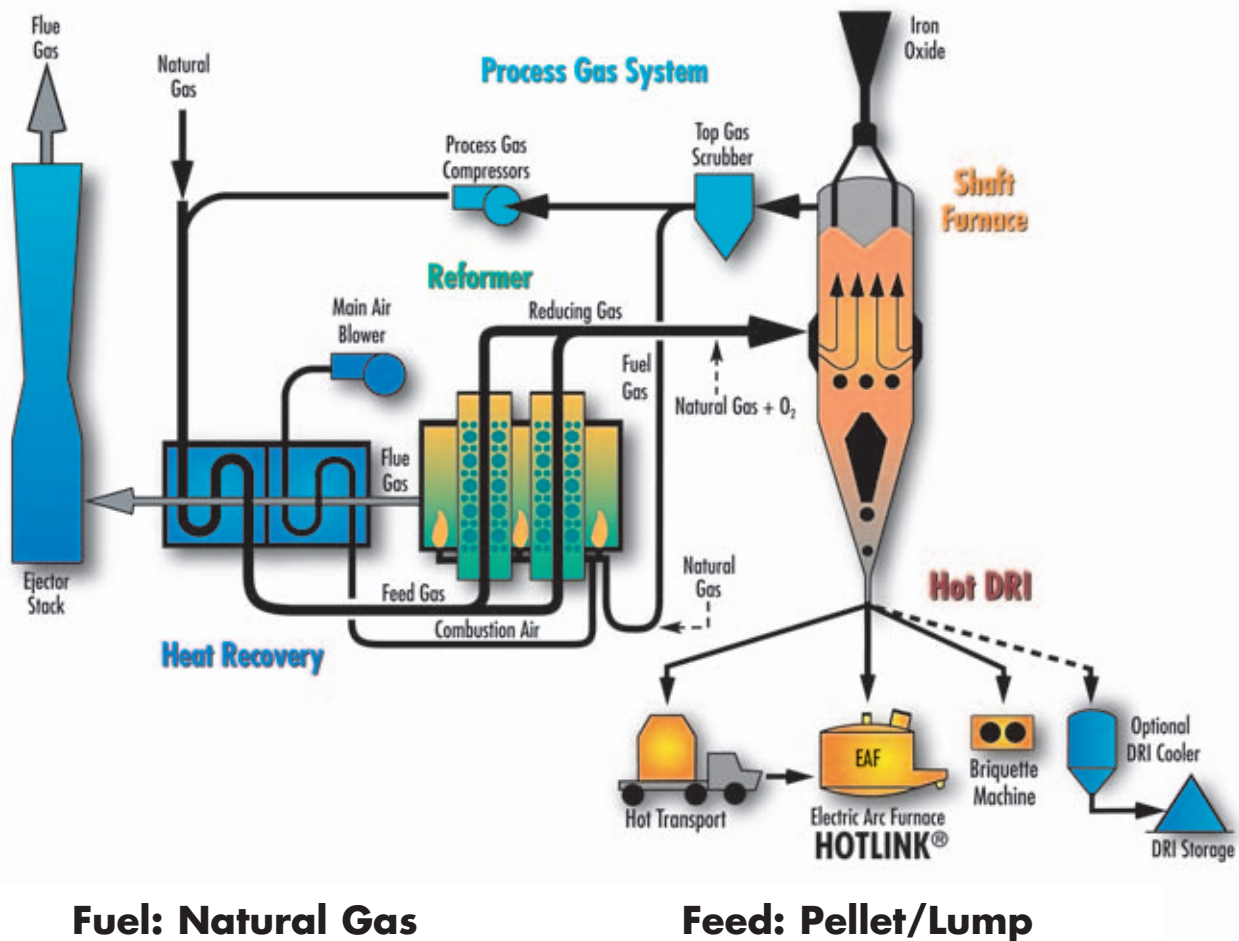
cold DR/EAF combination facilities as it hasn't cooled down, nor has it been handled excessively. Midrex pioneered the continuous gravity-flow direct reduction plant design, as well as the hot discharge furnace feature. This configuration of gravity-fed hot DRI has been used on all MIDREX HBI plants to produce more than 61 million tonnes of HDRI since 1984.

HOTLINK places a Midrex hot discharge furnace just outside and above the exterior wall of the meltshop. This provides the opportunity to discharge directly from the shaft furnace to a hot DRI surge bin and then from the surge bin directly to the EAF by gravity. Hot transport and charging of HDRI has been successfully performed by Essar Steel and continues today. In recent years, Essar has been transporting its HDRI directly to the nearby melt shop by container in batches up to 90 tonnes each with excellent results. These containers operate on the same principal as the HOTLINK system – once charged to the sealed movable bin by gravity, the HDRI is then released into the EAF by gravity. The only difference is that instead of being fixed above the melt shop, the bin is transported by truck and lifted into place by a crane. Thus, the containers can mimic the same results as HOTLINK, giving the brownfield DR/EAF combination the best return on investment.

HOT DISCHARGE and HOTLINK – Details of the System

The main process features of the hot discharge of DRI from the Midrex Shaft Furnace are shown in the Hot Discharge flowsheet on the next page. In the general sense, hot DRI can be discharged from the shaft furnace to be either utilized in the steelmaking melter using the HOTLINK concept, hot transported to the melter via transfer vessel or conveyor, briquetted into HBI, or optionally cooled to form cold DRI. Combinations of these arrangements (i.e. HOTLINK/HBI, HBI/DRI, HOT Transport/DRI) are now being constructed.

Hot Discharge HOTLINK®/Hot Transport/Hot Briquetting



Hot Discharge and HOTLINK

More specifically, HOTLINK Modules are equipped to handle any EAF upset conditions by incorporating a hot DRI surge bin (refer to HOTLINK flowsheet). The primary goal of the surge bin arrangement is to supply hot DRI to the EAF on demand. However, the DR plant must also be capable of continuing production in a steady-state mode, even if EAF operations are not. Thus, transitioning quickly and by-passing to the production of cold metallics (cold DRI or HBI) for storage is critical to maintaining annual DRI production targets. Moreover, cold or off-grade DRI can be recycled back to the shaft furnace to produce HDRI or fed directly to the EAF.

It is critical that the transport method from the DR furnace to the EAF is capable of delivering HDRI without adversely affecting product quality while providing maximum operational flexibility. Additionally, the transport system must be reliable, maintenance friendly and easy to operate. The HOTLINK system meets these criteria very well.

ROTARY HEARTH TECHNOLOGY

The rotary hearth furnace is not a new technology. For decades, RHF's have been successfully used in a variety of industrial applications including heat treating, calcification of petroleum coke, waste treatment, and non-ferrous high temperature metal recovery. Several attempts to use RHF technology for reduction of iron oxides have resulted in commercial failure, leading many to conclude that the technology is not appropriate for ironmaking. The coal-based direct reduction concept utilizing the RHF seems to be a simple one; however, commercial implementation of the concept has not been easily achieved. The landscape is littered with failures, with some exceptions.

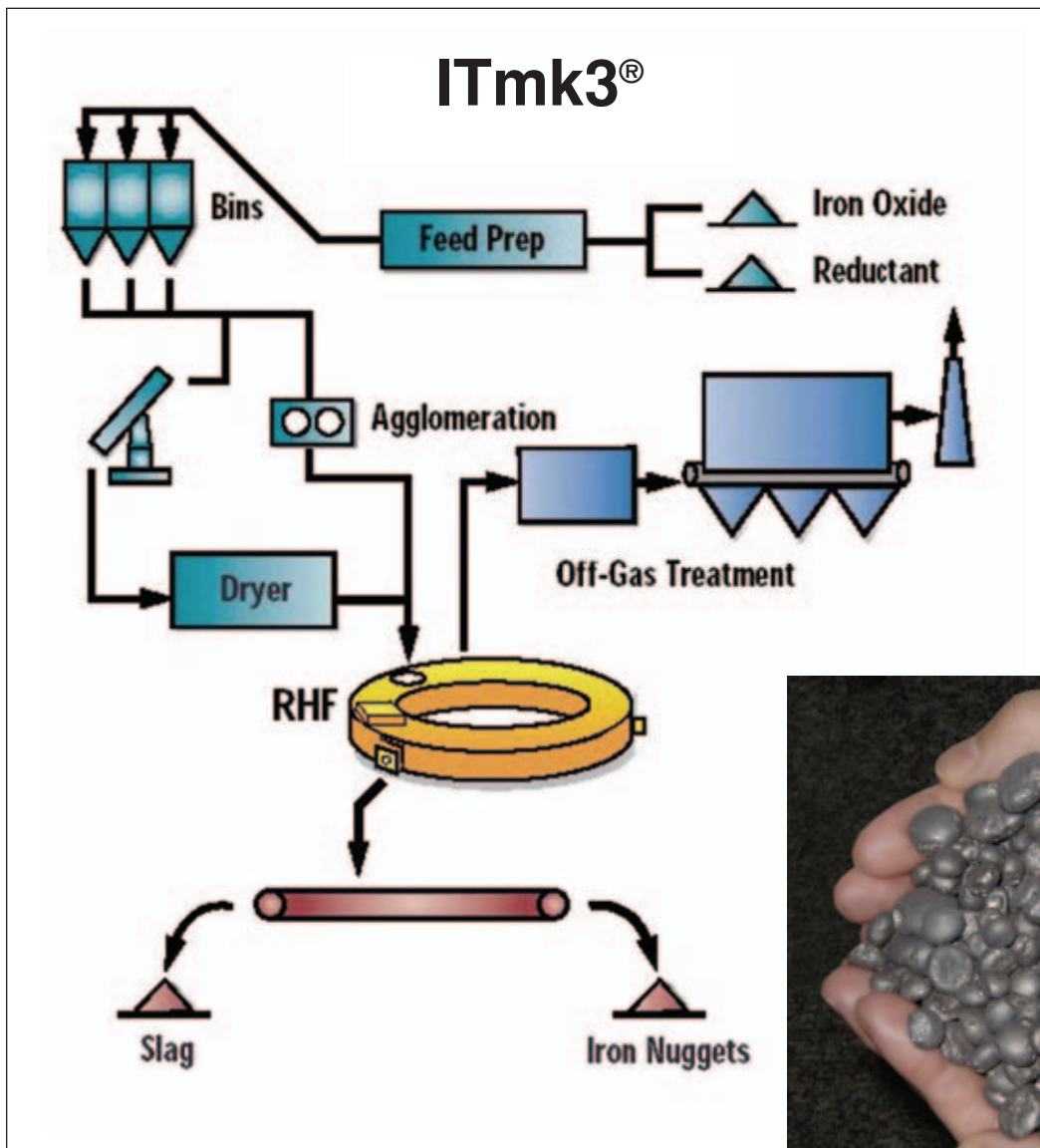
The problem with the use of RHF technology for the direct reduction of iron-bearing materials is not with the RHF itself; it's with the way it is being applied. The solution is a proper application of ironmaking principles and process engineering.

If the RHF is correctly integrated into the global process and direct reduction technology is applied correctly, the result is an energy efficient, environmentally friendly, economical system for producing high quality alternative iron. After more than 10 years of applied research and development effort, Midrex and Kobe Steel have proven the concept with continuous commercial-scale operation of three RHF direct reduction plants utilizing FASTMET technology.

For those unfamiliar with the RHF coal-based direct reduction concept, the rotary hearth furnace is a flat, circular refractory hearth rotating inside a high temperature, circular tunnel kiln. A water seal is used to "seal" the interface between the rotating hearth and the tunnel kiln preventing air or flue gas leakage. Prepared feed to the RHF typically consists of a composite agglomerate (either pellets or briquettes) made from a

mixture of iron oxides and a carbon source such as coal, coke fines, charcoal, or other carbon-bearing solid. The feed agglomerates are placed on the hearth evenly, one to two layers thick.

Burners located above the hearth provide heat required to raise the feed agglomerates to reduction temperature and start the process. The burners are fired with natural gas, fuel oil, waste oil, or pulverized coal. Most of the heat required for maintaining the process is supplied by combustion of volatiles, which are liberated from the heated reductant, and combustion of carbon monoxide, which is produced by the reaction of carbon reducing metallic oxides. The agglomerates are fed and discharged continuously and stay on the hearth for only one revolution, typically six to 12 minutes, depending on the reactivity of the feed mixture and target product quality.



**ITmk3®
The Process/Technology**

ITmk3 represents the next generation of modern ironmaking technology, processing iron ore fines into almost pure pig iron nuggets in only ten minutes. The result is a conveniently sized, slag-free material ideally suited for further processing by conventional technologies into high quality steel products and foundry iron castings. ITmk3 Process development successfully completed the demonstration plant phase in July 2004. The Mesabi Nugget Demonstration Plant achieved continuous, reliable production of pig iron nuggets under commercial operating conditions.



Iron Nuggets

ITmk3® The Process/Technology

Ten thousand metric tonnes of quality pig iron nuggets were produced during the four test campaigns. The produced nuggets were consumed in the steelmaking operations at various North American locations.

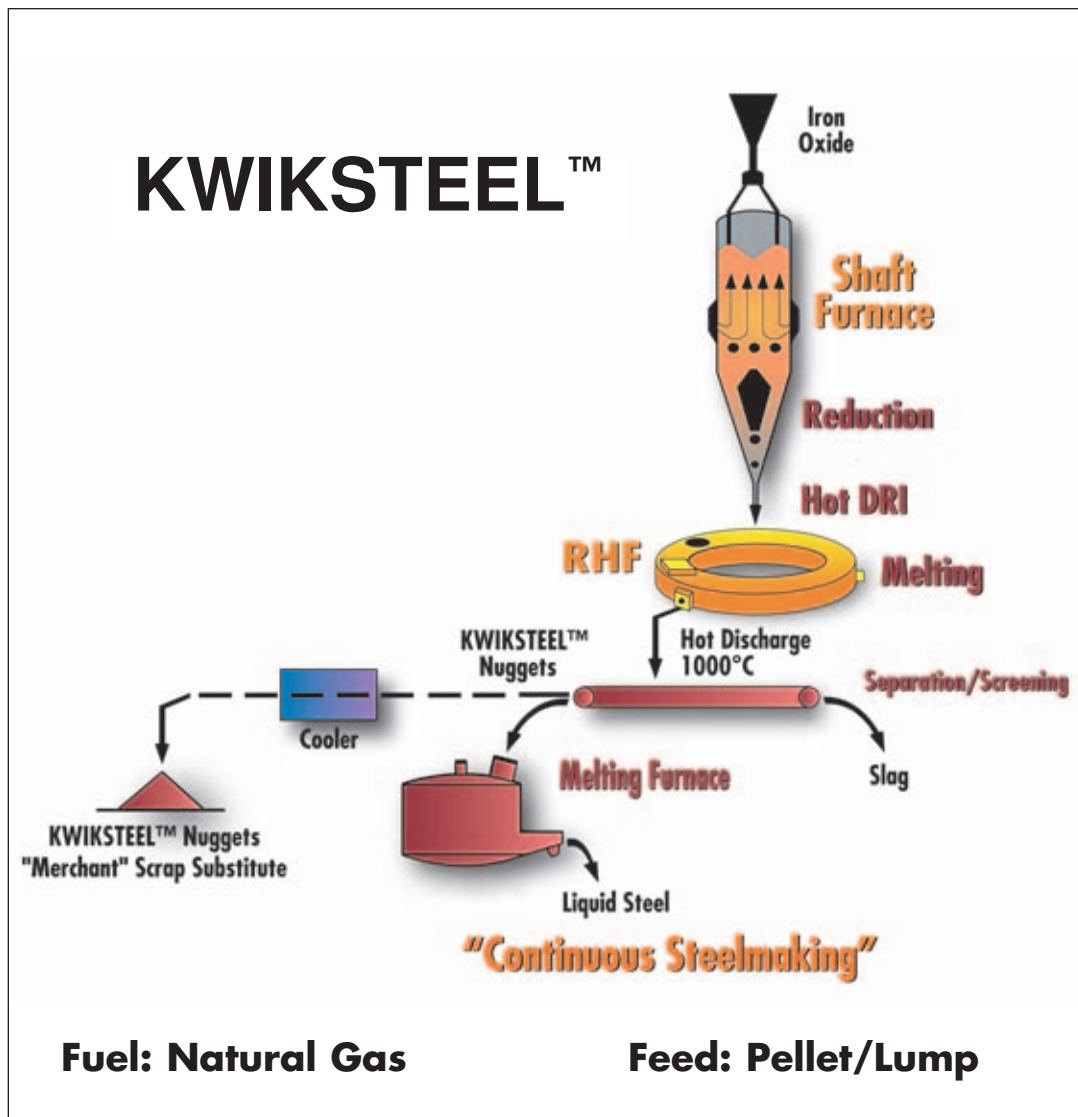
Purpose/Market

The ITmk3 Process is an ideal vehicle for iron ore mining companies to supply pig iron grade nuggets directly to the EAF steelmaking industry. ITmk3 nuggets are a metallurgically clean, dust-free source of alternative iron for high quality EAF steelmaking. ITmk3 nuggets are not prone to reoxidation and do not require special handling during shipment. Because of their convenient form, they can be continuously fed to the steelmaking furnace for higher productivity and lower liquid steel cost.

KWIKSTEEL™

The Process/Technology

KWIKSTEEL represents an extension and expansion of modern ironmaking technology that combines the best of natural gas-based MIDREX direct reduction with ITmk3-type technology. Hot, low-sulfur DRI produced by a conventional MIDREX shaft furnace is further processed by a "Finisher" rotary hearth furnace directly into hot, low-carbon steel nuggets. The resultant product is a conveniently sized, low-sulfur, slag-free steel nugget that is continuously produced without the use of oxygen. The absence of oxygen in the steelmaking operation means that the iron yield from DRI to steel nugget product is very high. Furthermore, the only slag associated with the KWIKSTEEL process is that formed during the selective melting step in the rotary hearth furnace. Here the small amount of gangue contained in the hot DRI is completely separated from the more useful metallic iron. The hot, pure steel nuggets are ideally suited for continuous processing into either liquid steel, or secondary cooling for the purpose of making virgin merchant steel nuggets without the need for granulation or splat cooling. The patented process concept is currently under further development at the MIDREX Technical R&D Center in Charlotte, NC.



KWIKSTEEL™ The Process/Technology

Purpose/Market

The KWIKSTEEL process is another method by which iron ore mining companies can enter the alternative iron market. A virgin, low-sulfur steel merchant product can be produced from either iron ore pellets or lump iron ore, without the need to invest in oxygen-based steelmaking facility, using low-cost natural gas as the primary energy source. The product can be either melted into liquid steel or sold directly to both the EAF and integrated mill steelmaking industries as a high grade merchant material. KWIKSTEEL nuggets are an easy solution to the world need for a low-sulfur metallic iron feed material produced directly from natural gas. KWIKSTEEL nuggets can be used to produce any grade of steel, and their convenient size and shape makes for easy material shipping and handling. Where Hot Briquetted Iron (HBI) is currently the product of choice when making merchant DRI for ocean transport, KWIKSTEEL could replace the briquetting equipment to produce a product with higher value and greater market appeal. Producers and consumers of merchant KWIKSTEEL nuggets also would benefit from higher iron yields when compared to HBI and DRI.

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Starting Product from MIDREX Plant	HDMI	CDRI	CDRI	HBI	HDMI	HDMI
Fe Yield: DRI/HBI to Liquid Steel	0.96	0.94	0.89	0.91	0.95	0.97
Energy Usage:						
Natural Gas used (mmBtu*/t Liq. Stl.)	12.9	12.5	13.2	13.5	17.1	16.3
Power used (kWh/t Liq. Stl.)	565	695	701	742	576	224**
Oxygen used (Nm ³ /t Liq. Stl.)	15-20	15-20	15-20	15-20	<10	0

*Natural gas figures represent the Gross Heating Value of the natural gas consumed
**This figure of 224 kWh/t Liquid Steel assumes a theoretical melter consumption figure of 100 kWh/t Liquid Steel when melting 100% hot (>1000°C) KWIKSTEEL nuggets, which are continuously fed.

Table 2 - Preliminary operating figures - estimated

Projected KWIKSTEEL Economics

Table 2 above shows a comparison table of KWIKSTEEL Economics as projected and directly contrasted against options of;

- (1) adjacent 100% Hot DRI use via HOTLINK
- (2) adjacent 100% Cold DRI use in an EAF
- (3) remote use of 100% Cold DRI in an EAF
- (4) remote use of 100% HBI in an EAF
- (5) remote use of 100% cold KWIKSTEEL nuggets
- (6) adjacent use of 100% hot KWIKSTEEL nuggets in an appropriate melter

MIDREX DRI/HBI Quality: In each case, the starting MIDREX DRI/HBI product quality is considered to be 93% metallization, 2.0% Carbon. If we assume DR-grade iron oxide as feed material, this would result in an approximate total iron content of 92.8% Fe in the DRI or HBI.

Iron Yield: Case 1 (HOTLINK DRI) is the most competitive of the DRI/HBI – EAF combinations, while Case 6 (Hot KWIKSTEEL nuggets fed to an adjacent melter) is expected to have the highest iron yield of all cases.

Energy Usage: Although KWIKSTEEL Nugget use in Cases 5 and 6 clearly require higher specific consumptions of natural gas, these costs would be minimized in a low cost gas location, such as South America, Middle East or Western Australia. In fact, the additional gas consumption would result in less than \$5.00 per ton of liquid steel in these locations. Case 5 provides a theoretical offset in the use of electrical power of up to 166 kWh/t liquid steel. However, Case 1 and Case 5 are nearly identical in power consumption per ton of liquid steel. KWIKSTEEL application is of most benefit in locations where natural gas is inexpensive, and the continuous stream of hot steel nuggets is delivered directly into an adjacent melter of appropriate design to continuously melt the steel nuggets (Case 6).

Capital Costs: Evaluations have not yet been completed regarding the projected impact on capital costs for an integrated KWIKSTEEL-melter combination, although continuous nugget production and feed to a continuous melter with low power requirements is expected to be at least as competitive as a conventional HOTLINK-EAF combination in terms of specific capital cost per ton of liquid steel produced.

Laboratory Testing to Date

Development of KWIKSTEEL at Midrex Technologies Inc. is cur-

rently in fast-track mode. Initial bench-scale test results have proven very promising and a decision has been made to undertake a significant development program to both refine and optimize technologies necessary to successfully integrate shaft furnace pre-reduction to rotary hearth finishing and subsequent melting on a continuous basis.

CONCLUSION

KWIKSTEEL is viewed to be the most promising application of integrating Hot DRI with a continuous steelmaking operation such that the best features of gas-based direct reduction technology and advanced rotary hearth technology are melded into a new process that continuously produces a low-sulfur steel without the need for oxygen injection. By feeding the 2-3% carbon hot DRI from a MIDREX HOTLINK® module directly to an ITmk3®-type Rotary Hearth furnace as the “finisher,” it should be possible to produce a continuous stream of high temperature steel nuggets made from virgin iron ore and natural gas. This patented process technology is now under development by Midrex.

The first generation of KWIKSTEEL should be able to efficiently convert iron ore pellets/lump to produce a merchant steel nugget. Future generations of KWIKSTEEL will have developed a continuous link of hot steel nuggets into a customized melter for continuous production of liquid steel without the need for oxygen or a strong power grid. Preliminary economic studies for KWIKSTEEL show that this technology has the potential to be significant breakthrough in the steelmaking industry.

Overall, KWIKSTEEL should be most beneficial where natural gas is available at low-cost, and the desired product is semi-finished or finished steelmaking. Natural gas consumption is the primary energy source, and the benefits of very low electricity consumption (light power grid requirement), high quality liquid steel, high iron yield, continuous production of liquid steel and environmental friendliness make KWIKSTEEL a very attractive alternative for future steelmaking – especially in locations that also have indigenous sources of DR-grade iron ore raw materials like Brazil and Western Australia.

Additional test work is currently being performed by Midrex at its Technical Center in Charlotte, NC with the aim to thoroughly establish the basic parameters for KWIKSTEEL nugget production, as well as to determine a path going forward for its commercial implementation. Future papers and presentations will become available as test work and viability studies progress.

Kobe Steel to Form Direct Reduced Iron Venture in China

Plans to Set Up Coal-based Direct Reduction Plant with Shijiazhuang Iron & Steel

In May, Midrex's parent company, Kobe Steel, Ltd., signed a letter of intent with Shijiazhuang Iron & Steel Company Limited (also called Shigang) to establish a joint venture company that will produce direct reduced iron using a coal-based process in Hebei Province, China.

Japanese trading firms Mitsui & Co., Ltd. and Sojitz Corporation also are planning to participate in the venture.

Under the letter of intent, the four companies will conduct a detailed feasibility study to set up the joint venture business. They plan to sign a final agreement later this year and begin plant operations in spring 2008. This will be the world's first commercial FASTMELT® Plant that uses the FASTMET® Process to make molten pig iron.



Details of the Letter of Intent

- **Partners:** Shigang & Kobe – Supply of plant, technology and operating services
 - Mitsui – Product marketing
 - Sojitz – Plant supply support
- **Equity Share:** Shigang 2/3, Japanese partners 1/3
- **Production Capacity of FASTMET/CDM Plant:** 500,000 tons per year
- Pig iron will be supplied to Shigang, but the Japanese partners will receive a minor portion for outside sale.

The FASTMELT Process, developed by Kobe Steel and Midrex Technologies, Inc., combines the commercially proven process FASTMET with a Coal-based DRI Melter (CDM) to produce pig iron.

Steam coal is used as the reductant to produce direct reduced iron (DRI). Agglomerates made of pulverized coal and iron ore fines are fed to a rotary hearth furnace and heated to a high temperature. At 1,350°C, the agglomerates are rapidly reduced in

Outline of Shigang

Name:	Shijiazhuang Iron & Steel Company Limited
Location:	Shijiazhuang, Hebei Province (300 km southwest of Beijing)
Established:	1957
Capital:	1.52 billion yuan (US \$184 million, in 2003)
Sales:	3.99 billion yuan (US \$482 million, in 2003)
Employees:	8,300 (in 2002)
Main Products:	Structural steel bar for machinery and automotive use
Equipment:	4 mini blast furnaces, 2 converters, 2 electric arc furnaces, 4 bar mills
Crude Steel Production:	2 million tons

10 minutes, leaving high quality DRI. The DRI is melted in a CDM and the slag is removed, leaving molten pig iron.

Most of the pig iron made by the joint venture will be supplied to Shigang. Plans call for the FASTMET/CDM plant to replace an aging mini blast furnace at Shigang.

As the FASTMET/CDM Process does not use coke or sintered iron ore, operating costs are reduced by roughly 30 percent in comparison to conventional mini blast furnaces.

