IRON MAKING IN MINI BLAST FURNACE (MBF)

The Blast Furnace ironmaking process had, until recently, been the unchallenged method of making hot metal on a large scale. Till 1990, the blast furnace route of ironmaking had about 97% (527mt) share of global iron production. Since then many other alternative processes of iron making have arisen e.g., Shaft Furnace DR processes (MIDREX, HyL), Rotary Kiln DR processes (SL/RN, CODIR, TDR), and recently the COREX Smelting Reduction process. The Mini Blast Furnace (MBF) is the most proven technology, as revealed by one recent global iron production data. While gas-based as well as coal-based DRI production routes produced 2.7% of total iron production in 1990 - 1991, the corresponding share held by MBF, operating mainly in Brazil, China and India, was 3.4%.

Mini Blast Furnaces (MBFs) are ideally suited to small scale operations. A Mini Blast Furnace (MBF), which can be viewed as is a miniature version of conventional large blast furnace, also has a few additional characteristic features known for their simplicity and economy. Since MBFs are small (working volume ranges between 100 - 370 m^3 corresponding to production capacities of hot metal between 60000 - 200000 tpa) blast furnaces, the technology involved is not only well proven, but also very sophisticated. Smaller scales of operation allows the use of inferior grade coke and iron ore (sinter usage is difficult). Mini blast furnaces are becoming increasingly as an economic and reliable source of iron for foundries as well as for forward integration with steelmaking units in EAF / EOF (and sometimes even small BOF) based steel plants.

The products from *mini blast furnaces* are of the same quality as that of normal Blast Furnaces and are free of tramp elements - this is of particular advantage in steel making in mini steel plants. Use of 40 - 45% hot metal in EAF (Electric Arc Furnace) charge has thus become standard practice, which has helped to reduce the power consumption in Electric Arc Furnaces to 380 - 400 kwh/t liquid steel from 550 - 600 kwh/t. At the same time, sine the hot blast temperature in MBFs is lower than normal blast furnaces and the specific heat loss is more, the coke rate tends to be 100 - 150 kg/thm higher.

The biggest limitation of mini blast furnaces is that coal injection is normally difficult and the higher specific heat requirement has to be met entirely by coke (normally purchased from external sources).

In India, with the recent increasing demand of pig iron and steel, mini blats furnace technology has proliferated. Kalinga Iron Works is successfully operating three small blast furnaces with volumes less than 100m^3 each, an MBF of 175m^3 capacities was commissioned in Goa in 1992 and nine more mini blast furnaces with installed capacity of 0.80 Mtpa of foundry pig iron and 0.10 Mtpa of basic grade are already operational. These units are spread all over the country. If this trend continues, which is more likely to happen, Mini Blast Furnace Technology would play an increasingly important role in the rapid and wide spread growth of iron and steel making capacity in this country.

Brazil has a large hot metal production through mini blast furnaces which use charcoal as a reducer and an energy source. These companies are not integrated and their final product is pig iron. The growth in this sector started in Brazil in the early 1970's as a result of the availability of cheap and good quality raw materials (native wood charcoal and granulated iron ore). In addition, the return of the investment in the construction of Mini Blast Furnace was very fast. Nowadays, this sector is consolidated and has a fundamental role in the national and international iron and steelmaking sector since Brazil is a major supplier of primary iron.

Plant availability as well as the perfection achieved in technology, made Mini Blast Furnaces a well accepted iron making route in China. The situation in India could be similar in future. Presently, about one fifth of China's total iron production is through about 55 - 60 MBFs. The furnaces in China use metallurgical coke, and the coke rates vary between 500 - 630 kg/thm. Extensive innovations have been introduced in the Chinese Mini Blast Furnaces including:

>> Injection of pulverized anthracite to the extent of 60 kg/thm, to bring down the coke rate by about 40 - 50 kg/thm.

>> Heat recovery from stove waste gas at 250-300^{O}C for increasing the hot blast temperature by about 80^{O}C.

>> Incorporation of self-preheating process stoves, enabling the generation of hot blast with a temperature of more than 1200^{O}C.

>> Dry cleaning of furnace gas.

<u>According to a published report some typical characteristics of raw materials used in Chinese Mini Blast Furnaces (MBFs) are given below:</u>

Chemical Analysis (%)	Iron Ore	Sinter
Fe	40-45	53-54
FeO	--	11-12
CaO	8	10.5-12
SiO2	13-14	8.5-9
Al2O3	2	---
MgO	1	2.5
S	0.03-0.04	0.03-0.04
P	0.02	---
Tumbler index, %	81-82	
Basicity	1.2-1.4	

A typical range of iron oxide feed done in Chinese MBF is as follows:

Size (mm)	Percent
+70	2
-70, +60	2
-60, +40	8
-40, +25	12
-25, +10	49
-10, +5	20
-5	7

The coke characteristics used in China are:

Ash = 13.5 - 14.0

V.M. = 1.1 - 1.4

Sulphur = 0.25 - 0.75

Moisture = 7.5 - 8.0

M10 index = 17

M40 index = 75

Size = 25 - 60 mm

Source : http://viewforyou.blogspot.in/2009/06/iron-making-in-mini-blast-furnace-mbf.html