Nitrogen plays a balancing role in micro-blast furnace ironmaking

Mini-blast furnace and ironmaking

Mini-blast furnaces (MBF) are often seen as miniature versions of conventional large blast furnaces (BF). These blast furnaces are ideally suited for small-scale operations. In fact， they are essentially the predecessors of the modern conventional final blast furnaces，so they have been in operation for a longer period of time. MBFs are located in many countries， but most MBFs are located in China， India， Brazil and Indonesia. The availability of plants and the perfection of this technology make MBFs the accepted route to ironmaking. In addition， most of the technologies designed， loaded and operated these days that have become the standard for today's modern large furnaces have also been adopted by MBFs.

The MBF is a vertical vertical shaft furnace with a crucible-type furnace chamber. A charge consisting of iron ore， coke or charcoal as reducing agent and fuel， and a melt，usually limestone or dolomite， is charged into the furnace top. The furnace works on the principle of a counter-flow reactor. As the charge descends through the shaft， it is preheated and pre-reduced by hot gases rising from the bottom of the furnace. These gases are generated by introducing hot air rich in oxygen through the blast port. The hot air burns the reducing agent and produces the reducing gases and the heat required for the reduction process that takes place in the furnace. The reduced charge material melts to form HM (liquid iron)， which is saturated with carbon and descends into the furnace chamber. The flux combines with impurities in the furnace charge to produce molten slag， which accumulates on top of the liquid iron in the furnace chamber. The liquid iron and liquid slag are periodically excavated from the furnace.

MBF shows flexibility and competitiveness， it is suitable for the production of basic and casting grade hot metal (HM). important features of MBF include simplicity and economy. other features of MBF are as follows.

Proven technology and equipment.

The design and equipment is simpler than conventional large BF.

It offers flexibility in ore roasting， which can range from 100% iron ore lumps to any mixture of iron ore lumps and agglomerates (sintered ore or pellets).

A range of reducing agents can be used， including low quality coke and charcoal.

The quality of the HM produced is similar to that of a conventional large BF.

It is similar in operation and maintenance to a conventional large incinerator， but is more flexible.

It has low capital costs and low equipment maintenance costs.

It is an economical and reliable source of HM for iron foundries and small steel mills，where it is used for forward integration with steelmaking plants consisting of induction furnaces/electric arc furnaces/energy optimization furnaces， and sometimes even with small basic oxygen furnaces.

As the name suggests， MBFs are small in size， with internal volumes ranging from 35 m3 to 600 m3. MBFs are typically low shaft furnaces， with effective furnace heights ranging from less than 12 m to around 20 m. MBFs are typically capable of productivity levels ranging from 2 tpd to well above 3 tpd.

Important features of MBFs

The MBF is a vertical shaft furnace with a vertical chimney superimposed on a crucible-like chamber. the MBF complex consists of the BF body， the hot blast furnace， the MBF top and charging system， several maintenance platforms， a storage system with several silos， a pouring platform and pouring chamber， a slag granulation system， a gas system， a BF gas purification system， a raw material and fuel supply system， a power supply and other utility The layout of the MBF is usually very compact and most of the facilities supporting HM production are installed very close to the furnace itself. Figure 1 shows a typical process flow diagram for an MBF with a dry gas cleaning unit.