Use & Benefits of Ore Based Metallics (OBM's)

Direct Reduced Iron

Hot Briquetted Iron

Pig Iron

Granulated Pig Iron

For detailed information about individual Ore Based Metallics, please refer to the respective Fact Sheets.

Conventional Use of OBMs

OBMs are typically used in EAF steelmaking operations due to their low content of residual metallic impurities. OBMs allow EAFs to achieve steel residual levels that are comparable to those achieved in BOF operations and as a result, EAFs are now capable of producing high-end steel products such as exposed auto body.

Many of the early captive DRI facilities were built due to the lack of conventional steel scrap materials to support a steelmaking operation. As the properties of DRI and HBI became better understood, these materials were used to dilute residuals in conventional scrap in order to meet more stringent steel chemistry requirements. The residual content in most OBMs is essentially zero.

The use of pig iron in the EAF was initially associated with operations that aimed to increase furnace productivity through the increased use of chemical energy in the EAF. Pig iron contains a large amount of carbon and lesser amounts of silicon and manganese. All of these elements can be oxidized in the steel bath to provide energy to the steelmaking process.

In some cases, OBMs may be used in order to take advantage of feedstock materials available locally. High residual scrap may be available at a discount in the local market. Through blending of these high residual materials with OBMs, the resultant steel chemistry is acceptable for the production of lower residual products.

Blending of OBMs

Many EAF operations have found great benefits from blending the different OBMs in the charge mix.

- Blending DRI, HBI and pig iron allows for flexibility in controlling slag generation which impacts iron yield losses to the slag.
- The overall Carbon/Oxygen/Iron balance can be manipulated to achieve shorter decarburization times while still achieving cost effective production of high-quality steels.
- Blending of OBMs can allow an experienced user to engineer a tap-to-tap cycle that is matched to desired production rates and the current market conditions. For example, when the market is weak the blend might contain more DRI/HBI in order to reduce material costs. In a strong market, the blend might favour a greater proportion of pig iron in order to take advantage of more chemical energy and higher productivity rates.

Other Benefits Attributed to OBMs

Known Chemistry: most OBMs have a known chemistry which allows the user to better plan the charge mix and to achieve more consistency with respect to melt-in chemistry. Clean iron units can be used to offset fluctuations in the properties of obsolete scrap thereby resulting in better operating consistency in the EAF

Consistent Carbon Recovery: recovery of charge and injection carbon in the EAF can range from 20-80%. Carbon recovery can be affected by the physical and chemical properties of the carbon and by EAF operating parameters and can vary widely within a single EAF. This variability affects the consistency of EAF operation and adds cost, increases energy and material consumption and negatively impacts the overall operations within the steel plant. By comparison, carbon contained in OBMs tends to be fully recovered to the EAF operation and is very consistent from heat-to-heat.

Ability to Continuously Charge: many OBMs such as DRI, HBI and granulated pig iron (GPI) are small enough that they can be continuously fed through the furnace roof, thus resulting in fewer bucket charges to the EAF. Every time the furnace is opened to make a bucket charge, energy losses of 10-20 kWh/ton arise. Thus, continuous charging helps to reduce energy consumption. Continuous charging of OBMs can also enhance slag foaming which further reduces energy consumption.

Benefit of High Density: due to their high density, OBMs can reduce the number of bucket charges when it is charged in the scrap bucket. Most OBMs are of a smaller size than cut grades of scrap and tend to fill the voids in the charge, thus greatly increasing the charge bulk density and reducing the number of charges required to make a heat. This results in energy savings and cost reduction.

Enhanced Slag Foaming: all OBMs contain carbon which will react in the EAF to form CO. When CO is generated in the slag, the slag will "foam". The volume of the slag can more than double when it foams and the result is that the electric arc is contained in the slag improving electrical efficiency and reducing energy losses in the EAF. DRI and HBI tend to result in natural slag foaming as they melt into the steel bath. Limited trials with roof fed GPI also indicate that slag foaming is greatly enhanced. Pig iron contributes a large amount of carbon to the steel bath when it melts in. When this carbon is blown out of the bath with lanced oxygen, CO is produced and enhanced slag foaming results.

Flexibility of Charge Make-up: the use of OBMs in the charge mix allows for a high degree of flexibility in the selection of charge materials. This can allow the EAF operator greater flexibility with regards to charge cost, optimizing charge density, charge chemistry and other factors conducive to improved EAF operations and lower operating costs.

Low Steel Nitrogen Levels: the N content in the steel tapped from the EAF is dependent on several factors, including N contained in feed materials, N that enters the steel and N that is removed from the steel bath. The higher the N content in the feed materials, the higher the N content of the liquid steel. OBMs tend to have extremely low N content (typically 10–30 ppm), DRI/HBI typically <20 ppm. Most steel scrap contains 80-120 ppm N. Thus, DRI/HBI help to dilute the bath N levels. DRI and HBI also promote slag foaming and protect the steel bath from being exposed to air. N can be added to the steel if the steel bath is exposed to air under the arc. N in the air will dissociate in the electric arc to form charged N ions that are quickly absorbed into the steel. If the arc is contained by the slag, N entering the steel bath will be minimized. Thus, good slag foaming operations are an effective way to minimize N pick-up in the EAF.

Pig iron is also very low in N content. When pig iron melts into the steel bath, it contributes a large amount of carbon. When oxygen is injected into the steel bath it will react with carbon to form CO. As CO bubbles rise through the steel bath, it can strip dissolved N and hydrogen from the steel bath. Therefore, if large quantities of carbon are blown out of the steel bath, very low levels of N in the steel will be achieved. Operations that use large quantities of pig iron in the EAF are capable of tapping steel with N contents <20 ppm.