

oxide, Fe_3O_4 . It decomposes steam at a red heat, liberating hydrogen and forming the black oxide, Fe_3O_4 . Iron forms two basic oxides, Ferrous, FeO , and Ferric, Fe_2O_3 . Iron dissolves in Hydrochloric Acid and dilute Sulphuric Acid, with the evolution of Hydrogen. Solutions contain Ferrous Salts. If Iron contains Carbide, the Hydrogen is mixed with Hydrocarbons. Dilute Nitric Acid dissolves Iron in the cold to Ferrous Nitrate, $\text{Fe}(\text{NO}_3)_2$ with the evolution of N_2O ; at a high temperature, to Ferric Nitrate, $\text{Fe}_2(\text{NO}_3)_6$ with the evolution of NO .

There are three commercial forms of Iron—Wrought Iron, Cast Iron and Steel—differing in properties and chemical composition. The first is nearly pure Iron; the second is Iron with varying quantities of Carbon and Silicon; the third has less Carbon than Cast Iron.

PREPARATION OF THESE COMMERCIAL FORMS

(1.) In the oldest method, Wrought Iron was at once obtained by heating the ore in a wind furnace with charcoal.

(2.) In the modern method, Cast Iron is the first product.

(a) The ore, if it is Siderite, FeCO_3 (clay is generally present as impurity), is first roasted, the Carbonic Acid CO_2 is driven off and Ferric Oxide Fe_2O_3 remains.

(b) The Ferric Oxide (or ore Hematite Fe_2O_3 , or Magnetic Iron ore Fe_3O_4) is placed with limestone and coal in a *blast furnace*.

(c) The Ferric Oxide, in its passage from the top to the bottom of the furnace, is reduced to a porous mass of Metallic Iron by the Carbonic Oxide, CO , proceeding from the lower layers of burning coal, $\text{Fe}_2\text{O}_3 + 3\text{CO} = \text{Fe}_2 + 3\text{CO}_2$. The heat here is not sufficient to fuse the Iron.

(d) "The clay, sand and other impurities of the ore, unite with the limestone to form a fusible silicate or slag, whilst the heated metal coming in contact with the Carbon (charcoal), unites at once with it to form a fusible compound, which runs down to the bottom of the furnace. This molten metal in passing through the hottest portion of the furnace, reduces the Silica, SiO_2 , with which it meets to *Silicon*, and combined with this and with the Carbon it forms Cast Iron."

(3.) Wrought Iron is obtained from Cast Iron by the processes of "*refining*" and "*puddling*."

(a) The Carbon, Silicon, Sulphur and Phosphorous, are burnt out by exposing the heated metal to a current of air in a reverberatory furnace.

(b) The melted Cast Iron becomes first covered with a coat of Oxide; gradually thickens, and is then rolled into balls; all the Carbon is oxidized to Carbonic Oxide CO , the Silicon to Silica SiO_2 (which unites with the Oxide of Iron and forms a fusible slag). P. and S. are also oxidized by this process.

(c) The ball is hammered to give the metal coherence and to squeeze out the liquid slag, and the mass is afterwards rolled into bars and plates.

(4.) Steel is formed when bars of Wrought Iron are heated to redness for some time in contact with charcoal.

(a) In the Bessemer process, the Carbon and Silicon are burnt out by passing a blast of atmospheric air through the molten metal. Enough pure Cast Iron is now added to this Wrought Iron to convert the whole mass into Steel.