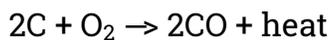


## The World-Changing Technology That is Iron and Steel

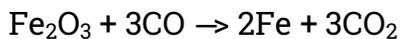
Although about 5% of the earth's crust consists of iron, it does not occur as pure iron, but rather in chemical compounds such as iron oxide. Four thousand years ago, the only way to obtain metallic iron was from a meteor. Around 2000 BC people started finding ways to separate the iron out of iron ore. (Ore is a mineral source of a metal.) This was done by combining iron ore with carbon sources such as charcoal, at high temperatures (1,150° C (2,100° F)).

At first, various small-scale methods were used for smelting, or obtaining iron from iron ore. Around the year 1500, blast furnaces were developed. With some modifications and increases in size, blast furnaces are still the main method of smelting iron.

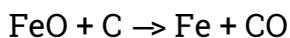
The blast furnace is a huge chemical reaction. Carbon in the form of charcoal or coke (made from coal) burns near the bottom of the furnace in the "blast" of air being forced into the furnace:



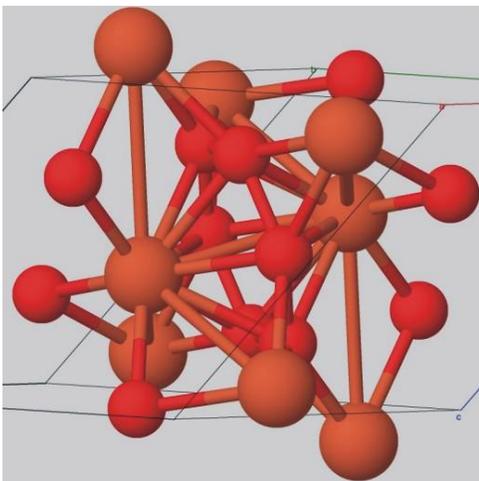
The heat generated by the reaction is carried upward by the rising gases and transferred to the descending "charge" of iron ore and additional charcoal or coke. The carbon monoxide (CO) in the gas then reacts with iron oxide in the stack, producing metallic iron and carbon dioxide (CO<sub>2</sub>):



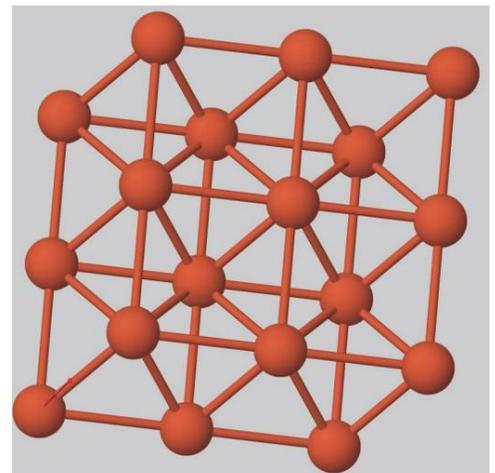
Not all the oxygen originally present in the ore is removed like this; some remaining oxide reacts directly with carbon at the higher temperatures encountered in the furnace:



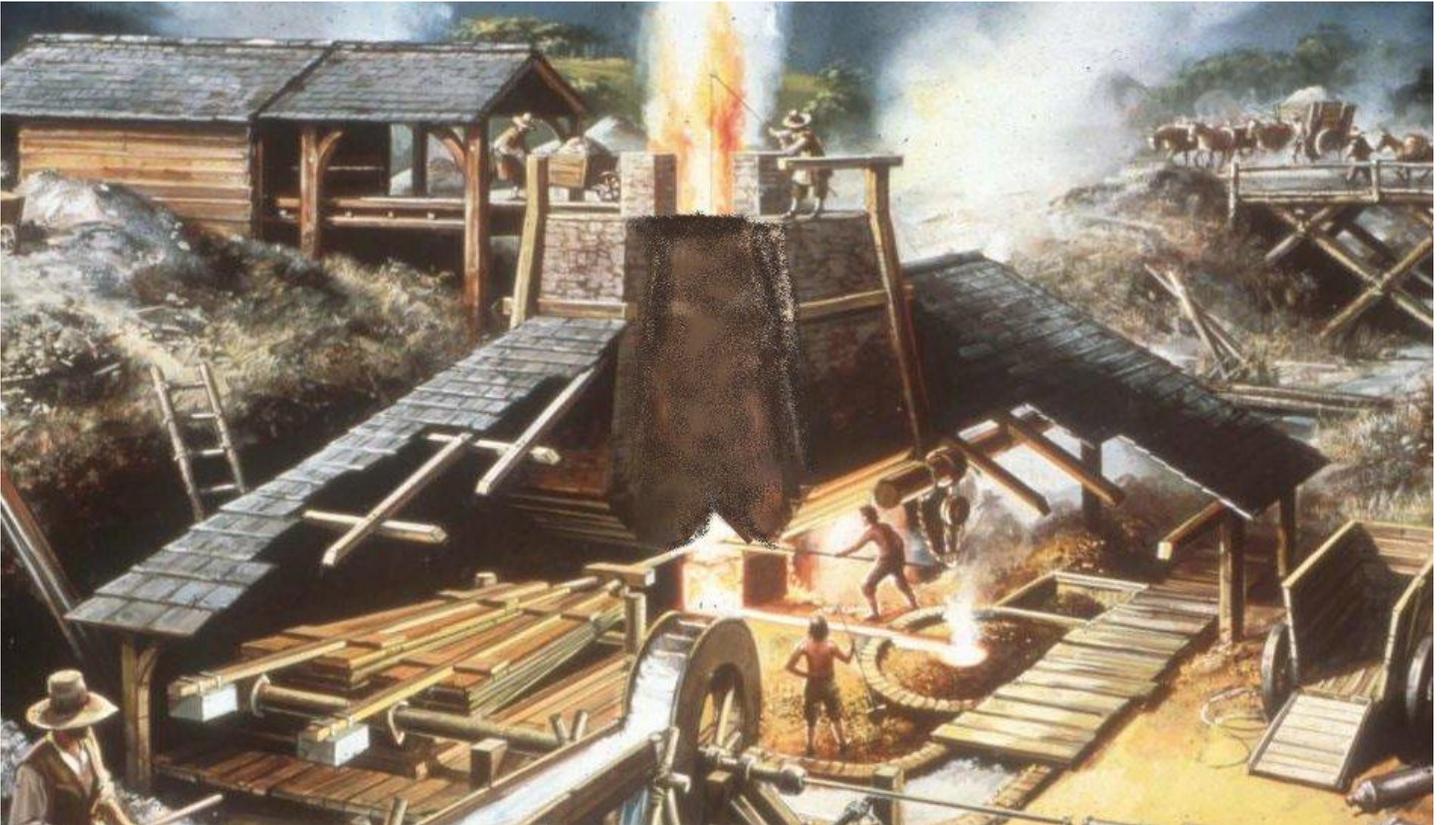
Softening and melting of the ore takes place here, droplets of metal and impurities, called slag, forming and trickling down through a layer of charcoal or coke to collect on the hearth<sup>1</sup>.



← hematite  
+  
carbon and oxygen  
yields  
carbon dioxide  
+  
iron →



<sup>1</sup> <https://www.britannica.com/technology/iron-processing/Iron-making>



"Whenever we visit an iron furnace, it must be remembered that countless individuals lived, worked, and sometimes died at these sites. Iron furnaces ran twenty-four hours a day, seven days a week, for many months on end. The roar and fire heat were continuous, while the furnace cast an eerie glow that could light up the night for a considerable area. Smoke from the charcoal production hung in the air, while the hills and dales surrounding the furnace were stripped bare of trees. Being near a furnace town meant co-existing with a living inferno - a terrible beast, partly tamed, that would produce the desired transformation of ore to iron at a price - one paid in earth and blood<sup>2</sup>."

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<sup>2</sup> <http://www.oldindustry.org/iron.html>