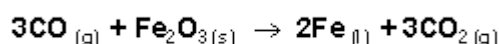
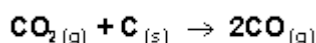
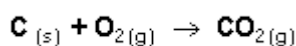


Iron sands were first noticed on the West Coast of New Zealand in 1841. It was known at this time that iron could be obtained from such iron sands. Up to this time iron was obtained from such iron ores in a blast furnace. In a blast furnace the iron sand (iron ore) is heated with charcoal or coke. The carbon in the coke or charcoal reacts with the oxygen in the iron sands leaving just iron.

Carbon in coke + iron ore (iron oxides) + heat → carbon oxides + iron. This is done in a series of chemical reactions, see below.



1

As well as iron oxides in the ore there can be other elements and compounds called impurities. When the iron sands are heated in a blast furnace these other impurities melt and float on top of the iron. This unwanted stuff is known as slag.

This traditional method of using a blast furnace though did not work with these New Zealand iron sands, as it did with other iron sands around the world. This was because the New Zealand iron sands contained high amounts of titanium. This titanium was in the form of titanium oxide. In a blast-furnace, the titanium (IV) oxide (TiO₂) in titanomagnetite ore is reduced to titanium nitride (TiN), titanium carbide (TiC) and the titanium (II) oxide (TiO). These products have high melting points and form a paste that blocked any holes that were used to remove either the molten iron or the slag and everything in the blast furnace became clogged up. The last attempt at using a blast furnace was between 1914 and 1919 by J.A. Heskith for the New Zealand iron ore smelting and manufacturing company. He noted that "titaniferous accretions built up in the hearth and gradually prevented tapping." Again problems occurred with titanium oxides clogging up the holes from which slag and purified iron was removed. The trick then was to come up with some method that made the iron and hence steel but prevented the titanium compounds with the high melting points from forming.

1

2

The method developed involved using a rotary kiln followed by an electric melter. Both of these processes involved the reduction of iron oxides, either directly or indirectly.

3

A primary concentrate is prepared. This is done using magnetic means and preheating with limestone and coal. This primary concentrate is fed into the rotary kiln. At Glenbrook there are 4 of these, and they are 65 metres long. This process is carried out at a temperature lower than what the reactions that form the titanium compounds occur at. This way this slag that clogs the holes up that are used to "tap off" the iron and slag do not become blocked. Once the more purified concentrate that has been tapped off is poured into the electric melters the temperature can be increased. Further reduction occurs in the melters (electric arc furnaces). From here any other elements that are still present as impurities are removed. This is done by controlled blowing of oxygen over the concentrate for oxidation. Once oxides are formed they can be removed. Now that almost pure iron has been obtained it can be made into various steel products. These products include hot and cold rolled steel, colour steel, zinc lume, pipe and hollow sections of steel.

3