SUBJECT - CHEMISTRY
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TOPIC : CHEMISTRY OF MANGANES (Mn)

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Important ores of Mn : The most important ores of manganese are:

(1) Pyrolusite : MnO_2

(2) Braunite : Mn_2O_3

(3) Hausmannite : Mn_3O_4

Extraction of Mn : Manganese is generally obtained from pyrolusite or hausmannite by reduction with aluminium (aluminothermic process). Since manganese dioxide gives an explosive reaction with finely divided aluminium, it is first Converted into manganomanganic oxide (Mn_3O_4) by heating it to redness. This is then reduced on heating with aluminium powder in a fire clay crucible embedded in Sand.

$$3Mn_3O_4 + 8Al \longrightarrow 9Mn + 4Al_2O_3$$

Refining of Manganese : The metal is purified further by an electrolytic process using $MnCl_2$ or $MnSO_4$ Solution as the bath. The impure metal is made the anode while an iron rod in Contact with flowing mercury is made the cathode. The amalgam of manganese Thus obtained is distilled in vacuum at 250°c to remove the mercury.

physical properties : It is a grey metal and exists in three allotropic forms which are stable over various temperature ranges. It is hard and brittle. It melts at a fairly high temperature of 1245°c and boils at 2150°c It is paramagnetic.

Chemical properties:

(1) Reaction with non-metals: Mn is not so reactive towards non-metals at ordinary temperatures. However when heated, it reacts vigorously. Thus it combines with fluorine yielding The fluornes MnF_2 and MnF_3. It burns in chlorine to give the chloride $MnCl_2$ and combines with nitrogen to give the nitride Mn_3N_2. It combines with oxygen to give various oxides, with Sulphur, it forms manganese Sulphide (MnS). It also combines with carbon at the temperature of carbon are forming manganese Carbide (Mn_2C). i.e

$$Mn + F_2 \xrightarrow{\Delta} MnF_2$$
$$Mn + F_3 \xrightarrow{\Delta} MnF_3$$
$$Mn + Cl_2 \xrightarrow{\Delta} MnCl_2$$
$$Mn + N_2 \xrightarrow{\Delta} MnN_2$$
$$Mn + S \xrightarrow{\Delta} MnS$$
$$Mn + C \xrightarrow{\Delta} MnC$$

2 Reaction with acids:

The oxidation potential of the reaction is 1.05 volt

$$Mn \longrightarrow Mn^{2+} + 2e^-$$

Manganes is therefore, fairly electropositive. It dissolves readily in dilute acid evolving hydrogen.

$$Mn + 2H^+ \longrightarrow Mn^{2+} + H_2\uparrow$$

3 Action of water

$$Mn + 2H_2O \longrightarrow Mn(OH)_2 + H_2\uparrow$$

Uses: About 80 percent of manganese produced is used in the manufacture of manganese steel. Manganese when added to steel performs two functions. If added in small amounts, it acts as a cleansing agent in removing oxygen and sulphur forming manganese oxide and manganese sulphide, which can be easily eliminated. This improves the strength of the final product. When added in large amounts up to 14 percent, it imparts special hardness and toughness to the steel. ordinary steel contains from 0.6 – 1.5 percent of manganese, the toughness increases with increase in the manganese content.