SUBJECT - CHEMISTRY

CLASS - BSc(Hons) PART-I

PAPER: I

GROUP: A

TOPIC: CARBIDES

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Carbides

Compounds of Carbon and a less electronegative element are called Carbides. This excludes Compounds with N, P, O, S and the halogens from this Section. Carbides are of Three main types;

1. Ionic or Salt-like
2. Interstitial or metallic
3. Covalent

Salt-like Carbides

It is Convenient to group these depending on whether the structure Contains C, C_2 or C_3 anions.

Beryllium Carbide Be_2C is a red Solid and may be made by heating C and BeO at 2000°C Aluminium Carbide Al_4C_3 is a pale yellow Solid formed by heating the elements in an electric furnace. Be_2C Contains individual C atoms/ions. but the structure of Al_4C_3 is Complex. It is misleading to formulate the structure as $4Al^{3+}$ and $3C^{4-}$ as such a high charge Separation is unlikely. Both Be_2C and Al_4C_3 are called methanides because they react with H_2O. yielding methane.

Carbides with a C_2 unit are well known. They are formed mainly by the elements in Group 1 ($M^I_2C_2$) GROUP 2($M^{II}C_2$): The Coinage metals(Cu, Ag, Au): Zn and Cd: and Some of the lanthanides (LnC_2 and $Ln_4(C_2)_3$). These are all Colourless ionic Compounds and Contain the Carbide ion $(-C\equiv C-)^{2-}$ By far the most important Compound is CaC_2. This is made Commercially by strongly heating lime and coke.

$$CaO + 3C \longrightarrow CaC_2 + CO \quad \Delta H = +466 KJ\,mol^{-1}$$

Interstitial Carbides

These are formed mostly by transition elements and some of the lanthanides and actinides. The Cr, Mn, Fe Co and Ni groups form a large number of carbides with a wide range of stoichiometries. They are typically infusible or are very high melting and are very hard. for example. TaC has a melting point of 3900°C and is very hard (9-10 on Mohs Scale of hardness) and WC is also very hard. Both are used to make cutting tools for lathes. Interstitial carbides retain many of the properties of metals. They Conduct electricity by metallic Conduction. and have a lustre like a metal.

Covalent Carbides

SiC and B_4C are the most important. Silicon carbide is hard (9.5 on Mohs' scale). infusible and chemically inert. It is widely used as an abrasive called carborundum, and about 300000 tonnes are produced annually by heating quartz or sand with an excess of coke in an electric furnace at 2000 - 2500°C

$$SiO_2 + 2C \longrightarrow Si + 2CO$$
$$Si + C \longrightarrow SiC$$

SiC is very unreactive. It is unaffected by acids (except H_3PO_4) but it does react with NaOH and air, and with Cl_2 at 100°C

$$SiC + 2NaOH + 2O_2 \longrightarrow Na_2SiO_3 + CO_2 + H_2O$$
$$SiC + 2Cl_2 \longrightarrow SiCl_4$$