"ORGANOMETALLIC COMPOUNDS"

Introduction: The compounds having at least one carbon to metal bond are known as organometallic compounds. This bond can be either a direct carbon to metal bond (σ-bond) or a metal complex bond (π-bond). compounds containing metal to hydrogen bonds as well as some compounds containing non-metallic (metalloid) elements bonded to carbon are sometimes included in this class of compounds. Some common property of organometallic compounds are Low M.P, insolubility in water, solubility in ether and related solvents, toxicity, oxidisability and high reactivity.

possibly the 1st scientist to synthesize an organometallic compound was Edward Frankland, who prepared diethyl zinc by the reaction of ethyl iodide (C_2H_5I) with 'Zn' metal

$$2C_2H_5I + 2Z \longrightarrow CH_3CH_2ZnC_2H_5CH_3 + ZnI_2.$$

In organometallic compounds, most p-electrons of transition metals confirm to an empirical rule called 18-electron rule. This rule assumes that the metal atom accepts from its ligands the number of electrons needed in order for it to attain the electronic configuration of the next "noble gas". Hence it assumes that the Valence shell of the metal atom will contain 18 electrons.

Applications of ~~Grignard~~ organometallic Compounds

(1) Use as reagents or catalysts: - Organometallic compounds are very useful as catalyst or reagents in the synthesis of organic compounds such as pharmaceutical products. one of the major advantages of organometallic compounds as compared to organic and inorganic compounds is their reactivity. A second advantages is the high reaction selectivity which is often achived via the use of the organometallic catalysts

Examples → ordinary free radical polymerization of ethylene yields a wavy low-density polyethylene but the use of special organometallic catalyst produces a more ordered linear polyethyle with a higher density with high M.P

and greater strength. A third advantages is the many of this wide range of compounds are stable and many of these are found uses in medicine and pesticides. A fourth advantages is the recovery of pure compounds are stable and pure metal isolation from a pure sample of organometallic compounds containing the desired metal can be easily obtained.

Some of the reactions organometallic compounds used as catalyst

① In alkene hydrogenation Wilkinson's catalyst $(Ph_3P)_3RhCl$ is used, which is an organometallic compound

② In the hydroformylation reaction i.e the reaction of alkene with CO and H_2 catalyzed by both cobalt and Rhodium salts of the organometallic compound i.e $Co_2(CO)_8$ mainly used

③ polyalkenes is the most common and useful class of synthetic polymer and are often prepared by the use of organometallic catalysts - i.e mostly ziegler-Natta catalyst $[TiCl_4 + (C_2H_5)_3Al]$

④ organolithium, organomagnesium, organoaluminium compounds are highly basic and highly reducing. They catalyze many polymerization reactions but also be useful in stoichiometry.

⑤ Use as Grignard Reagents :- one of the most commonly used classes of organometallic compounds is the organomagnesium halides or Grignard reagents ($RMgX$ or $ArMgX$) when R and Ar represents the alkyl and aryl groups respectively and 'X' is the halogen atom. It is generally used extensively in synthetic organic chemistry. They are usually prepared by the reaction of 'Mg' metal with alkyl or Aryl halides. other commonly used organometallic compounds are the organolithium and organozinc compounds.

⑥ Antiknocking agent :- Tetraethyl lead (TEL) previously was combined with gasoline as an antiknocking agent. Due to the toxicity of Lead it is no Longer used and it has been replaced by other organometallic compounds

such as 'ferrocene', methylcyclopentadienyl magnesium tricarbonyl (MMT).

(5) Manufacture of CH_3COOH :- The Monsanto process utilizes a rhodium-carbonyl complex to manufacture acetic acid from CH_3OH and CO industrially.

Also Ruthenium-BINAP complex is used in the production of fine chemicals and Pharmaceuticals.

(6) some other applications :- (i) Metal co-ordination and organo-metallic compounds are used in a no. of advance applications such as catalysis in chemical manufacturing & also used as an 'automobile catalyst converter'.

(ii) Organometallic materials are key componets of biosensers for clinical, environmental, agriculture and biotechnological applications and also microelectronics (organic Light-emitting diode applications)

(iii) organometallic compounds used as an active Pharmaceutical Ingredients in medicines specially as an anti-cancer.

Ex. cis-platin $[cis-PtCl_2(NH_3)_2]$.