

## Transition metal-alkyl and -aryl complexes

Organometallic Compounds are Organic Compounds of metals, with metal-carbon bond. Their chemistry functions as a bridge between organic and inorganic chemistry. They possess ionic or covalent, localised or delocalised bonding between one or more carbon atoms of organic group or molecule and transition metals or lanthanides or actinides or main group metal atoms. Organic compounds are hydrocarbons or their derivatives, hence organometallic compounds are generally those compounds which have one or more hydrocarbon group(s)/radical(s) directly linked to metal atom. Therefore, metal-carbides, metal-carbonates, metal-cyanides, metal-carboxylates, metal-carbonyls, should not be included in organometallic compounds. Metal carbonates and metal carboxylates are not organometallic compounds, as they do not have metal-carbon bond. While, although metal-carbides and metal-cyanides have metal-carbon bond, they are not organic compounds.

Compounds of metals with alkyl radicals are called 'Metal-alkyls', while those with aryl radicals are known 'Metal-aryls'.

**Nomenclature:** Names of metal-alkyls and metal-aryls are derived as, first naming the ligands in alphabetic order followed by the name of the metal with oxidation state in parenthesis, in reference to Werner's and IUPAC rules of naming. For example:  $[\text{Zn}(\text{C}_2\text{H}_5)_2]$  will be Diethyl Zinc(II) and  $[\text{Me}_3\text{PtCl}]$  is Chloro trimethyl Platinum(IV).

**Classification and Types:** On the basis of nature, bonding and structure, organo-transition metal compounds are classified into following three groups:

1. Ionic
2.  $\sigma$ -Bonded covalent
3.  $\pi$ -Bonded covalent compounds

Ionic Organometallic compounds are generally formed by strongly electropositive s-block metals, though alkyl and aryl compounds of Mn, Zn and Eu also show sufficient ionic property. Here hydrocarbon radical is present in the form of carbo-anion and is bond with non-directional electrostatic forces. These compounds resemble with alkali and alkaline earth halide and hydrides.

Transition metal organometallic complexes can be divided into two broad groups, for convenience:

- (a)  $\sigma$ -bonded organometallics ( $\sigma$ -hydrocarbyls): Here, one single carbon atom of the ligand is linked directly to the metal through  $\sigma$ -bond.
- (b)  $\pi$ -bonded organometallics: These are formed between metal atom and ligands such as CO, RNC, :CRR<sub>1</sub>, CR, RC≡CR and other unsaturated types.