ORGANOMETALLIC'S SYNTHESIS & APPLICATION

Module 1
B.Tech. I Year Students

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Course Contents:

- Introduction
- Classification of Organometallics
- Synthesis's of Organometallic's reagent
- Synthetic Application of Organometallic's reagents

What is Organometallic's ?

Compounds that contain a metal-carbon bond, R-M (alkali metal or transition metals) are known as "*organometallic*" compounds. Organometallic compounds of Li, Mg (Grignard reagents) are amongst some of the most important organic reagents. Organometallic compounds provide a source of nucleophilic carbon atoms which can react with electrophilic carbon to form a new carbon-carbon bond. This is a very important for the synthesis of complex molecules from simple starting materials.

Organometallics compounds are name as:

- **Alkyl metal (Me.Li, MethylLithium)**
- **Alkyl metal halide (CH3MgBr, Methylmagnesium bromide)**
- **Organometallic are usually kept in solution in organic solvents due to their very high reactivity (especially with H2O, O2 etc.)**
- **Organolithiums and organomagnesiums have a σ bond between a C atom and the metal: C-M**
- **These are very polar, covalent bonds due to the electropositive character of the metals.**

Classification of Organometallic Compounds.

There are several basic set to classify the Organometallics compound. The most important organometallic compounds considered here are those containing M-C bond, excluding Metal carbonyls (M-CO), Metal Cyanide (M-CN) and Metal Carbide (M-C). A useful classification is based on M-C type of bonds.

- **Ionic Organometallic's (Group 1 elements)**
- **Covalent Organometallic's (Group 12,13, 14 & 15 elements)**
- **Electron Deficient Organometallic's (Li, Be, B, Mg etc.)**

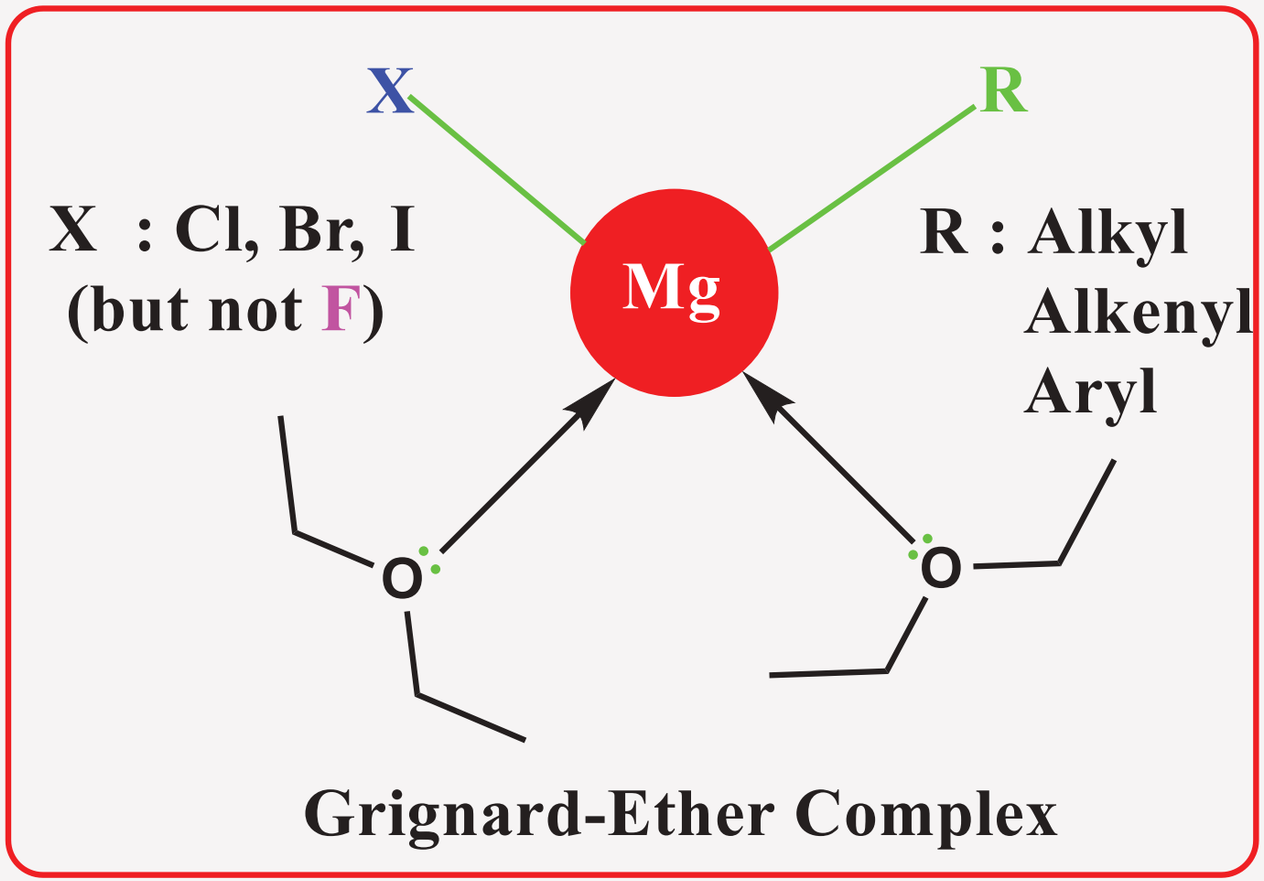
There is no such thing as electron deficient compounds, only theory deficient chemists.

ORANOMAGNESIUM REAGENTS / GRIGNARD REAGENTS

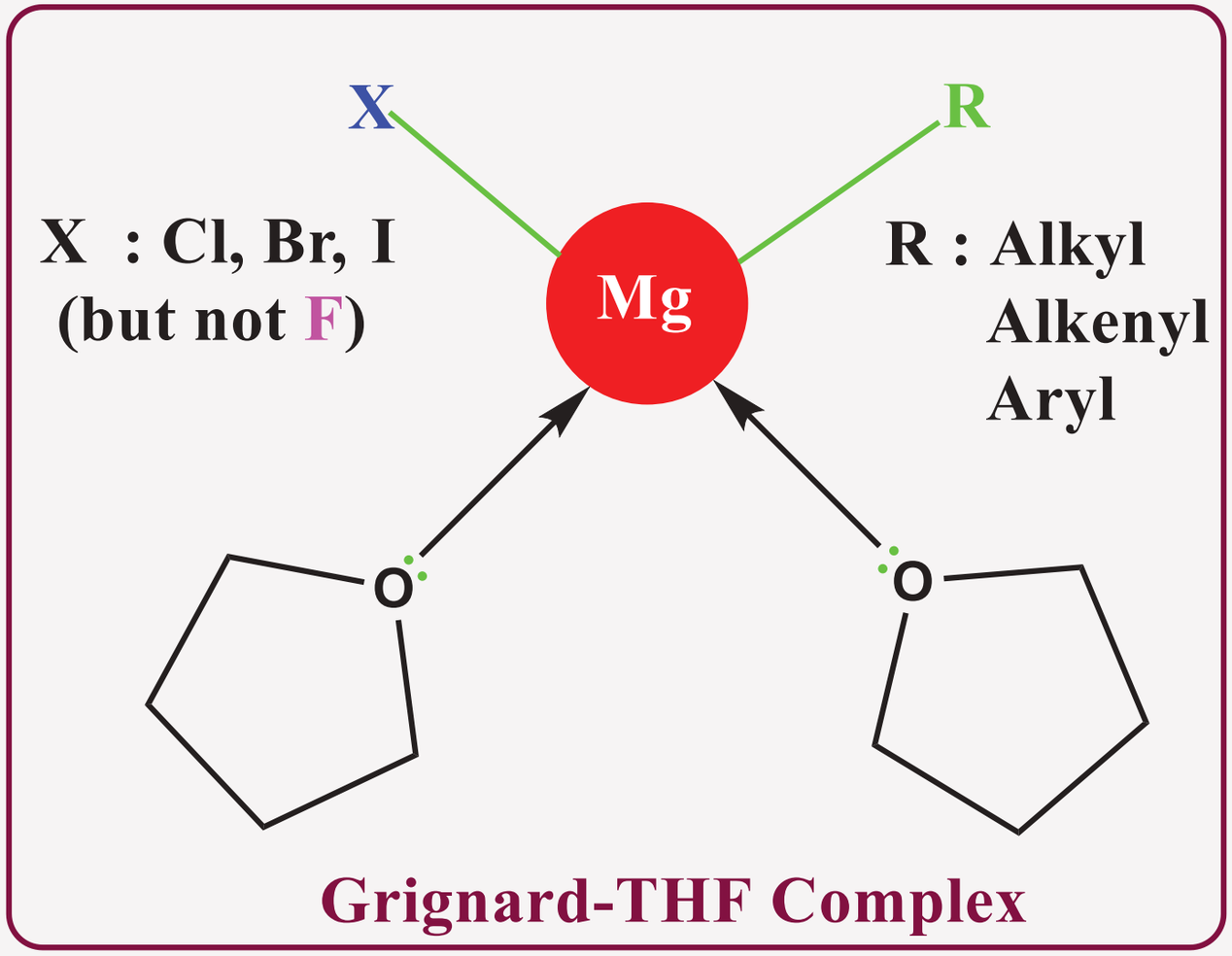
During the past 108 years the Grignard reagents probably have been the most widely used organometallic reagents. Most of them are easily prepared in ethereal solution (usually diethyl ether or, since the early 1950s, THF) by the reaction of an organic halide with metallic magnesium.

The importance of this contribution to synthetic chemistry was recognized very early, and for his discovery Grignard was awarded a Nobel Prize in Chemistry in 1912.

STRUCTURE OF GRIGNARD REAGENT



STRUCTURE OF GRIGNARD REAGENT



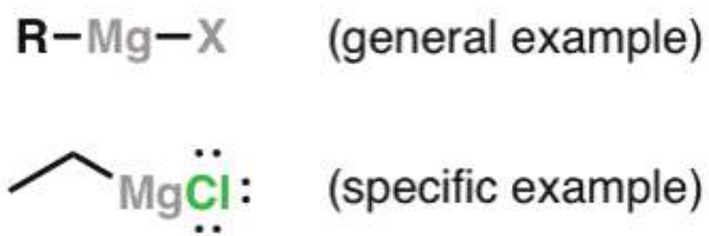
STRUCTURE OF GRIGNARD REAGENT

- **The Grignard reagent is a highly reactive Organomagnesium compound formed by reacting a haloalkane with magnesium in an ether/THF (tetrahydrofuran)solvent.**

- **Pure Grignard reagents are extremely reactive solids. They are normally handled as solutions in solvents such as diethyl ether or tetrahydrofuran; which are relatively stable as long as water is excluded. In such a medium, a Grignard reagent is invariably present as a complex (look previous two slides) with the magnesium atom connected to the two ether oxygens by coordination bonds.**

What is Grignard Reagent ?

A Grignard reagent or Grignard compound is a chemical compound with the generic formula R–Mg–X, where X is a halogen and R is an organic group, normally an alkyl or aryl. Two typical examples are methylmagnesium chloride Cl–Mg–CH3 and phenylmagnesium bromide (C6H5)–Mg–Br. They are a subclass of the Organomagnesium compounds.

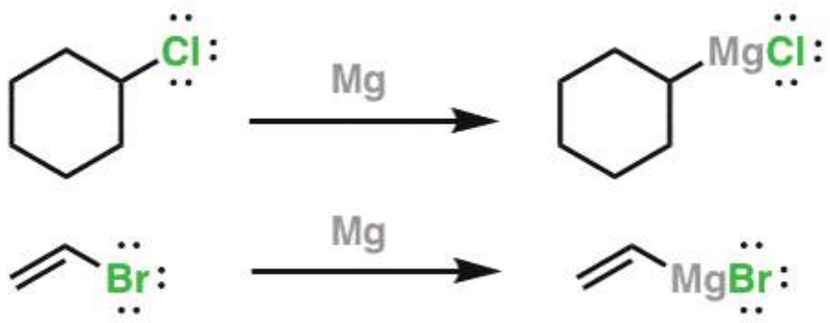


Grignard Reagents

PREPARATION OF GRIGNARD REAGENTS

Grignard reagents are made through the addition of magnesium metal to alkyl or alkenyl halides using anhydrous ether or THF as solvent. The halide can be Cl, Br, or I (not F).

Example 1: Formation of Grignard reagents



Grignards can be formed from alkyl or alkenyl chlorides, bromides or iodides (never fluorides)

PREPARATION OF GRIGNARD REAGENTS

Point to Remember:

- **Organomagesiums are formed by the reaction of alkyl halides with magnesium metal.**
- **Typical solvents are normally anhydrous diethyl ether or tetrahydrofuran.**
- **The alkyl group can be primary, secondary or tertiary.**
- **Halide reactivity : I > Br > Cl**
- **R can be alkyl, vinyl or aryl.**

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THANK YOU