

UG2 part I

INORGANIC chemistry

Organometallic Compounds

The compounds which contain direct bond between carbon atoms of organic group are bound to metal atom.

These compounds are different from metalloorganics which refers to metal-containing compounds lacking direct metal-carbon bonds but which contain organic ligands.

Examples of such organometallic compounds include all Grilman reagents, which contain lithium and copper.

Tetracarbonyl and ferrocene are examples of organometallic compounds containing transition metals.

Other examples include organomagnesium and all Grignard reagents including organolithium.

Organometallic chemistry

It is the study of organometallic compounds.

Organomagnesium compounds

Magnesium compounds of which the Grignard reagents are best known, are most likely the widely used of all organometallic compounds.

They are employed for the synthesis of alkyl and aryl compounds of other elements as well as for a host of organic synthesis.

- Beryllium makes a range of organometallic compounds, their hazardous nature has limited their study.

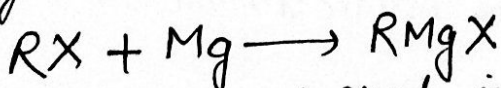
Example of Organomagnesium compound

Grignard Reagents

Grignard reagents are named after Victor Grignard. Haloalkanes and other compounds with the halogen atom bonded to either sp^3 hybridized or sp^2 hybridized carbon atoms (aryl and vinyl halides) react with magnesium metal to yield organomagnesium halides called Grignard reagents.

Preparation

The general synthesis of a Grignard reagent involves the reaction of an alkyl halide (RX , where $X = Cl, Br$) with magnesium metal in suitable ether solvent.

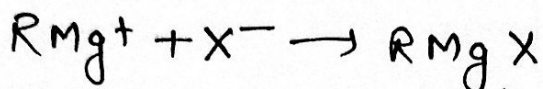
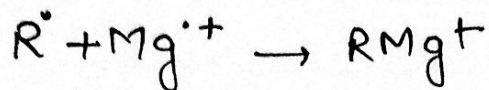
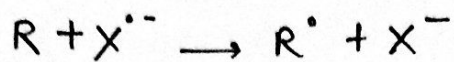
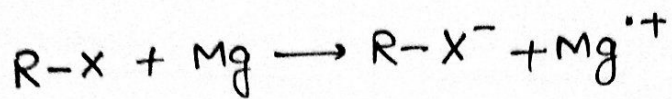


The suitable solvent used in this reaction are diethyl ether, tetrahydrofuran, tetraethylamine, dimethyl sulphide, etc.

Mechanism

Grignard reagents form via the reaction of an alkyl or aryl halide with magnesium metal. The reaction is conducted by adding organic halide to a suspension of magnesium in an etherial solvent, which provides ligands required to stabilize the organomagnesium compound.

Empirical evidence suggests that the reaction takes place on the surface of the metal. The reaction proceeds through single electron transfer. In the Grignard reagent formation reaction, radicals may be converted into carbanions through a second electron transfer.

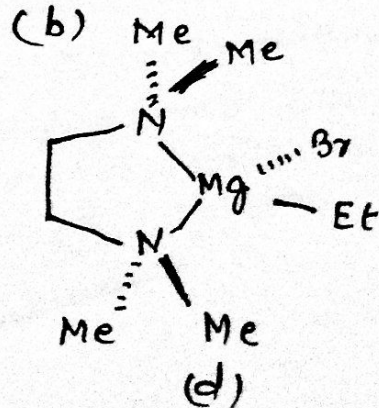
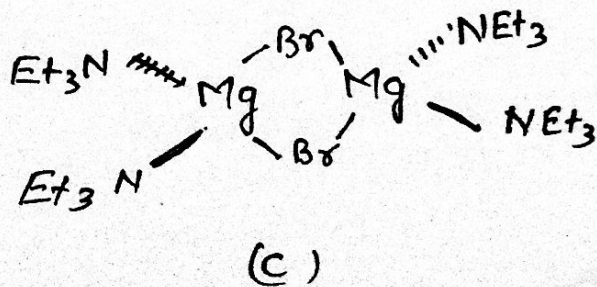
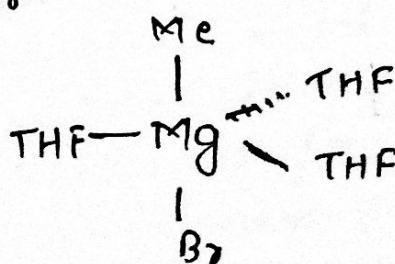
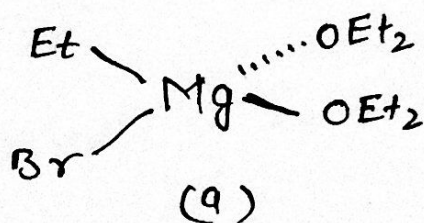


In general the alkyl halide is added to an excess of magnesium suspended in the solvent.

Structure

The solid structure of Grignard reagents is controlled by the presence and identity of the solvent used in the synthesis. In this regard the size and the basicity of solvent is important.

For example, the structure of $EtMgBr$ crystallized from diethyl ether exists as a 4-coordinate monomer (fig a), while the use of the sterically less demanding THF results in a 5-coordinate monomeric structure (fig-b). In contrast, the use of triethylamine yields a dimeric bromide bridged structure (fig c) and the use of a chelate bidentate amine gives a structure (fig d) similar to that observed with diethyl ether.



Molecular structure of $EtMgBr$ in (a) diethyl ether
 b) THF c) triethyl amine and d) tetramethylethylenediamine (TMED)