M.Sc Sem – 1 (Chemistry)

Lecture – 1 ; Gattermann-Koch reaction

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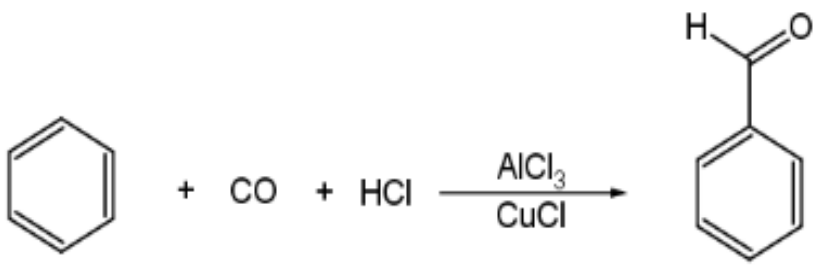
Gattermann - Koch Reaction : -

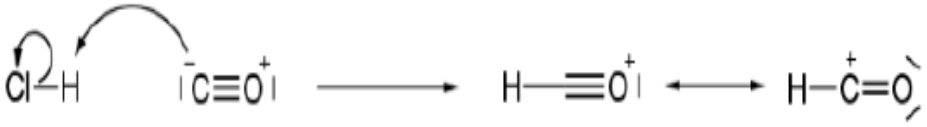
It is the method of synthesizing aromatic aldehydes by the action of a mixture of CO and HCl on aromatic hydrocarbons. The catalyst is aluminum chloride or aluminum bromide, with a small amount of monochloride of copper. The overall aim of the reaction is to attach a formyl group (-CHO group) to an aromatic system. An example of the Gattermann – Koch reaction is given below.

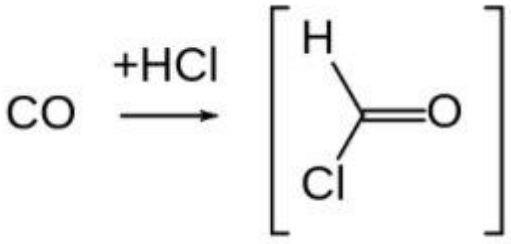


Mechanism of Gattermann – Koch Reaction

Step 1 :-

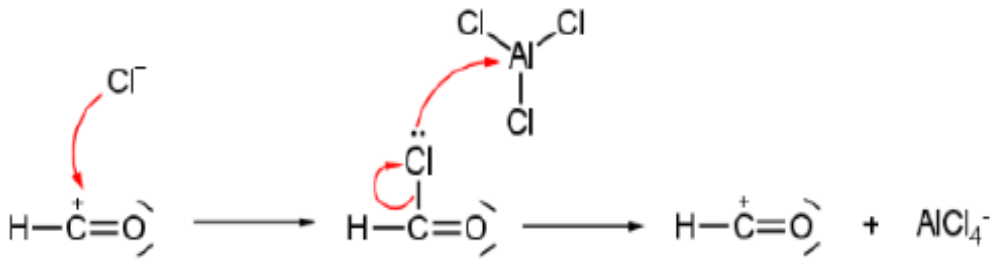
The first step of the Gattermann Koch reaction mechanism is the generation of the reactive species which can later be used to react on the aromatic ring. Since carbon monoxide acts as a lewis base, it can accept a proton from the hydrochloric acid. This results in a positively charged molecule which has different resonance structures. One such resonance structure displays a positive charge on the carbon, explaining the reactivity of the hybrid. This species can act as an electrophile while reacting with the aromatic ring. However, it is more likely to be the target of a nucleophilic attack from the chloride ion in the hydrochloric acid.





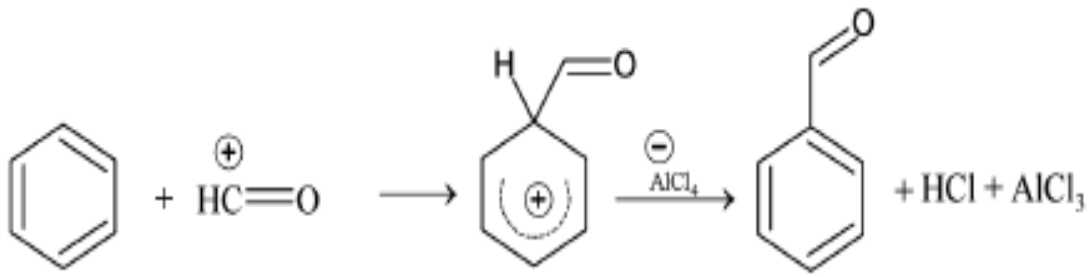
Step 2 : -

When a Lewis acid (aluminium chloride) is added, it easily removes a chloride ion from the species. The species now reverts back to the reactive formyl cation.



Step 3 : -

An electrophilic aromatic substitution occurs at the aromatic ring. The aromatic ring acts as a nucleophile and donates an electron pair to the formyl cation. The temporary loss of aromaticity is quickly restored by the expulsion of a proton.



In short, the mechanism of Gattermann-Koch reaction can be written as follow.