

The most popular organometallic reagent in early of the twentieth century is Grignard reagents. This organomagnesium reagent opened a broad window in synthetic organic chemistry. It was the most effective reagent for C-C bond formation reaction and thus the discoverer received the Nobel Prize in 1912. Later on Georg Wittig reported another C-C bond formation reaction which converts the carbonyl compound to olefins. However the reaction facing some difficulties in the sense of yield, risks, greenness, air sensitivity, purification, lots of synthetic steps etc. Thus transition metal catalyst comes into picture of organic synthesis in late twentieth century. Transition metals such as palladium with different ligands acts as efficient catalyst for C-C bond formation reaction during the course of organic synthesis. The Suzuki reaction, Sonogashira coupling reaction, Heck coupling reaction etc. These type of reaction are very much green in the sense of atom economy, toxicity, sustainability. Most of these reactions are less sensitive towards air and moisture and have high yield, and thus the reaction is easier to handle .Furthermore most of cases, the catalysts can be regenerated. More interestingly it is found that the C-C coupling reaction is very broad in the sense the coupling can be done with Sp^2C-Sp^2C ; $Sp^2C- SpC$, $SpC -SpC$, and sometimes between $Sp^3C- Sp^3C$. Another very interesting transition metal catalyst is the Rh based N- heterocyclic complex, which is being used in a lots of organic transformation in last few decades such as alkene metathesis reaction. Apart from the use in organic transformation, the metal based N- heterocyclic complexes (as a composition of drug) are being used in Cancer cell proliferation treatment in very recent years.

The Ruthenium based catalyst such as Grubbs 1st generation catalyst, Grubbs 2nd generation catalyst, Hoveyda-Grubbs catalyst open a new window in organic reaction such as alkene metathesis reaction. In the last decades the

excellent discovery by two European scientists Peter Ludwig Pauson and Ihsan Ullah Khand is the [2+2+1] cycloaddition reaction for the synthesis of five membered ring which is very difficult to prepare in any other methods. Moreover the beauty of transition metal catalyst is that, it reduces the number of steps during the organic synthesis, as for example if we look into the synthetic route of Ibuprofen (once most popular antipyretic medicine) we can see that the number of steps are avoided by using the Pd(0) based catalyst which is greener also(the most advanced route so far)

And thus the organic chemists basically organic synthetic chemists are very much eager towards these transition based catalysts due to its broad utility in organic synthesis and methodology; and sometimes we are trying to replace the concerned transition metal by another of the same group to improve its catalytic activity..