BETA-HYDRIDE INSERTION AND ELIMINATION

A coordinated organic carbonyl is also electrophilic.

Figure MI4.1. Activation of an organic carbonyl by a metal ion.

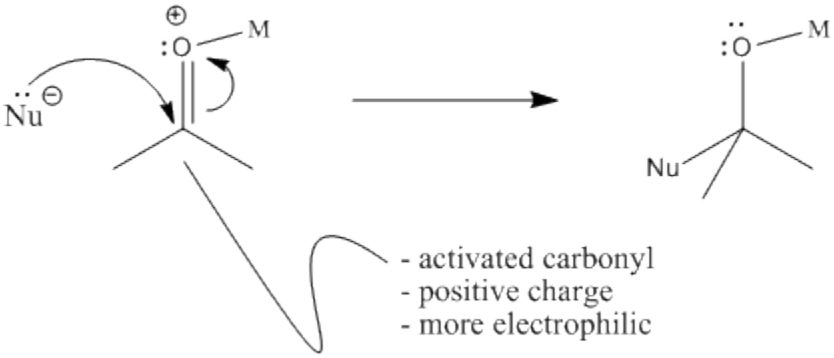

Figure MI4.2. Coordination of an organic carbonyl to a metal ion makes the carbonyl more reactive towards nucleophiles.

A hydride attached to the metal can donate to the carbonyl.

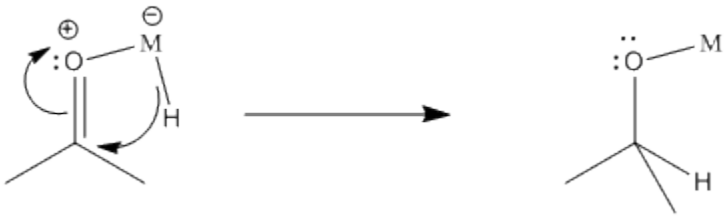

Figure MI4.3. The intermolecular reaction of a coordinated organic carbonyl with a coordinated nucleophile.

Unlike migratory insertion, the nucleophile does not move to the atom attached to the metal.

The nucleophile moves to the second atom away from the metal: the position.

- In this case, the insertion can be reversible.
- The reverse of an insertion is called a 1,2-elimination or a beta-elimination.

Figure MI4.4. The reverse of a 1,2-addition is a 1,2-elimination.

The Greek lettering refers to the number of atoms away from the metal. The first atom attached to the metal is called the alpha position. A hydrogen on that atom is called an alpha hydrogen. The next atom along the chain is called the beta position. The third atom along the chain is the gamma position. A hydrogen attached to the beta position can undergo 1,2-elimination or beta-elimination.

- elimination leads to formation of a double bond.
- The double bond forms between the alpha and the beta position.

This nomenclature can be confusing because a carbonyl compound already has an alpha position and a beta position. The position is the carbonyl carbon and the position is the carbon next to the carbonyl. This Greek lettering system is a general way of designating positions and it is used in a number of different contexts; you need to be able to decide which context fits. If elimination is occurring, then the term, position, may mean one thing. If enolate formation is occurring, then the term, position, means something else.

Source : http://employees.csbsju.edu/cschaller/Reactivity/insertion/insertion%20beta.htm