Migratory insertion is important elementary step in organometallic chemistry. In particular, the insertions of alkene or CO into metal-carbon bond are fundamental steps in the catalytic cycle of transition metal-catalyzed C-C bond forming reactions. The insertion of an alkene into palladium-carbon bond, which introduces a two-carbon unit, is the key step in Heck-Mizoroki reaction (Eq. 1). The insertion of CO, which is a one-carbon unit insertion, is the base for transition metal-catalyzed carbonylation (Eq. 2). However, the similar one-carbon unit insertion of carbene has received less attention (Eq. 3). In this lecture, several novel cross-coupling processes based on migratory insertion of metal carbene are discussed. These coupling reactions demonstrate new possibilities of migratory insertion process in the development of novel transition-metal-catalyzed C-C bond forming reactions.

All the transformations so far developed in this arena can be summarized in the following scheme. The organometallic species can be generated by oxidative addition or transmetallation, which reacts with diazo substrate to generate metal carbene intermediate. Subsequent migratory insertion forms C-C bond. These transformations can be considered as the insertion of a metal carbene process into the catalytic cycle of classic cross-coupling reaction.

References