

Organotransition Metal-Catalyzed Electrochemistry

Tian-Sheng Mei*

State Key Laboratory of Organometallic Chemistry, Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences, 345 Lingling Road, Shanghai 200032

Abstract: Since transition metals have or are easy to form partly full electron-filled d orbitals, they provide unique chemical bond activation capabilities and many elementary reactions such as oxidative addition and reductive elimination. Generally, the low valence state of metals (e.g. Pd⁰, Ni⁰) is good for oxidative addition, the middle valence state is good for C–H activation (e.g. Pd^{II}), while the high valence state (e.g. Pd^{IV}, Ni^{III}) is good for reductive elimination. Therefore, metal-catalyzed reactions usually require chemical oxidation and reduction reagents to realize the valence control of metal species. However, chemical redox reagents generally have the following shortcomings: 1) fixed redox strength; 2) easy to interfere with the reaction; 3) easy to produce reagent by-products; 4) reagent purity, stability, solubility, and other issues. Electrochemistry has the characteristics of adjustable and controllable current and potential, so it is easy to control the different valence states of metals. It can also overcome other shortcomings of the above chemical redox reagents. In the past few years, our research group has carried out a series of work around electrochemically regulated metal-catalyzed reactions, including anodic oxidation to obtain high valence metal to promote reductive elimination or middle valence metal to achieve C–H activation and cathode reduction to obtain low valence metal to promote oxidative addition. This talk mainly focuses on metal-catalyzed C–H functionalization via anodic oxidation and reductive couplings via cathodic reduction.