

Transition-metal catalyzed C-N and C-C bond activation reactions are synthetically valuable reactions for selective and atom-economical synthesis of complex organic molecules. Catalytic reactions that involve activation of unreactive bonds are important for synthesis of stereoselective molecular scaffolds from readily available substrates derived from bio-mass feedstock. Despite these advances, designing a broadly applicable catalytic method faces challenges of selectivity and harsh reaction conditions.

Five coordinate Ru-H complex was found to be an effective catalyst for promoting multicomponent deaminative coupling reaction of anilines, aldehydes and tertiary amines to selectively afford 2,3-disubstituted quinoline products. The scope of the reaction was expanded to enamines to generate 2,3,4-trisubstituted quinolines.

We devised a stereoselective synthesis of (*Z*)-acrylic nitriles from the Ru-catalyzed coupling reaction of nitriles with unsaturated carbonyl compounds via C-C bond cleavage. The mechanistic studies revealed that C-C bond cleavage step is the rate-determining step of the reaction mechanism.

The tetranuclear Ru-H complex was found to be an effective catalyst for hydrodeaminative