N-Heterocyclic Carbene-Catalyzed Single-Electron-Transfer Radical Processes for Reductive Coupling Reactions

This thesis focuses on exploring single-electron-transfer (SET) reductive coupling reactions catalyzed by N-heterocyclic carbene (NHC) organocatalysts. The key mechanistic pathway is that NHC nucleophilic attacks the aldehyde to form Breslow intermediate, then the Breslow intermediate serves as reductive species to give one electron to oxidative species via SET process to generate radical intermediate follow by further transformations. The oxidative species should be nitroalkenes or nitrobenzyl bromides. These works provides new carbene-catalyzed activation mode that should enable unconventional transformation of common substrates under mild organocatalytic conditions.