Control of Electron Transfer for Efficient Oxygenation Reactions

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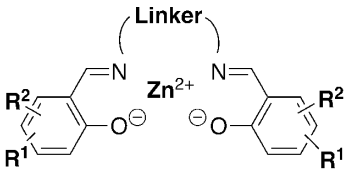
Electron transfer is the most fundamental reaction to govern chemical reactions. To find an effective way to control electron transfer, electronic structures of key active species were investigated in detail with various techniques including absorption, ^{1}H and ^{2}H NMR, EPR, IR resonance Raman spectroscopy and magnetic susceptibility measurements. Correlations between electronic structures and electron transfer ability are the main focus. The insight obtained from electronic structural studies is utilized to create a new catalyst, which is applied for the reactions of gaseous methane under photoirradiation.

1. Development of Photoactive Schiff Base Ligands for Photocatalytic Reactions

A Schiff base ligand such as salen, which is prepared from salicylaldehydes and amines, could be easily obtained in a large scale and is also suitable for a wide variety of chemical modifications. This structural feature makes a Schiff base complex one of the most versatile framework for catalysts and materials. Some of Schiff base ligands shows relatively strong fluorescence, which has been used for sensory applications. But the photophysical properties of Schiff base ligands have not been fully exploited, and the mechanistic aspects of strong or weak fluorescence remains unknown. The present study explored a higher fluorescence quantum yield and longer emission wavelength by systematically changing the structure of salen-type Schiff base ligands with zinc ion shown in Figure 1.



R^{1}, **R^{2}** = MeO-, Me-, *t*-Bu-, Ph-, Cl-, MeCO-, NO_2-

Figure 1. Schiff base complexes for fluorescence studies.