Abstract

The major theme of the work presented in this dissertation is to develop an understanding of the basic processes that govern the excited state of transition metal complexes and to shed an insight into the mechanism of single electron transfer as a means of driving catalysis. Charge transfer states and unique photophysical characteristics exhibited by transition metal complexes have been probed to develop a strong foothold on the driving processes of photosensitization. The excited state dynamics coupled with the lifetime of homoleptic and heteroleptic base metal systems has been thoroughly investigated with substantial experimental and computational aids to arrive at appropriate strategies with the intent of developing an effective and cost efficient photosensitizer to replace the conventional noble metal photosensitizers. In the other part of the thesis, base metal assisted catalysis of two industrially significant reactions have been established. The role of redox active ligands to serve as an electron reservoir facilitating single electron transfer catalysis has been investigated.