

Title of the Thesis: “Multistimuli-Responsive Cyclometalated and Noncyclometalated Ru(II) and Os(II) Complexes Based on Stilbene-Appended Terpyridine Ligands Towards the Development of Molecular Switches”

Submitted by: Smt. Soumi Das

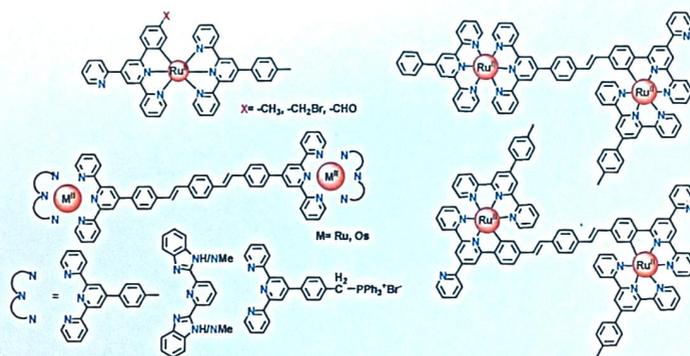
Department of Chemistry  
Jadavpur University, Kolkata - 700032

Index No. 5/20/Chem./26

**Abstract**

This thesis deals with a series of cyclometalated and noncyclometalated Ru(II) and Os(II) terpyridine complexes having stilbene units in the ligand framework. The complexes were synthesized and thoroughly characterized using standard analytical tools and spectroscopic techniques. Their photophysical behavior was systematically investigated by UV-vis absorption and both steady-state and time-resolved emission spectroscopic techniques. The electrochemical properties were examined by cyclic and square-wave voltammetry. In the cyclometalated derivatives, the presence of a non-coordinated nitrogen atom in the outer coordination sphere enabled reversible modulation of spectral features in response to acid, base, and thermal stimuli. The incorporation of stilbene chromophores imparted reversible *trans-cis* photoisomerization under alternating treatment with visible and UV light with substantial modulation of their photo-redox properties. Apart from light, stimuli-responsive behavior of the complexes was also investigated under the influence of acid, base, oxidant, reductant, anion and temperature via multiple optical channels and spectroscopic techniques. In conjunction with experimental demonstration, theoretical investigations including DFT and TD-DFT methods were also performed to get insight about the electronic structure of the complexes, appropriate assignments of the experimentally observed spectral bands, as well as to elucidate their mode of interaction with different stimuli. In essence, the complexes induce efficient multi-step photoswitching under the appropriate interplay of the said stimuli. Additionally, the diverse optical signals, generated by different combinations of stimuli, have been employed to mimic the functions of simple as well as advanced logic operations.

The thesis comprises six chapters and consists of 278 pages.



Soumi Das  
11/09/2025

Sujoy Baitalik  
Professor Sujoy Baitalik  
Department of Chemistry  
Jadavpur University  
Kolkata- 700 032, India  
11/09/2025