

### UNIT 3: INORGANIC PHOTOCHEMISTRY (9 HRS)

3.1 Excited states in transition metal complexes: Intra-ligand excited states and metal centred excited states. Photochemical reactions: Substitution and redox reactions of Cr(III), Co(III), Rh(III) and Ru(II) complexes, manganese-based photosystems for the conversion of water into oxygen, applications-synthesis and catalysis, chemical actinometry and photochromism, metal-metal multiple bonds, dissociative photochemistry, ligand loss.

3.2 Metal complex sensitizers, electron relay, semiconductor supported metal oxide systems, water photolysis, nitrogen fixation and CO<sub>2</sub> reduction, dinitrogen splitting.

#### PART 2

### MANGANESE-BASED PHOTOSYSTEMS FOR THE CONVERSION OF WATER INTO OXYGEN

Manganese (Mn) sparks the photosynthesis process by splitting water after Photosystem II (PSII) fixes light to initiate the conversion of CO<sub>2</sub> and water into carbohydrates.



The water-oxidizing complex (WOC), also known as the oxygen-evolving complex (OEC), of photosystem II in oxygenic photosynthetic organisms efficiently catalyzes water oxidation. *Pirson* was the first to discover that Mn is essential for oxygenic photosynthesis and extensive research since then has led to the establishment of the PSII pigment-protein complex to be responsible for photosynthetic oxygen evolution. Manganese-based catalytic systems including Mn-terpy dimer/titanium oxide, Mn-oxo tetramer/Nafion, Mn-terpy oligomer/tungsten oxide, manganese-calcium (Mn<sub>4</sub>CaO<sub>5</sub>(H<sub>2</sub>O)<sub>4</sub>) cluster which are highly active in water oxidation catalysis.

Water oxidation to produce one oxygen molecule requires the removal of four electrons, and Kok et al proposed an explanation for the observed oscillation of the oxygen evolution pattern. Kok's hypothesis was that in a cycle of water oxidation, a succession of oxidizing equivalents is stored at the WOC, and when four oxidizing equivalents have accumulated one by one, an

# Inorganic Photochemistry Lecture Notes

**J Spring**



## **Inorganic Photochemistry Lecture Notes:**

*American Scientist*, 1942    *Energy Abstracts for Policy Analysis*, 1975-07    Concepts of Inorganic Photochemistry  
Arthur W. Adamson, Paul D. Fleischauer, 1975 PHOTOPHYSICAL PROCESSES ENERGY LEVELS AND SPECTRA KINETICS  
OF PHOTOPHYSICAL PROCESSES CHARGE TRANSFER PHOTOCHEMISTRY SUBSTITUTIONAL PHOTOCHEMISTRY OF  
FIRST ROW TRANSITION ELEMENTS PHOCHEMISTRY OF THE HEAVIER ELEMENTS PHOTOCHEMISTRY OF CARBONYL  
COMPLEXES PHOTOCHEMISTRY OF 1,3-DIKETONATE CHELATES THE PHOTOLYSIS OF SIMPLE INORGANIC IONS IN  
SOLUTION PHOTOCHEMISTRY IN THE SOLID STATE PHOTOCHROMISM AND CHEMILUMINESCENCE    **Directory of  
Published Proceedings**, 1988    **Photophysics of Organometallics** Alistair J. Lees, 2009-12-03 Arvind Kumar Shih Sheng  
Sun and Alistair J Lees Photophysics and Photochemistry of Organometallic Rhenium Diimine Complexes Conor Long  
Photophysics of CO Loss from Simple Metal Carbonyl Complexes Anton n Vlcek Jr Ultrafast Excited State Processes in Re I  
Carbonyl Diimine Complexes From Excitation to Photochemistry Kenneth Kam Wing Lo Exploitation of Luminescent  
Organometallic Rhenium I and Iridium III Complexes in Biological Studies Maria L Muro Aaron A Rachford Xianghuai Wang  
and Felix N Castellano Platinum II Acetylide Photophysics Andreas F Rausch Herbert H H Homeier and Hartmut Yersin  
Organometallic Pt II and Ir III Triplet Emitters for OLED Applications and the Role of Spin Orbit Coupling A Study Based on  
High Resolution Optical Spectroscopy    **Pure and Applied Chemistry**, 1970 Some vols include Plenary lectures of the  
International Conference on Organometallic Chemistry    **Emerging Nanomaterials for Energy Conversion and  
Storage Applications** Guohua Jia, Hongbo Li, Zongyou Yin, 2022-01-04    *Choice*, 2008    *The Cumulative Book Index*  
, 1999    *Molecular Distortions in Ionic and Excited States* Peter V. Schastnev, Lyudmila N. Shchegoleva, 1995-08-25 This  
book discusses the achievements in the study on the structure of active species being formed at the change of molecule  
charge or electronic state It gives a systematic outline of the problem of molecular structure distortions in radical ionic and  
excited states involving experimental and theoretical material The text focuses on analyzing the physical reasons for  
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presents numerous facts on the structural distortions in ions of various types of organic molecules Data is presented for the  
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