Coordination Chemistry
（1900016）

Course name: Coordination Chemistry
Credits: 3
Course hours: 48 hours in total
Prerequisites: Inorganic Chemistry, Analytical Chemistry, Organic Chemistry, Physical Chemistry

Objectives

Coordination Chemistry is a fundamental course for chemistry, material science, environmental science and biology curriculum, which develops the concepts of coordination chemistry and metal-based supramolecular chemistry and their applications. The course will introduce (i) the fundamental aspects of transition metal complexes including crystal field theory, physical and chemical properties of coordination complexes, electronic spectra, (ii) the construction of coordination polymers with novel and prospective crystal structures and functional properties, (iii) the experimental techniques used for structural characterization of sophisticated coordination complexes, such as: X-ray single crystal and powder diffraction analysis, IR/Raman spectroscopy, NMR, Mass spectrum, electron microscopy, SEM, TEM and AFM, (iv) the supramolecular coordination assemblies, a promising materials for a variety of applications, from molecular-based materials, solar cells, electronic circuits, light- emitting devices, data storage, biological tags, cancer treatments, drug delivery and catalysts.

Contents

Chapter 1 Introduction
1.1 An Introduction To Coordination Chemistry
1.2 The Key Features of Coordination Complex
1.3 Nomenclature of Coordination Complex
1.4 Isomerism of Coordination Complex
1.5 Supramolecular Chemistry
1.6 Bio-coordination Chemistry
1.7 Nanochemistry and Coordination Chemistry

Chapter 2 The Bonding Theories of Coordination Complex
2.1 Symmetry in Chemistry – Group Theory
2.2 Valence Bond Theory and Hybrid Atomic Orbital
2.3 Crystal Field Theory
2.4 Molecular Orbital Theory
2.5 Intermolecular Interaction
2.6 Self-assembly Process
2.7 Construction of Functional Device

Chapter 3 Spectroscopy of Coordination Complex
3.1 Ultraviolet and Visible Absorption Spectroscopy (UV-Vis)
3.2 Infrared Spectroscopy
3.3 X-ray Powder and Single Crystal Diffraction Analysis
3.4 Photoelectron Spectroscopy
3.5 Nuclear Magnetic Resonance (NMR) Spectroscopy
3.6 Electronic Paramagnetic Resonance (EPR)
3.7 Circular Dichroism (CD)
3.8 SEM, TEM, STM, AFM Methods for Nanosize Coordination Complex

Chapter 4 The Structure and Physicochemical Properties of Coordination Complex
4.1 The Structures of Several Kinds of Coordination Complexes

4.2 Metal-Organic Framework (MOF)
4.3 Bio-mimic Coordination Complex
4.4 Thermodynamic Properties and Balances of Coordination Complex in Solution
4.5 Molecular Electronic Devices—Redox-active Coordination Complex
4.6 Magnetic Properties of Coordination Complex
4.7 Photochemical Properties of Coordination Complex
4.8 Solar-energy Conversion and Energy Coordination Complex

Chapter 5 Kinetics and Mechanisms of Reactions of Coordination Complex
5.1 Introductory Survey
5.2 Reaction Mechanisms of Coordination and Organometallic Complex
5.3 Substitution Reactions of Coordination Complex
5.4 Electron Transfer Reactions of Coordination Complex
5.5 Homogeneous catalysis
5.6 The Experimental and Theoretical Methods for Studying Mechanisms.

Examination and grading:

The score uses a hundred-mark system. Total Score100%： Classroom Performance 50%, mini-paper 50%.

References

[1] Hui Li, Coordination Chemistry, Second Edition (Chinese-English Bilingualism). Chemical Industry Press, 2011.

[2] Ulrich Müller, Inorganic Structural Chemistry, Second Edition. John Wiley & Sons, Inc., 2007.

[3] F. A. Cotton, G. Wilkison, C. A. Murillo, M. Bochmann, Advanced Inorganic Chemistry, 6ed. A Wiley-Interscience Publication, John Wiley & Sons, Inc., 1999.

[4] Brian N Figgis, Michael A. Hichman, Ligand Field Theory and Its applications. Wiley, 2000.

[5] Carson J. Bruns, J. Fraser Stoddart, The Nature of The Mechanical Bond--From Molecules to Machines. Wiley, 2017.

[6] 游效曾，配位化合物的结构与性质. 科学出版社. 第2版，2012.

[7] 游效曾，分子材料-光电功能化合物. 科学出版社. 第2版，2017.

[8] J.-M. Lehn, Supramolecular Chemistry. Wiley-VCH., 1995.

[9] S. F. A. Kettle, Physical Inorganic Chemistry: A Coordination Chemistry Approach. Oxford: Spektrum, 1996.

[10] Jacques Simon, Pierre Bassoul, Design of Molecular Materials--Supramolecular Engineering, John Wiley & Sons, Inc., 2000.

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