Introduction To Ligand Field Theory

GEORGE CHRISTOU Indiana University, Bloomington I am no doubt representative of a large number of current inorganic chemists in having obtained my undergraduate and postgraduate degrees in the 1970s. It was during this period that I began my continuing love affair with this subject, and the fact that it happened while I was a student in an organic laboratory is beside the point. I was always enchanted by the more physical aspects of inorganic chemistry; while being captivated from an early stage by the synthetic side, and the measure of creation with a small c that it entails, I nevertheless found the application of various theoretical, spectroscopic and physicochemical techniques to inorganic compounds to be fascinating, stimulating, educational and downright exciting. The various bonding theories, for example, and their use to explain or interpret spectroscopic observations were more or less universally accepted as belonging within the realm of inorganic chemistry, and textbooks of the day had whole sections on bonding theories, magnetism, kinetics, electron-transfer mechanisms and so on. However, things changed, and subsequent inorganic chemistry teaching texts tended to emphasize the more synthetic and descriptive side of the field. There are a number of reasons for this, and they no doubt include the rise of diamagnetic organometallic chemistry as the dominant subdiscipline within inorganic chemistry and its relative narrowness vis-d-vis physical methods required for its prosecution.

A complete, up-to-date treatment of ligand field theory and its applications Ligand Field Theory and Its Applications presents an up-to-date account of ligand field theory, the

model currently used to describe the metal-ligand interactions in transition metal compounds, and the way it is used to interpret the physical properties of the complexes. It examines the traditional electrostatic crystal field model, still widely used by physicists, as well as covalent approaches such as the angular overlap model, which interprets the metal ligand interactions using parameters relating directly to chemical behavior. Written by internationally recognized experts in the field, this book provides a comparison between ligand field theory and more sophisticated treatments as well as an account of the methods used to calculate the energy levels in compounds of the transition metals. It also covers physical properties such as stereochemistry, light absorption, and magnetic behavior. An emphasis on the interpretation of experimental results broadens the book's field of interest beyond transition metal chemistry into the many other areas where these metal ions play an important role. As clear and accessible as Brian Figgis's 1966 classic Introduction to Ligand Fields, this new book provides inorganic and bioinorganic chemists as well as physical chemists, chemical physicists, and spectroscopists with a much-needed overview of the many significant changes that have taken place in ligand field theory over the past 30 years.

The basics of group theory and its applications to themes such as the analysis of vibrational spectra and molecular orbital theory are essential knowledge for the undergraduate student of inorganic chemistry. The second edition of Group Theory for Chemists uses diagrams and problem-solving to help students test and improve their understanding, including a new section on the application of group theory to electronic spectroscopy. Part one covers the essentials of symmetry and group theory, including symmetry, point groups and representations. Part two deals with the application of group theory to vibrational spectroscopy, with chapters covering

topics such as reducible representations and techniques of vibrational spectroscopy. In part three, group theory as applied to structure and bonding is considered, with chapters on the fundamentals of molecular orbital theory, octahedral complexes and ferrocene among other topics. Additionally in the second edition, part four focuses on the application of group theory to electronic spectroscopy, covering symmetry and selection rules, terms and configurations and d-d spectra. Drawing on the author's extensive experience teaching group theory to undergraduates, Group Theory for Chemists provides a focused and comprehensive study of group theory and its applications which is invaluable to the student of chemistry as well as those in related fields seeking an introduction to the topic. Provides a focused and comprehensive study of group theory and its applications, an invaluable resource to students of chemistry as well as those in related fields seeking an introduction to the topic Presents diagrams and problem-solving exercises to help students improve their understanding, including a new section on the application of group theory to electronic spectroscopy Reviews the essentials of symmetry and group theory, including symmetry, point groups and representations and the application of group theory to vibrational spectroscopy

As it results from the very nature of things, the spherical symmetry of the surrounding of a site in a crystal lattice or an atom in a molecule can never occur. Therefore, the eigenfunctions and eigenvalues of any bound ion or atom have to differ from those of spherically symmetric respective free ions. In this way, the most simplified concept of the crystal field effect or ligand field effect in the case of individual molecules can be introduced. The conventional notion of the crystal field potential is narrowed to its non-spherical part only through ignoring the dominating spherical part which produces only a uniform energy shift of gravity centres of the

free ion terms. It is well understood that the non-spherical part of the effective potential "seen" by open-shell electrons localized on a metal ion plays an essential role in most observed properties. Light adsorption, electron paramagnetic resonance, inelastic neutron scattering and basic characteristics derived from magnetic and thermal measurements, are only examples of a much wider class of experimental results dependent on it. The influence is discerned in all kinds of materials containing unpaired localized electrons: ionic crystals, semiconductors and metallic compounds including materials as intriguing as high-Tc superconductors, or heavy fermion systems. It is evident from the above that we deal with a widespread effect relative to all free ion terms except those which can stand the lowered symmetry, e.g. S-terms. Despite the universality of the phenomenon, the available handbooks on solid state physics pay only marginal attention to it, merely making mention of its occurrence. Present understanding of the origins of the crystal field potential differs essentially from the pioneering electrostatic picture postulated in the twenties. The considerable development of the theory that has been put forward since then can be traced in many regular articles scattered throughout the literature. The last two decades have left their impression as well but, to the authors' best knowledge, this period has not been closed with a more extended review. This has also motivated us to compile the main achievements in the field in the form of a book.

At the heart of coordination chemistry lies the coordinate bond, inits simplest sense arising from donation of a pair of electronsfrom a donor atom to an empty orbital on a central metalloid ormetal. Metals overwhelmingly exist as their cations, but these arerarely met ‘naked’ – they are clothed in an arrayof other atoms, molecules or ions that involve coordinate covalentbonds (hence the name coordination

compounds). These metal ioncomplexes are ubiquitous in nature, and are central to an array ofnatural and synthetic reactions. Written in a highly readable, descriptive and accessible styleIntroduction to Coordination Chemistry describes propertiesof coordination compounds such as colour, magnetism and reactivityas well as the logic in their assembly and nomenclature. It isillustrated with many examples of the importance of coordinationchemistry in real life, and includes extensive references and abibliography. Introduction to Coordination Chemistry is a comprehensiveand insightful discussion of one of the primary fields of study inInorganic Chemistry for both undergraduate and non-specialistreaders.

This profusely illustrated book, by a world-renowned chemist and award-winning chemistry teacher, provides science students with an introduction to atomic and molecular structure and bonding. (This is a reprint of a book first published by Benjamin/Cummings, 1973.)

Introduction to Ligand Field Theory

The phenomenon of spin-crossover has a large impact on the physical properties of a solid material, including its colour, magnetic moment, and electrical resistance. Some materials also show a structural phase change during the transition. Several practical applications of spin-crossover materials have been demonstrated including display and memory devices, electrical and electroluminescent devices, and MRI contrast agents. Switchable liquid crystals, nanoparticles, and thin films of spin-crossover materials have also been achieved. Spin-Crossover Materials: Properties and Applications presents a comprehensivesurvey of recent developments in spin-crossover research, highlighting the multidisciplinary nature of this rapidly expanding field. Following an introductory chapter which describes the spin-crossover phenomenon and historical development of the

field, the book goes on to cover a wide range of topics including Spin-crossover in mononuclear, polynuclear and polymeric complexes Structure: function relationships in molecular spin-crossover materials Charge-transfer-induced spin-transitions Reversible spin-pairing in crystalline organic radicals Spin-state switching in solution Spin-crossover compounds in multifunctional switchable materials and nanotechnology Physical and theoretical methods for studying spin-crossover materials Spin-Crossover Materials: Properties and Applications is a valuable resource for academic researchers working in the field of spin-crossover materials and topics related to crystal engineering, solid state chemistry and physics, and molecular materials. Postgraduate students will also find this book useful as a comprehensive introduction to the field.

Inorganic Chemistry, Third Edition, emphasizes fundamental principles, including molecular structure, acid-base chemistry, coordination chemistry, ligand field theory and solid state chemistry. The book is organized into five major themes: structure, condensed phases, solution chemistry, main group and coordination compounds, each of which is explored with a balance of topics in theoretical and descriptive chemistry. Topics covered include the hard-soft interaction principle to explain hydrogen bond strengths, the strengths of acids and bases, and the stability of coordination compounds, etc. Each chapter opens with narrative introductions and includes figures, tables and end-of-chapter problem sets. This new edition features updates throughout, with an emphasis on bioinorganic chemistry and a new chapter on nanostructures and graphene. In addition, more in-text worked-out examples encourage active learning and prepare students for exams. This text is ideal for advanced undergraduate and graduate-level students enrolled in the Inorganic Chemistry course. Includes physical chemistry to show the relevant principles

from bonding theory and thermodynamics Emphasizes the chemical characteristics of main group elements and coordination chemistry Presents chapters that open with narrative introductions, figures, tables and end-of-chapter problem sets

Introduction to Magnetochemistry provides an introduction to the more important aspects of magnetochemistry. The measurement of magnetic moment has been one of the most consistently useful to coordination chemists. For teaching purposes it provides a simple method of illustrating the ideas of electronic structure, and in research it can provide fundamental information about the bonding and stereochemistry of complexes. The book contains six chapters covering topics such as free atoms and ions, transition metal complexes, crystal field theory, second and third row transition metal complexes, antiferromagnetism, and spin-pairing of electrons. The final chapter describes important experimental methods and then to shows briefly the way in which the problems of interpretation may be tackled.

Comprehensive Coordination Chemistry II (CCC II) is the sequel to what has become a classic in the field, Comprehensive Coordination Chemistry, published in 1987. CCC II builds on the first and surveys new developments authoritatively in over 200 newly comissioned chapters, with an emphasis on current trends in biology, materials science and other areas of contemporary scientific interest.

This is a complete and authoritative reference text on an evolving field. Over 200 international scientists have written over 340 separate topics on different aspects of geochemistry including organics, trace elements, isotopes, high and low temperature geochemistry, and ore deposits, to name just a few.

To appreciate the chemistry and physical properties of

complexes of the transition series, an understanding of metal-ligand interactions applied to complexes of the d-block is needed. Metal Ligand Bonding aims to provide this through an accessible, detailed, non-mathematical approach. Initial chapters detail the crystal-field model, using it to describe the use of magnetic measurements to distinguish complexes with different electronic configurations and geometries. Subsequent chapters look at the molecular orbital theory of transition metal complexes using a pictorial approach. Bonding in octahedral complexes is explored and electronic spectra and magnetic properties are given extensive coverage. The material addressed in this book forms the foundation of undergraduate lecture courses on d-block chemistry and facilitates learning through various key features, including: full colour diagrams; in-text questions with answers; revision exercises and clearly defined learning outcomes to encourage a reflective approach to study; an associated website; and experimental data and observations from everyday life. A basic knowledge of atomic and molecular orbitals as applied to main group elements is assumed.

Practical Approaches to Biological Inorganic Chemistry, Second Edition, reviews the use of spectroscopic and related analytical techniques to investigate the complex structures and mechanisms of biological inorganic systems that contain metals. Each chapter presents an overview of the technique, including relevant theory, a clear explanation of what it is, how it works, and how the technique is actually used to evaluate biological structures. New chapters cover Raman Spectroscopy

and Molecular Magnetochemistry, but all chapters have been updated to reflect the latest developments in discussed techniques. Practical examples, problems and many color figures are also included to illustrate key concepts. The book is designed for researchers and students who want to learn both the basics and more advanced aspects of key methods in biological inorganic chemistry. Presents new chapters on Raman Spectroscopy and Molecular Magnetochemistry, as well as updated figures and content throughout Includes color images throughout to enable easier visualization of molecular mechanisms and structures Provides worked examples and problems to help illustrate and test the reader's understanding of each technique Written by leading experts who use and teach the most important techniques used today to analyze complex biological structures

An advanced-level textbook of inorganic chemistry for the graduate (B.Sc) and postgraduate (M.Sc) students of Indian and foreign universities. This book is a part of four volume series, entitled "A Textbook of Inorganic Chemistry – Volume I, II, III, IV". CONTENTS: Chapter 1. Stereochemistry and Bonding in Main Group Compounds: VSEPR theory, d? -p? bonds, Bent rule and energetic of hybridization. Chapter 2. Metal-Ligand Equilibria in Solution: Stepwise and overall formation constants and their interactions, Trends in stepwise constants, Factors affecting stability of metal complexes with reference to the nature of metal ion and ligand, Chelate effect and its thermodynamic origin, Determination of binary formation constants by pH-metry

and spectrophotometry. Chapter 3. Reaction Mechanism of Transition Metal Complexes – I: Inert and labile complexes, Mechanisms for ligand replacement reactions, Formation of complexes from aquo ions, Ligand displacement reactions in octahedral complexes-acid hydrolysis, Base hydrolysis, Racemization of tris chelate complexes, Electrophilic attack on ligands. Chapter 4. Reaction Mechanism of Transition Metal Complexes – II: Mechanism of ligand displacement reactions in square planar complexes, The trans effect, Theories of trans effect, Mechanism of electron transfer reactions – types; Outer sphere electron transfer mechanism and inner sphere electron transfer mechanism, Electron exchange. Chapter 5. Isopoly and Heteropoly Acids and Salts: Isopoly and Heteropoly acids and salts of Mo and W: structures of isopoly and heteropoly anions. Chapter 6. Crystal Structures: Structures of some binary and ternary compounds such as fluorite, antifluorite, rutile, antirutile, crystobalite, layer lattices- CdI2, BiI3; ReO3, Mn2O3, corundum, pervoskite, Ilmenite and Calcite. Chapter 7. Metal-Ligand Bonding: Limitation of crystal field theory, Molecular orbital theory, octahedral, tetrahedral or square planar complexes, ?-bonding and molecular orbital theory. Chapter 8. Electronic Spectra of Transition Metal Complexes: Spectroscopic ground states, Correlation and spin-orbit coupling in free ions for Ist series of transition metals, Orgel and Tanabe-Sugano diagrams for transition metal complexes (d1 – d9 states), Calculation of Dq, B and ? parameters, Effect of distortion on the d-orbital energy levels, Structural

evidence from electronic spectrum, John-Tellar effect, Spectrochemical and nephalauxetic series, Charge transfer spectra, Electronic spectra of molecular addition compounds. Chapter 9. Magantic Properties of Transition Metal Complexes: Elementary theory of magneto - chemistry, Guoy's method for determination of magnetic susceptibility, Calculation of magnetic moments, Magnetic properties of free ions, Orbital contribution, effect of ligand-field, Application of magneto-chemistry in structure determination, Magnetic exchange coupling and spin state cross over. Chapter 10. Metal Clusters: Structure and bonding in higher boranes, Wade's rules, Carboranes, Metal Carbonyl Clusters - Low Nuclearity Carbonyl Clusters, Total Electron Count (TEC). Chapter 11. Metal-? Complexes: Metal carbonyls, structure and bonding, Vibrational spectra of metal carbonyls for bonding and structure elucidation, Important reactions of metal carbonyls; Preparation, bonding, structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes; Tertiary phosphine as ligand.

With more than 40% new and revised materials, this second edition offers researchers and students in the field a comprehensive understanding of fundamental molecular properties amidst cutting-edge applications. Including ~70 Example-Boxes and summary notes, questions, exercises, problem sets, and illustrations in each chapter, this publication is also suitable for use as a textbook for advanced undergraduate and graduate students. Novel material is introduced in description of multi-orbital chemical bonding, spectroscopic and

magnetic properties, methods of electronic structure calculation, and quantum-classical modeling for organometallic and metallobiochemical systems. This is an excellent reference for chemists, researchers and teachers, and advanced undergraduate and graduate students in inorganic, coordination, and organometallic chemistry.

Multiplets of Transition-Metal Ions in Crystals provides information pertinent to ligand field theory. This book discusses the fundamentals of quantum mechanics and the theory of atomic spectra. Comprised of 10 chapters, this book starts with an overview of the qualitative nature of the splitting of the energy level as well as the angular behavior of the wavefunctions. This text then examines the problem of obtaining the energy eigenvalues and eigenstates of the two-electron systems, in which two electrons are accommodated in the t2g and eg shells in a variety of ways. Other chapters discuss the ligand-field potential, which is invariant to any symmetry operation in the group to which symmetry of the system belongs. This book discusses as well the approximate method of expressing molecular orbitals (MO) by a suitable linear combination of atomic orbitals (AO). The final chapter discusses the MO in molecules and the self-consistent field theory of Hartree–Fock. This book is a valuable resource for research physicists, chemists, electronic engineers, and graduate students.

Many courses dealing with the material in this text are called "Applications of Group Theory." Emphasizing the central role and primary importance of symmetry in the applications, Symmetry in Bonding and Spectra enables

students to handle applications, particularly applications to chemical bonding and spectroscopy. It contains the essential background in vectors and matrices for the applications, along with concise reviews of simple molecular orbital theory, ligand field theory, and treatments of molecular shapes, as well as some quantum mechanics. Solved examples in the text illustrate theory and applications or introduce special points. Extensive problem sets cover the important methods and applications, with the answers in the appendix.

The importance of metals in biology, the environment and medicine has become increasingly evident over the last twenty five years. The study of the multiple roles of metal ions in biological systems, the rapidly expanding interface between inorganic chemistry and biology constitutes the subject called Biological Inorganic Chemistry. The present text, written by a biochemist, with a long career experience in the field (particularly iron and copper) presents an introduction to this exciting and dynamic field. The book begins with introductory chapters, which together constitute an overview of the concepts, both chemical and biological, which are required to equip the reader for the detailed analysis which follows. Pathways of metal assimilation, storage and transport, as well as metal homeostasis are dealt with next. Thereafter, individual chapters discuss the roles of sodium and potassium, magnesium, calcium, zinc, iron, copper, nickel and cobalt, manganese, and finally molybdenum, vanadium, tungsten and chromium. The final three chapters provide a tantalising view of the

roles of metals in brain function, biomineralization and a brief illustration of their importance in both medicine and the environment. Relaxed and agreeable writing style. The reader will not only fiind the book easy to read, the fascinating anecdotes and footnotes will give him pegs to hang important ideas on. Written by a biochemist. Will enable the reader to more readily grasp the biological and clinical relevance of the subject. Many colour illustrations. Enables easier visualization of molecular mechanisms Written by a single author. Ensures homgeneity of style and effective cross referencing between chapters

J.P. Dahl: Carl Johan Ballhausen (1926–2010).- J.R. Winkler and H.B. Gray: Electronic Structures of Oxo-Metal Ions.- C.D. Flint: Early Days in Kemisk Laboratorium IV and Later Studies.- J.H. Palmer: Transition Metal Corrole Coordination Chemistry. A Review Focusing on Electronic Structural Studies.- W.C. Trogler: Chemical Sensing with Semiconducting Metal Phthalocyanines.- K.M. Lancaster: Biological Outer-Sphere Coordination.- R.K. Hocking and E.I. Solomon: Ligand Field and Molecular Orbital Theories of Transition Metal X-ray Absorption Edge Transitions.- K.B. Møller and N.E. Henriksen: Time-resolved X-ray diffraction: The dynamics of the chemical bond.

This book focuses on two main topics in fundamental structural chemistry: the properties of chemical bonding derived from the behavior of the microscopic particles and their wave functions, and the three-dimensional molecular and crystal structures. The principle that ?structure determines properties and properties reflect

structures? is clearly demonstrated. This book emphasizes practical examples linking structure with properties and applications which provide invaluable insight for students, thus stimulating their mind to deal with problems in the topics concerned.

Graduate-level text develops group theory relevant to physics and chemistry and illustrates their applications to quantum mechanics, with systematic treatment of quantum theory of atoms, molecules, solids. 1964 edition.

Twenty years ago Tanabe and Sugano published the first ligand field energy diagrarns which are applicable to dN electronic configurations. These diagrams are limited in scope in that they can be used only for octahedral symmetry and for a limited number of terms. The present volume is an attempt to fill the gap by providing a reasonable nurober of complete and accurate ligand field energy diagrarns for dN configurations in the most commonly encountered symmetries. Despite their limited nature, the diagrarns of Tanabe and Sugano were exten sively used in the past in order to rationalize optical and luminescence spectra and to discuss various electronic properties of transition metal ions, their coordination compounds and solids. Moreover, Tanabe-Sugano diagrams have an established place in the theory of transition metal compounds and are included in most textbooks of inorganic and coordination chemistry. It is expected that the present diagrarns will be found useful for a similar purpose.

Advanced Inorganic Chemistry: Applications in Everyday Life connects key topics on the subject with actual

experiences in nature and everyday life. Differing from other foundational texts with this emphasis on applications and examples, the text uniquely begins with a focus on the shapes (geometry) dictating intermolecular forces of attractions, leading to reactivity between molecules of different shapes. From this foundation, the text explores more advanced topics, such as: Ligands and Ligand Substitution Processes with an emphasis on Square-Planar Substitution and Octahedral Substitution Reactions in Inorganic Chemistry and Transition Metal Complexes, with a particular focus on Crystal-Field and Ligand-Field Theories, Electronic States and Spectra and Organometallic, Bioinorganic Compounds, including Carboranes and Metallacarboranes and their applications in Catalysis, Medicine and Pollution Control. Throughout the book, illustrative examples bring inorganic chemistry to life. For instance, biochemists and students will be interested in how coordination chemistry between the transition metals and the ligands has a direct correlation with cyanide or carbon monoxide poisoning (strong-field Cyanide or CO ligand versus weak-field Oxygen molecule). Engaging discussion of key concepts with examples from the real world Valuable coverage from the foundations of chemical bonds and stereochemistry to advanced topics, such as organometallic, bioinorganic, carboranes and environmental chemistry Uniquely begins with a focus on the shapes (geometry) dictating intermolecular forces of attractions, leading to reactivity between molecules of different shapes

It has long been recognized that metal spin states

play a central role in the reactivity of important biomolecules, in industrial catalysis and in spin crossover compounds. As the fields of inorganic chemistry and catalysis move towards the use of cheap, non-toxic first row transition metals, it is essential to understand the important role of spin states in influencing molecular structure, bonding and reactivity. Spin States in Biochemistry and Inorganic Chemistry provides a complete picture on the importance of spin states for reactivity in biochemistry and inorganic chemistry, presenting both theoretical and experimental perspectives. The successes and pitfalls of theoretical methods such as DFT, ligand-field theory and coupled cluster theory are discussed, and these methods are applied in studies throughout the book. Important spectroscopic techniques to determine spin states in transition metal complexes and proteins are explained, and the use of NMR for the analysis of spin densities is described. Topics covered include: DFT and ab initio wavefunction approaches to spin states Experimental techniques for determining spin states Molecular discovery in spin crossover Multiple spin state scenarios in organometallic reactivity and gas phase reactions Transition-metal complexes involving redox non-innocent ligands Polynuclear iron sulfur clusters Molecular magnetism NMR analysis of spin densities This book is a valuable reference for researchers working in bioinorganic

and inorganic chemistry, computational chemistry, organometallic chemistry, catalysis, spin-crossover materials, materials science, biophysics and pharmaceutical chemistry.

Inorganic Complexes describes the particular features of inorganic complex chemistry, as it has developed since 1950. The chemical information recorded in this book is intimately connected with the theoretical approach applying M.O. theory, which is also called ligand field theory in the special case of transition group complexes with a partly filled shell, for classification of the energy levels and rationalization of the absorption spectra. This text also discusses the aqua, hydroxo, oxo, fluoro, chloro, bromo, and iodo complexes; nitrogen-, oxygen-, and sulfur-containing ligands; amino acids and other N,O-containing ligands; and intermetallic bonding and co-operative effects. This publication is a good source for chemists and students conducting work on inorganic complex chemistry.

"I have tried to give an introduction to that field of chemistry which deals wit the spectral and magnetic features of inorganic complexes. It has been my intention not to follow the theory in all its manifestations, but merely to describe the basic ideas and applications. This has been done with an eye constantly aimed at the practical and experimental features of the chemistry of the complex ions. The book is thus primarily intended for

the inorganic chemist, but it is true that, in order to follow the exposition, a course in basic quantum mechanics is needed"--Preface.

The second edition of this classic book provides an updated look at crystal field theory and its applications.

C. Brady, J.J. McGarvey, J.K. McCusker, H. Toftlund, D.N. Hendrickson: Time-Resolved Relaxation Studies of Spin Crossover Systems in Solution.- V. Ksenofontov, P. Gütlich et al.: Spin Crossover under Pressure.- A. Bousseksou, F. Varret, M. Goiran, K. Boukheddaden, J.P. Tuchagues: The Spin Crossover Phenomenon under High Magnetic Field.- J.-P. Tuchagues, A. Bousseksou, G. Molnár, J.J. McGarvey, F. Varret: The Role of Molecular Vibrations in the Spin Crossover Phenomenon.- W. Linert, M. Grunert, A.B. Koudriavtsev: Isokinetic and Isoequilibrium Relationships in Spin Crossover Systems.- H. Winkler, A.I: Chumakov, A.X. Trautwein: Nuclear Resonant Forward and Nuclear Inelastic Scattering Using Synchrotron Radiation for Spin Crossover Systems.- M. Sorai: Heat Capacity Studies of Spin Crossover Systems.- H. Spiering et al.: Cooperative Elastic Interactions in Spin Crossover Systems.- H. Paulsen, A.X. Trautwein: Density Functional Theory Calculations for Spin Crossover Complexes.- J.-F. Létard, P. Guionneau, L. Goux-Capes: Towards Spin Crossover Applications.

Essentials of Coordination Chemistry: A Simplified Approach with 3D Visuals provides an accessible overview of this key, foundational topic in inorganic chemistry. Thoroughly illustrated within the book and supplemented by online 3D images and videos in full color, this valuable resource covers basic fundamentals before exploring more advanced topics of interest. The work begins with an introduction to the structure, properties, and syntheses of ligands with metal centers, before discussing the variety of isomerism exhibited by coordination compounds, such as structural, geometrical and optical isomerism. As thermodynamics and kinetics provide a gateway to synthesis and reactivity of coordination compounds, the book then describes the determination of stability constants and composition of complexes. Building upon those principles, the resource then explains a wide variety of nucleophilic substitution reactions exhibited by both octahedral and square planar complexes. Finally, the book discusses metal carbonyls and nitrosyls, special classes of compounds that can stabilize zero or even negative formal oxidation states of metal ions. Highlighting preparations, properties, and structures, the text explores the unique type of Metal-Ligand bonding which enable many interesting applications of these compounds. Thoughtfully organized for academic use, Essentials of Coordination Chemistry: A

Simplified Approach with 3D Visuals encourages interactive learning. Advanced undergraduate and graduate students, as well as researchers requiring a full overview and visual understanding of coordination chemistry, will find this book invaluable. Includes valuable visual content through 3D images and videos in full color, available online Provides a valuable introduction to the study of organic and inorganic ligands with metal centers Discusses advanced topics including metal carbonyls and nitrosyls