

## Chapter 2 Solid State Chemistry

This proven book introduces the basics of coordination, solid-state, and descriptive main-group chemistry in a uniquely accessible manner, featuring a less is more approach. Consistent with the less is more philosophy, the book does not review topics covered in general chemistry, but rather moves directly into topics central to inorganic chemistry. Written in a conversational prose style that is enjoyable and easy to understand, this book presents not only the basic theories and methods of inorganic chemistry (in three self-standing sections), but also a great deal of the history and applications of the discipline. This edition features new art, more diversified applications, and a new icon system. And to better help readers understand how the seemingly disparate topics of the periodical table connect, the book offers revised coverage of the author's Network of Interconnected Ideas on new full color endpapers, as well as on a convenient tear-out card. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

This is the first book to present both classical and quantum-chemical approaches to computational methods, incorporating the many new developments in this field from the last few years. Written especially for "non"-theoretical readers in a readily comprehensible and implemental style, it includes numerous practical examples of varying degrees of difficulty. Similarly, the use of mathematical equations is reduced to a minimum, focusing only on those important for experimentalists. Backed by many extensive tables containing detailed data for direct use in the calculations, this is the ideal companion for all those wishing to improve their work in solid state research.

Solid State Chemistry today is a frontier area of mainstream chemistry, and plays a vital role in the development of materials. The present work, consisting of a selection of Prof. C N R Rao's papers, covers most of the important aspects of solid state chemistry and provides the flavor of the subject, showing how the subject has evolved over the years. The book is up-to-date, and will be useful to students, teachers, beginning researchers and practitioners in solid state chemistry as well as in the broader area of materials science.

The ideal addition to the companion volume on fundamentals, methodologies, and applications, this second volume combines fundamental information with an overview of the role of ceramic membranes, electrodes and interfaces in this important, interdisciplinary and rapidly developing field. Written primarily for specialists working in solid state electrochemistry, this first comprehensive handbook on the topic focuses on the most important developments over the last decade, as well as the methodological and theoretical aspects and practical applications. This makes the contents equally of interest to material, physical and industrial scientists, and to physicists. Also available as a two-volume set.

The Handbook of Solid State Electrochemistry is a one-stop resource treating the two main areas of solid state electrochemistry: electrochemical properties of solids such as oxides, halides, and cation conductors; and electrochemical kinetics and mechanisms of reactions occurring on solid electrolytes, including gas-phase electrocatalysis. The fund

Recent trends within the pharmaceutical industry through the Quality by Design initiatives have seen a greater emphasis on the development of a molecular-scale understanding in the development of efficient manufacturing processes for active pharmaceutical ingredients (APIs) and their formulation into drug products. This book examines the state-of-the-art computational approaches to guide solid form experiments to optimize the physical and chemical properties of API related to its stability, bioavailability and formulatability. The book is intended to be used as a professional reference to researchers in Pharmaceutical industry and in academia and potentially as a text book reference for

undergraduate, graduate and postgraduate students in the field of Computational Chemistry, Solid State Chemistry, Pharmaceutical Science and Material Science.

Intended for first- and second-year undergraduates, this introduction to solid-state chemistry includes practical examples of applications and modern developments to offer students the opportunity to apply their knowledge in real-life situations. It aims to provide students with a thorough understanding of the traditional knowledge of crystal structures: lattices, unit cells, close packing, and octahedral and tetrahedral holes and their occupation by various ions in the well-known crystal structures. This descriptive work is augmented by free-electron and band theory. Links to other branches of chemistry and practical examples are emphasized, as are the links back to band theory and crystal structures. For this second edition, the book has been updated throughout and has two new chapters, one on X-ray diffraction techniques and another on solid-state preparative methods, as well as new sections on symmetry and ferroelectrics.

Engineering requires applied science, and chemistry is the center of all science. The more chemistry an engineer understands, the more beneficial it is. In the future, global problems and issues will require an in-depth understanding of chemistry to have a global solution. This book aims at bridging the concepts and theory of chemistry with examples from fields of practical application, thus reinforcing the connection between science and engineering. It deals with the basic principles of various branches of chemistry, namely, physical chemistry, inorganic chemistry, organic chemistry, analytical chemistry, surface chemistry, biochemistry, geochemistry, fuel chemistry, polymer chemistry, cement chemistry, materials chemistry, and asphalt chemistry. Written primarily for use as a textbook for a university-level course, the topics covered here provide the fundamental tools necessary for an accomplished engineer./a

The 3rd edition of this successful textbook continues to build on the strengths that were recognized by a 2008 Textbook Excellence Award from the Text and Academic Authors Association (TAA). Materials Chemistry addresses inorganic-, organic-, and nano-based materials from a structure vs. property treatment, providing a suitable breadth and depth coverage of the rapidly evolving materials field — in a concise format. The 3rd edition offers significant updates throughout, with expanded sections on sustainability, energy storage, metal-organic frameworks, solid electrolytes, solvothermal/microwave syntheses, integrated circuits, and nanotoxicity. Most appropriate for Junior/Senior undergraduate students, as well as first-year graduate students in chemistry, physics, or engineering fields, Materials Chemistry may also serve as a valuable reference to industrial researchers. Each chapter concludes with a section that describes important materials applications, and an updated list of thought-provoking questions.

The principal objective of this book is to stimulate interest in research that will extend available theory towards a greater understanding of the steps involved in solid-state decompositions and the properties of solids that control reactivities. Much of the activity in this field has been directed towards increasing the range of reactants for which decomposition kinetic data is available, rather than extending insights into the fundamental chemistry of the reactions being studied. The first part of the book (Chapters 1-6) is concerned with theoretical aspects of the subject. The second part (Chapters 7-17) surveys groups of reactions classified by similarities of chemical composition. The final Chapter (18) reviews the subject

by unifying features identified as significant and proposes possible directions for future progress. Studies of thermal reactions of ionic compounds have contributed considerably to the theory of solid-state chemistry. Furthermore, many of these rate processes have substantial technological importance, for example, in the manufacture of cement, the exploitation of ores and in the stability testing of drugs, explosives and oxidizing agents. Despite the prolonged and continuing research effort concerned with these reactions, there is no recent overall review. This book is intended to contribute towards correcting this omission. The essential unity of the subject is recognized by the systematic treatment of reactions, carefully selected to be instructive and representative of the subject as a whole. The authors have contributed more than 200 original research articles to the literature, many during their 25 years of collaboration. Features of this book: • Gives a comprehensive in-depth survey of a rarely-reviewed subject. • Reviews methods used in studies of thermal decompositions of solids. • Discusses patterns of subject development perceived from an extensive literature survey. This book is expected to be of greatest value and interest to scientists concerned with the chemical properties and reactions of solids, including chemists, physicists, pharmacists, material scientists, crystallographers, metallurgists and others. This wide coverage of the literature dealing with thermal reactions of solids will be of value to both academic and industrial researchers by reviewing the current status of the theory of the subject. It could also provide a useful starting point for the exploitation of crystalline materials in practical and industrial applications. The contents will also be relevant to a wide variety of researchers, including, for example, those concerned with the stabilities of polymers and composite materials, the processing of minerals, the shelf-lives of pharmaceuticals, etc.

Solid State Chemistry An Introduction CRC Press

One of the motivating questions in materials research today is, how can elements be combined to produce a solid with specified properties? This book is intended to acquaint the reader with established principles of crystallography and cohesive forces that are needed to address the fundamental relationship between the composition, structure and bonding. Starting with an introduction to periodic trends, the book discusses crystal structures and the various primary and secondary bonding types, and finishes by describing a number of models for predicting phase stability and structure. Containing a large number of worked examples, exercises, and detailed descriptions of numerous crystal structures, this book is primarily intended as an advanced undergraduate or graduate level textbook for students of materials science. It will also be useful to scientists and engineers who work with solid materials.

The last quarter-century has been marked by the extremely rapid growth of the solid-state sciences. They include what is now the largest subfield of physics, and the materials engineering sciences have likewise flourished. And, playing an active role throughout this vast area of science and engineering have been very large numbers of chemists. Yet, even

though the role of chemistry in the solid-state sciences has been a vital one and the solid-state sciences have, in turn, made enormous contributions to chemical thought, solid-state chemistry has not been recognized by the general body of chemists as a major subfield of chemistry. Solid-state chemistry is not even well defined as to content. Some, for example, would have it include only the quantum chemistry of solids and would reject thermodynamics and phase equilibria; this is nonsense. Solid-state chemistry has many facets, and one of the purposes of this Treatise is to help define the field. Perhaps the most general characteristic of solid-state chemistry, and one which helps differentiate it from solid-state physics, is its focus on the chemical composition and atomic configuration of real solids and on the relationship of composition and structure to the chemical and physical properties of the solid. Real solids are usually extremely complex and exhibit almost infinite variety in their compositional and structural features.

Solid State Chemistry is a general textbook, composed for those with little background knowledge of the subject, but who wish to learn more about the various segments of solid state theory and technology. The information is presented in a form that can easily be understood and will be useful to readers wishing to build on their own store of knowledge and experience. Well presented in easy to understand format Informative textbook aimed primarily at the novice

Comprehensively covers the segments of solid state theory and technology

The book on solid state chemistry presents studies of chemical, structural, thermodynamic, electronic, magnetic, and optical properties and processes in solids. Research areas include: bonding in solids, crystal chemistry, crystal growth mechanisms, diffusion epitaxy, high-pressure processes, magnetic properties of materials, optical characterisation of materials, order-disorder, phase equilibria and transformation mechanisms, reactions at surfaces, statistical mechanics of defect interactions, structural studies and transport phenomena.

Defects play an important role in determining the properties of solids. This book provides an introduction to chemical bond, phonons, and thermodynamics; treatment of point defect formation and reaction, equilibria, mechanisms, and kinetics; kinetics chapters on solid state processes; and electrochemical techniques and applications. \* Offers a coherent description of fundamental defect chemistry and the most common applications. \* Up-to-date trends and developments within this field. \* Combines electrochemical concepts with aspects of semiconductor physics.

This book provides a study in Bonding, Structure and Solid State Chemistry. It is based on lecture courses given over several years, but is not directed at any particular degree course. Thus, it will find a place in all years of first-degree courses in both chemistry and those subjects for which chemistry forms a significant part. It will also prepare readers for more intensive study in the title topics. Pre-knowledge is assumed in mathematics and physical sciences at about A-level. Additional mathematical and other topics are presented where necessary as appendices, so as not to disturb the

flow of the main text. The book is copiously illustrated, including many stereoscopic diagrams (with practical advice on correct viewing) and colour illustrations. A suite of computer programs, some of which are interactive, has been devised for the book and is available on-line from the publisher's website [insert URL here]. They are available for both 32- and 64-bit operating systems, and are easily executed on a PC or laptop; notes on their applications are provided. Problems have been devised for each chapter and fully worked 'tutorial'; solutions are included. After an introductory chapter, the book presents a study based on the main interactive forces responsible for cohesion in the solid state of matter. No classification is without some ambiguity, but that chosen allows for a structured discussion over a wide range of compounds. Each chapter includes worked examples on the study topics which, together with the problems provided, should ensure a thorough understanding of the textual material.

The scientific exploration of solid materials represents one of the most important, fascinating and rewarding areas of scientific endeavour in the present day, not only from the viewpoint of advancing fundamental understanding but also from the industrial perspective, given the immense diversity of applications of solid materials across the full range of commercial sectors. *Turning Points in Solid-State, Materials and Surface Science* provides a state-of-the-art survey of some of the most important recent developments across the spectrum of solid-state, materials and surface sciences, while at the same time reflecting on key turning points in the evolution of this scientific discipline and projecting into the directions for future research progress. The book serves as a timely tribute to the life and work of Professor Sir John Meurig Thomas FRS, who has made monumental contributions to this field of science throughout his distinguished 50-year career in research, during which he has initiated, developed and exploited many important branches of this field. Indeed, the depth and breadth of his contributions towards the evolution and advancement of this scientific discipline, and his critical role in elevating this field to the important position that it now occupies within modern science, are demonstrated recurrently throughout the chapters of this book. Individual chapters are contributed by internationally leading experts in their respective fields, and the topics covered include solid-state chemistry of inorganic and organic materials, heterogeneous catalysis, surface science and materials science, with one section of the book focusing on modern developments in electron microscopy and its contributions to chemistry and materials science. The book serves as a modern and up-to-date monograph in these fields, and provides a valuable resource to researchers in academia and industry who require a comprehensive source of information on this important and rapidly developing subject.

*Inorganic Chemistry, Second Edition*, provides essential information for students of inorganic chemistry or for chemists pursuing self-study. The presentation of topics is made with an effort to be clear and concise so that the book is portable and user friendly. The text emphasizes fundamental principles—including molecular structure, acid-base chemistry,

coordination chemistry, ligand field theory, and solid state chemistry. It is organized into five major themes (structure, condensed phases, solution chemistry, main group and coordination compounds) with several chapters in each. There is a logical progression from atomic structure to molecular structure to properties of substances based on molecular structures, to behavior of solids, etc. The textbook contains a balance of topics in theoretical and descriptive chemistry. For example, the hard-soft interaction principle is used to explain hydrogen bond strengths, strengths of acids and bases, stability of coordination compounds, etc. Discussion of elements begins with survey chapters focused on the main groups, while later chapters cover the elements in greater detail. Each chapter opens with narrative introductions and includes figures, tables, and end-of-chapter problem sets. This new edition features new and improved illustrations, including symmetry and 3D molecular orbital representations; expanded coverage of spectroscopy, instrumental techniques, organometallic and bio-inorganic chemistry; and more in-text worked-out examples to encourage active learning and to prepare students for their exams. This text is ideal for advanced undergraduate and graduate-level students enrolled in the Inorganic Chemistry course. This core course serves Chemistry and other science majors. The book may also be suitable for biochemistry, medicinal chemistry, and other professionals who wish to learn more about this subject area. Concise coverage maximizes student understanding and minimizes the inclusion of details students are unlikely to use. Discussion of elements begins with survey chapters focused on the main groups, while later chapters cover the elements in greater detail. Each chapter opens with narrative introductions and includes figures, tables, and end-of-chapter problem sets.

The essential introduction to the understanding of the structure of inorganic solids and materials. This revised and updated 2nd Edition looks at new developments and research results within Structural Inorganic Chemistry in a number of ways, special attention is paid to crystalline solids, elucidation and description of the spatial order of atoms within a chemical compound. Structural principles of inorganic molecules and solids are described through traditional concepts, modern bond-theoretical theories, as well as taking symmetry as a leading principle.

This book on solid state chemistry presents studies of chemical, structural, thermodynamic, electronic, magnetic, and optical properties and processes in solids. Research areas include: bonding in solids, crystal chemistry, crystal growth mechanisms, diffusion epitaxy, high-pressure processes, magnetic properties of materials, optical characterisation of materials, order-disorder, phase equilibria and transformation mechanisms, reactions at surfaces, statistical mechanics of defect interactions, structural studies and transport phenomena.

Advances in Physical Organic Chemistry provides the chemical community with authoritative and critical assessments of the many aspects of physical organic chemistry. The field is a rapidly developing one, with results and methodologies

finding application from biology to solid state physics.

New crystalline materials (organic, inorganic, hybrid) are promising for various applications, including electrical, piezoelectric, ferroelectric, magnetic, and catalytic processes. In addition, given their remarkable structural richness, these materials exhibit several interesting physical properties, such as ionic conduction, ion exchange, and others. Crystal growth, morphology, and grain size are factors influencing these physical properties. This book examines methods of synthesis of the most common crystalline materials and describes nucleation and crystal growth of various materials.

"A comprehensive guide to solid-state chemistry which is ideal for all undergraduate levels. It covers well the fundamentals of the area, from basic structures to methods of analysis, but also introduces modern topics such as sustainability." Dr. Jennifer Readman, University of Central Lancashire, UK "The latest edition of Solid State Chemistry combines clear explanations with a broad range of topics to provide students with a firm grounding in the major theoretical and practical aspects of the chemistry of solids." Professor Robert Palgrave, University College London, UK Building a foundation with a thorough description of crystalline structures, this fifth edition of Solid State Chemistry: An Introduction presents a wide range of the synthetic and physical techniques used to prepare and characterise solids. Going beyond this, this largely nonmathematical introduction to solid-state chemistry includes the bonding and electronic, magnetic, electrical, and optical properties of solids. Solids of particular interest—porous solids, superconductors, and nanostructures—are included. Practical examples of applications and modern developments are given. It offers students the opportunity to apply their knowledge in real-life situations and will serve them well throughout their degree course. New in the Fifth Edition A new chapter on sustainability in solid-state chemistry written by an expert in this field Cryo-electron microscopy X-ray photoelectron spectroscopy (ESCA) Covalent organic frameworks Graphene oxide and bilayer graphene Elaine A. Moore studied chemistry as an undergraduate at Oxford University and then stayed on to complete a DPhil in theoretical chemistry with Peter Atkins. After a two-year postdoctoral position at the University of Southampton, she joined the Open University in 1975, becoming a lecturer in chemistry in 1977, senior lecturer in 1998, and reader in 2004. She retired in 2017 and currently has an honorary position at the Open University. She has produced OU teaching texts in chemistry for courses at levels 1, 2, and 3 and written texts in astronomy at level 2 and physics at level 3. She was team leader for the production and presentation of an Open University level 2 chemistry module delivered entirely online. She is a Fellow of the Royal Society of Chemistry and a Senior Fellow of the Higher Education Academy. She was co-chair for the successful Departmental submission of an Athena Swan bronze award. Lesley E. Smart studied chemistry at Southampton University, United Kingdom. After completing a PhD in Raman spectroscopy, she moved to a

lectureship at the (then) Royal University of Malta. After returning to the United Kingdom, she took an SRC Fellowship to Bristol University to work on X-ray crystallography. From 1977 to 2009, she worked at the Open University chemistry department as a lecturer, senior lecturer, and Molecular Science Programme director, and she held an honorary senior lectureship there until her death in 2016. At the Open University, she was involved in the production of undergraduate courses in inorganic and physical chemistry and health sciences. She served on the Council of the Royal Society of Chemistry and as the chair of their Benevolent Fund.

Dust is widespread in the galaxy. To astronomers studying stars it may be just an irritating fog, but it is becoming widely recognized that cosmic dust plays an active role in astrochemistry. Without dust, the galaxy would have evolved differently, and planetary systems like ours would not have occurred. To explore and consolidate this active area of research, *Dust and Chemistry in Astronomy* covers the role of dust in the formation of molecules in the interstellar medium, with the exception of dust in the solar system. Each chapter provides thorough coverage of our understanding of interstellar dust, particularly its interaction with interstellar gas. Aimed at postgraduate researchers, the book also serves as a thorough review of this significant area of astrophysics for practicing astronomers and graduate students.

In 2001 Wyn Roberts celebrated both his 70th birthday and 50 years of working in surface science, to use the term "surface science" in its broadest meaning. This book aims to mark the anniversary with a contribution of lasting value, something more than the usual festschrift issue of a relevant journal. The book is divided into three sections: Surface Science, Model Catalysts and Catalysis, topics in which Wyn has always had interests. The authors for each chapter were chosen from some of the many eminent scientists who have worked with Wyn in various ways and are all internationally acknowledged as leaders in their field. The authors have produced authoritative reviews of their own specialties which together result in a book with an unrivalled combination of breadth and depth exploring the most recent developments in surface chemistry and catalysis.

The vast majority of drugs are organic molecular entities. A clear understanding of the organic chemistry of drug degradation is essential to maintaining the stability, efficacy, and safety of a drug product throughout its shelf-life. During analytical method development, stability testing, and pharmaceutical manufacturing troubleshooting activities, one of the frequently occurring and usually challenging events would be the identification of drug degradants and understanding of drug degradation mechanisms and pathways. This book is written by a veteran of the pharmaceutical industry who has first-hand experience in drug design and development, drug degradation mechanism studies, analytical development, and manufacturing process troubleshooting and improvement. The author discusses various degradation pathways with an emphasis on the mechanisms of the underlying organic chemistry, which should aid greatly in the efforts of degradant identification, formulation development, analytical development, and manufacturing process improvement. Organic reactions that are significant in drug degradation will first be reviewed and then illustrated by examples of drug degradation reported in the literature. The author brings the book to a close with a final chapter dedicated to the strategy for rapid elucidation of drug degradants with regard to the current regulatory requirements and guidelines. One chapter that should be given special attention is Chapter 3, Oxidative Degradation. Oxidative degradation is one of the most common degradation pathways but perhaps the most complex one. This chapter employs more than sixty drug degradation case studies with in-depth discussion in regard to their unique degradation pathways. With the increasing regulatory requirements on the quality and safety of pharmaceutical products, in particular with regard to drug impurities and degradants, the book will

be an invaluable resource for pharmaceutical and analytical scientists who engage in formulation development, analytical development, stability studies, degradant identification, and support of manufacturing process improvement. In addition, it will also be helpful to scientists engaged in drug discovery and development as well as in drug metabolism studies.

"For centuries fireworks have been a source of delight and amazement in cultures around the world. But what produces their dazzling array of effects? This book takes you behind the scenes to explore the chemistry and physics behind the art of pyrotechnics. Topics covered include history and characteristics of gunpowder; principles behind each of the most popular firework types: rockets, shells, fountains, sparklers, bangers, roman candles and wheels; special effects, including sound effects, coloured smokes and electrical firing; firework safety for private use and displays; and firework legislation. The Chemistry of Fireworks is aimed at students with A level qualifications or equivalent. The style is concise and easy to understand, and the theory of fireworks is discussed in terms of well-known scientific concepts wherever possible. It will also be a useful source of reference for anyone studying pyrotechnics as applied to fireworks. Review Extracts ""a worthwhile addition to the pyrotechnist's library"" Fireworks ""a useful source of information which makes absorbing reading."" Angewandte Chemie, International Edition"

The Advances in Chemical Physics series provides the chemical physics and physical chemistry fields with a forum for critical, authoritative evaluations of advances in every area of the discipline. Filled with cutting-edge research reported in a cohesive manner not found elsewhere in the literature, each volume of the Advances in Chemical Physics series serves as the perfect supplement to any advanced graduate class devoted to the study of chemical physics.

The thesis focuses on the syntheses, structural characterizations and chemical bonding analyses for several ternary R–M–Ge (R = rare earth metal; M = another metal) intermetallics. The challenges in understanding the main interactions governing the chemistry of these compounds, which lead to our inability to predict their formation, structure and properties, are what provided the motivation for this study. In particular, the R<sub>2</sub>MGe<sub>6</sub> (M = Li, Mg, Al, Cu, Zn, Pd, Ag), R<sub>4</sub>MGe<sub>10-x</sub> (M = Li, Mg), R<sub>2</sub>Pd<sub>3</sub>Ge<sub>5</sub>, Lu<sub>5</sub>Pd<sub>4</sub>Ge<sub>8</sub>, Lu<sub>3</sub>Pd<sub>4</sub>Ge<sub>4</sub> and Yb<sub>2</sub>PdGe<sub>3</sub> phases were synthesized and structurally characterized. Much effort was put into the stabilization of metastable phases, employing the innovative metal flux method, and into the accurate structure solution of twinned crystals. Cutting-edge position-space chemical bonding techniques were combined with new methodologies conceived to correctly describe the Ge–M, Ge–La and also La–M polar-covalent interactions for the La<sub>2</sub>MGe<sub>6</sub> (M = Li, Mg, Al, Cu, Zn, Pd, Ag) series. The present results constitute a step forward in our comprehension of ternary germanide chemistry as well as providing a good playground for further investigations.

Introduction to Materials Chemistry will appeal to advanced undergraduates and graduate students in chemistry, materials science, and chemical engineering by leading them stepwise from the elementary chemistry on which materials science depends, through a discussion of the different classes of materials, and ending with a description of how materials are used in devices and general technology.

This comprehensive textbook provides a modern, self-contained treatment for upper undergraduate and graduate level students. It emphasizes the links between structure, defects, bonding, and properties throughout, and provides an integrated treatment of a wide range of materials, including crystalline, amorphous, organic and nano- materials. Boxes on synthesis methods, characterization tools, and technological applications distil specific examples and support student understanding of materials and their design. The first six chapters cover the fundamentals of extended solids, while later chapters explore a specific property or class of material, building a coherent framework for students to master core concepts with confidence, and for instructors to easily tailor the coverage to fit their own single semester course.

With mathematical details given only where they strengthen understanding, 400 original figures and over 330 problems for hands-on learning, this accessible textbook is ideal for courses in chemistry and materials science.

This first monograph in the new AAPS book series concisely reviews important aspects of powder and particle systems and the critical quality attributes that should be used as a guide to future developments intended to maximize the control of product quality and performance. Drs. Hickey and Giovagnoli have written an essential primer for any scientists involved in powder or particle research and manufacturing. It is appropriate for those just entering the field or as a rapid reference for the experienced pharmaceutical scientist. The authors have both academic and industrial experience and the coverage includes solid state chemistry; crystallization; physical processes; particle size and distribution; particle interaction; manufacturing processes; quality by design; and a general discussion of the industry. *Pharmaceutical Powder and Particles* is intended to concisely review important aspects of powder and particle systems and the critical quality attributes that should be used as a guide to future developments intended to maximize the control of product quality and performance.

*Preparative Methods in Solid State Chemistry* deals with the preparative methods used in solid state chemistry and highlights the importance of the chemist's role in preparing materials of desired quality as well as obtaining materials according to the requirements of the user such as the physicist. Topics covered range from high-pressure techniques in preparative chemistry to methods of growing single crystals of high-melting-point oxides. This book is comprised of 14 chapters and begins with an overview of possibilities for high-pressure synthesis, as well as the methods used to obtain high pressures, including transmission by gaseous or liquid fluids or in the solid state. The method of shock waves is then considered both from the point of view of thermodynamics and thermoelasticity, along with the possibility of using superpressures for evidently revolutionary applications. Subsequent chapters focus on the synthesis of single crystals of refractory oxides either at high temperatures (essentially liquid-solid transformations) or at lower temperatures in the presence of a solvent or a chemical reagent. The production of single crystals by electrolytic reduction in molten salts is also described. Numerous examples of vapor transport reactions in a temperature gradient are presented. This monograph should be of interest to chemists and students of solid state chemistry.

The first broad account offering a non-mathematical, unified treatment of solid state chemistry. Describes synthetic methods, X-ray diffraction, principles of inorganic crystal structures, crystal chemistry and bonding in solids; phase diagrams of 1, 2 and 3 component systems; the electrical, magnetic, and optical properties of solids; three groups of industrially important inorganic solids--glass, cement, and refractories; and certain aspects of organic solid state chemistry, including the "organic metal" of new materials.

The 2nd edition of Materials Chemistry builds on the strengths that were recognized by a 2008 Textbook Excellence Award from the Text and Academic Authors Association (TAA). Materials Chemistry addresses inorganic-, organic-, and nano-based materials from a structure vs. property treatment, providing a suitable breadth and depth coverage of the rapidly evolving materials field — in a concise format. The 2nd edition continues to offer innovative coverage and practical perspective throughout, e.g.: the opening solid-state chemistry chapter uses color illustrations of crystalline unit cells and digital photos of models to clarify their structures. This edition features more archetypical unit cells and includes fundamental principles of X-ray crystallography and band theory. In addition, an ample amorphous-solids section has been expanded to include more details regarding zeolite syntheses, as well as ceramics classifications and their biomaterial applications. The subsequent metals chapter has been re-organized for clarity, and continues to treat the full spectrum of powder metallurgical methods, complex phase behaviors of the Fe-C system and steels, and topics such as corrosion and shape-memory properties. The mining/processing of metals has also been expanded to include photographs of various processes occurring in an actual steelmaking plant. The semiconductor chapter addresses evolution and limitations/solutions of modern transistors, as well as IC fabrication and photovoltaics. Building on the fundamentals presented earlier, more details regarding the band structure of semiconductors is now included, as well as discussions of GaAs vs. Si for microelectronics applications, and surface reconstruction nomenclature. The emerging field of ‘soft lithographic’ patterning is now included in this chapter, and thin film deposition methodologies are also greatly expanded to now include more fundamental aspects of chemical vapor deposition (CVD) and atomic layer deposition (ALD). The polymer and ‘soft’ materials chapter represents the largest expansion for the 2nd edition. This chapter describes all polymeric classes including dendritic polymers, as well as important additives such as plasticizers and flame-retardants, and emerging applications such as molecular magnets and self-repairing polymers. This edition now features ‘click chemistry’ polymerization, silicones, conductive polymers and biomaterials applications such as biodegradable polymers, biomedical devices, drug delivery, and contact lenses. Final chapters on nanomaterials and materials-characterization techniques are also carefully surveyed, focusing on nomenclature, synthetic techniques, and applications taken from the latest scientific literature. The 2nd edition has been significantly updated to now include nanotoxicity, vapor-phase growth of 0-D nanostructures, and more details regarding synthetic techniques and mechanisms for solution-phase growth of various nanomaterials. Graphene, recognized by the 2010 Nobel Prize in Physics, is now also included in this edition. Most appropriate for Junior/Senior undergraduate students, as well as first-year graduate students in chemistry, physics, or engineering fields, Materials Chemistry may also serve as a valuable reference to industrial researchers. Each chapter concludes with a section that describes important materials

applications, and an updated list of thought-provoking questions. The appendices have also been updated with additional laboratory modules for materials synthesis (e.g., porous silicon) and a comprehensive timeline of major materials developments.

Solid State Physics opens with the adiabatic approximation to the many-body problem of a system of ions and valence electrons. After chapters on lattice symmetry, structure and dynamics, it then proceeds with four chapters devoted to the single-electron theory of the solid state. Semiconductors and dielectrics are covered in depth and chapters on magnetism and superconductivity follow. The book concludes with a chapter on solid surfaces. Every section is followed by solved problems, some of them illustrating areas of current interest in solid state physics, to give the student a practical working knowledge of the subject, and the text is illustrated by many supplementary examples.

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