Chapter 8 Covalent Bonding Norwell High School

M. C. Roco and W.S. Bainbridge In the early decades of the 21st century, concentrated efforts can unify science based on the unity of nature, thereby advancing the combination of nanotechnology, biotechnology, information technology, and new technologies based in cognitive science. With proper attention to ethical issues and societal needs, converging in human abilities, societal technologies could achieve a tremendous improvement outcomes, the nation's productivity, and the quality of life. This is a broad, cross cutting, emerging and timely opportunity of interest to individuals, society and humanity in the long term. The phrase "convergent technologies" refers to the synergistic combination of four major "NBIC" (nano-bio-info-cogno) provinces of science and technology, each of which is currently progressing at a rapid rate: (a) nanoscience and nanotechnology; (b) biotechnology and biomedicine, including genetic engineering; (c) information technology, including advanced computing and communications; (d) cognitive science, including cognitive neuroscience.

Timely and Broad Opportunity. Convergence of diverse technologies is based on material unity at the nanoscale and on technology integration from that scale.

All living things contain carbon in some form, as it is the primary component of macromolecules including proteins, lipids, nucleic acids (RNA and DNA), and carbohydrates. As a matter of fact, it is the backbone of all organic (chemistry) compounds forming different kinds of bonds. Carbon: The Black, the Gray and the Transparent is not a complete scientific history of the material, but a book that describes key discoveries about this old faithful element while encouraging broader perspectives and approaches to its research due to its vast applications. All allotropes of carbon are described in this book, along with their properties, uses, and methods of procurement or manufacturing. Black carbon is represented by coal, gray carbon is represented by graphite, and transparent carbon is represented by diamond.

Chemical Synthesis: Gnosis to Prognosis (XTUICIKI ~uv8eoTr ana TT rVWOT) OTT npaYVWOT) " . . . . other things being equal, that field has the most merit which contributes most heavily to, and illuminates most brightly, its neighbouring scientific disciplines[!] One hundred scientists, a blend of students, industrialists, and academics from twenty countries gathered to circumscribe, understand, and elaborate this topic in the magical setting of Ravello, Italy. The mandate of this workshop? To survey existing knowledge, assess current work, and discuss the future directions of chemical synthesis as it impinges on three exciting interdisciplinary themes of science in the 1990's: bioactive molecules, man-made chemical materials, and molecular recognition. This tempting but inexact menu summoned diverse students and scientists who wished to seriously reflect upon, dissect, and eject ideas and own experiences into open debate on this topic, which is at a crossroad in internal evolution and impact on the life and material sciences. The group arrived from many directions and in various forms of transportation, matters soon forgotten, when it found itself in the village which nurtured Wagner's inspiration and set to work immediately to ponder the question which has received extensive thought, prediction, and caveat from illustrious chemists over a period of time [2], two of which, to the delight of all, in presence among the Lectures.

Chemical education is essential to everybody because it deals with ideas that play major roles in personal, social, and economic decisions. This book is based on three principles: that all aspects of chemical education should be associated with research; that the development of opportunities for chemical education should be both a continuous process and be linked to research; and that the professional development of all those associated with chemical education should make extensive and diverse use of that research. It is intended for: pre-service and practising chemistry teachers and lecturers; chemistry teacher educators; chemical education researchers; the designers and managers of formal chemical curricula; informal chemical educators; authors of textbooks and curriculum support materials; practising chemists and chemical technologists. It addresses: the relation between chemistry and chemical education; curricula for chemical education; teaching and learning about chemical compounds and chemical change; the development of teachers; the development of chemical education as a field of enquiry. This is mainly done in respect of the full range of formal education contexts (schools, universities, vocational colleges) but also in respect of informal education contexts (books, science centres and museums).

The ASI workshop on "Selectivities in Lewis Acid Promoted Reactions" held in the Emmantina-Hotel in Athens-Glyfada, Greece, October 2-7, 1988 was held to bring some light into the darkness of Lewis acid induced processes. As such the workshop reflects some current trends in organic synthesis, where Lewis acids are becoming a powerful tool in many different modern reactions, e.g. Diels-Alder reactions, Ene reactions, Sakurai reactions, and in general silicon and tin chemistry. The objective of this meeting was to bring together most of the world experts in the field to discuss the major reactions promoted by Lewis acids. Organic synthesis will play a major role in this book connected with some fundamental mechanistic work on allylsilane and -tin chemistry. Both natural product synthesis and unnatural molecules are presented in the chapters. The book presents all the 15 invited lectures and the contributions of 15 posters. I am confident that the material presented in this book will stimulate the chemistry, which has been discussed on our meeting, around the world. The meeting and the book were only possible through a grant of the NATO Scientific Affairs Devison and financial support by the following companies: Kali Chemie (Hannover, W-Germany), E. Merck (Darmstadt, W-Germany), Sandoz (Basel, Switzerland), Schering (Berlin, W-Germany).

This book is devoted to general questions of the chemistry of metal alkoxides -- including physiochemical properties, structure, specific features of single groups of alkoxides, theoretical principles of their use, and major applications of this method in the preparation of functional materials.


Excess of homocysteine, a product of the metabolism of the essential amino acid methionine, is associated with poor
health, is linked to heart and brain diseases in general human populations, and accelerates mortality in heart disease patients. Neurological and cardiovascular abnormalities occur in patients with severe genetic hyperhomocysteinemia and lead to premature death due to vascular complications. Although it is considered a non-protein amino acid, studies over the past dozen years have discovered mechanisms by which homocysteine becomes a component of proteins. Homocysteine-containing proteins lose their normal biological function and become auto-immunogenic and pro-thrombotic. In this book, the author, a pioneer and a leading contributor to the field, describes up-to date studies of the biological chemistry of homocysteine-containing proteins, as well as pathological consequences and clinical implications of their formation. This is a comprehensive account of the broad range of basic science and medical implications of homocysteine-containing proteins for health and disease.

Algorithms for VLSI Physical Design Automation is a core reference text for graduate students and CAD professionals. It provides a comprehensive treatment of the principles and algorithms of VLSI physical design. Algorithms for VLSI Physical Design Automation presents the concepts and algorithms in an intuitive manner. Each chapter contains 3-4 algorithms that are discussed in detail. Additional algorithms are presented in a somewhat shorter format. References to advanced algorithms are presented at the end of each chapter. Algorithms for VLSI Physical Design Automation covers all aspects of physical design. The first three chapters provide the background material while the subsequent chapters focus on each phase of the physical design cycle. In addition, newer topics like physical design automation of FPGAs and MCMs have been included. The author provides an extensive bibliography which is useful for finding advanced material on a topic. Algorithms for VLSI Physical Design Automation is an invaluable reference for professionals in layout, design automation and physical design.

This reference on current VB theory and applications presents a practical system that can be applied to a variety of chemical problems in a uniform manner. After explaining basic VB theory, it discusses VB applications to bonding problems, aromaticity and antiaromaticity, the dioxygen molecule, polyradicals, excited states, organic reactions, inorganic/organometallic reactions, photochemical reactions, and catalytic reactions. With a guide for performing VB calculations, exercises and answers, and numerous solved problems, this is the premier reference for practitioners and upper-level students.

This book constitutes the Proceedings of the NATO Advanced Research Workshop on Conjugated Polymers held at the University of Mons, Belgium, during the first week of September 1989. The Workshop was attended by about fifty scientists representing most of the leading research groups within NATO countries, that have contributed to the development of conjugated polymeric materials. The program was focused on applications related to electrical conductivity and nonlinear optics. The attendance was well balanced with a blend of researchers from academic, industrial, and government labs, and including synthetic chemists, physical chemists, physicists, materials scientists, and theoreticians. The Workshop provided an especially timely opportunity to discuss the important progress that has taken place in the field of Conjugated Polymers in the late eighties as well as the enormous potential that lies in front of us. Among the recent significant developments in the field, we can cite for instance: (i) The discovery of novel synthetic routes affording conjugated polymers - that are much better characterized, especially through control of the molecular weight; - that can be processed from solution or the melt; the early promise that conducting polymers would constitute materials combining the electrical conductivities of metals with the mechanical properties of plastics is now being realized; - that can reach remarkably high conductivities.

Despite the rationalist tradition of Confucianism, the Chinese people before the republican era were no less superstitious and credulous than were Europeans during the Middle Ages. Supernatural tales are still cultivated in Taiwan, though less extensively or seriously than they were from the mid-seventeenth to the early twentieth centuries under the Manchu Dynasty, when a great number of such collections were published and enjoyed by a wide audience. Of these collections, Strange Stories from a Chinese Studio is the recognized classic, superior to the rest for its style, learned allusions, wonderful mixture of humanity with the preposterous, and inventiveness. Although Pu Songling claimed in his preface that he did nothing more than copy down what he heard and edit contributions from his friends, quite a number of the stories were his creations, judging from the sophistication of sentiment and the neatness of plot. These stories, mostly supernatural in theme, rich in poetic symbolism, and deep in psychological insight, are a unique achievement in Chinese literature as studies of the feminine mind clothed in vivid imagination. The preponderant supernatural element in these stories is far from naïve: The human nature revealed here is wholly selfish or manipulative or compassionate lover rather than to an innocent blessed with sense of wonder but little experience. Like the fairy tales of Western civilization, the stories are governed by their own logic. Supernatural intervention is common, and men associate freely with spirits. Causes are followed by effects, but not in the same manner as in the natural or everyday human world. Spirits, demons, and human beings are all under the control of the law of causation or just retribution; good deeds or evil bring forth rewards or punishments. Therefore the author believed that his stories, in spite of their weirdness, absurdity, or even, in certain cases, obscenity, had a moral purpose. Radiopharmaceutical research has recently undergone a major change in direction. In past years it has been concerned mainly with the development of perfusion tracers, the biodistribution of which reflect the regional blood flow to areas of major organs such as the heart and brain. However, a major new direction of interest now lies in the development of receptor-binding radio-tracers which can be used to perform in-vivo characterisation of diseased tissues and it is likely that much of the future research in this field will follow this direction. The difficulties in developing such tracers are considerable. The researcher must first identify a promising target for radiopharmaceutical development. High specific activity radioactive molecules must be designed and synthesised which will both bind to the target receptor with high affinity, and also have the physicochemical characteristics which will allow them to reach the target site in sufficient quantity while at the same time showing minimal uptake in non-target tissues. Thus the knowledge base required for radiopharmaceutical development has now expanded beyond the limits of radiopharmaceutical chemistry to include aspects of biochemistry, molecular biology and conventional drug design. The portfolio of basic knowledge required to support current radiopharmaceutical development is changing and scientists working in this arena need to be trained in this regard. At the same time, the very latest developments in the field need to be communicated to the scientific community in order to stimulate the advancement of this exciting new direction of research.

F. T. Wallenbergethis book serves as an introduction to advanced inorganic fibers and aims to support fundamental research, assist applied scientists and designers in industry, and facilitate materials science instruction in universities and colleges. Its three main sections deal with fibers which are derived from the vapor phase such as single crystal silicon whiskers or carbon nanotubes, from the liquid phase such as advanced glass and single crystal oxide fibers, and from solid precursor fibers such as carbon and ceramic fibers. Contents FIBERS FROM THE VAPOR, LIQUID AND SOLID PHASE 1.1 The most important phase is the liquid phase 1.2 After by any name istill after 1.3 Biographic sketches of the authors 1.4 Acknowledgments CHAPTER 1 FIBERS FROM THE VAPOR, LIQUID AND SOLID PHASE F. T. Wallenbergethe book describes advanced inorganic fibers, focuses on principles and concepts, analyzes experimental and commercial processes, and relates process variables to structures, structures to fiber properties and fiber properties to end-use performance. In principle, there are discontinuous or inherently short, and continuous or potentially endless, fibers. Short fibers range from asbestos fibers, which were
described as early as 300 BC to carbon nanotubes which were discovered in 1991 [1] and have been fully described in 1999 [2].

This volume contains the Proceedings of the 8th International Symposium on Magnesium. It presents research and applications in order to interface between medical doctors, clinicians and scientists responsible for magnesium involvement in the pathogenesis of diseases, its biological significance, metabolism and many other utilizations which are associated with membranes and cells. The topics which are discussed concern mechanisms of the mode of action of free magnesium cations, hydrated cations and magnesium-linked cations. Increasing the accumulation of aluminum in the bone (body) in cases of renal osteodystrophy may influence the histopathologic aspect of the bones. Alumnum blunts the effect of increasedPTH secretion and favours the genesis of osteoid. That means, in cases of renal failure combined with aluminum accumulation, a relatively low bone turnover is found and no fibrosis of the bone marrow. Furthermore the amount of osteoid is increased. This means that there is evidence of osteomalacia especially when the latter is defined as an increased amount of osteoid covered with a relatively low number of cubic osteoblasts. To a certain extent the effect of aluminum accumulation is comparable to the effect of PTX. Treatment with DFO may normalize the bone, although not necessarily with a concomitant disappearance of alumnum from the bone. The presence of aluminum in the bone can be suggested by routine histologic investigation of the bone and can be made rather probably with the aluminum staining combined with iron-staining, but can only be proven by more advanced techniques like ET AAS and LAMMA. References 1. Boyce BF, Elder HY, Elliot HL, Fogelman I, Gell GS, Lunor Bl, Beattall G, Boyle YT, 1982: Hypercaemic osteomalacia due to aluminium toxicity. Lancet 6: 1009. 2. Verbueken AH, Visser WI, Van de Vyver FL, Van Grieken RE, De Broe ME, 1986: The use of laser microprobe mass analysis (LAMMA) to control the staining of aluminum by aurin tricarboxylate (aluminon). Stain Technology 61: 287.

Having fully established themselves as workable engineering materials, composite materials are now increasingly commonplace around the world. Serves as both a text and reference guide to the behavior of composite materials in different engineering applications. Revised for this Second Edition, the text includes a general discussion of composites as material, practical aspects of design and performance, and further analysis that will be helpful to those engaged in research on composites. Each chapter closes with references for further reading and a set of problems that will be useful in developing a better understanding of the subject.

This volume constitutes the proceedings of the Nobel Laureate Symposium on Applied Quantum Chemistry held during the International Chemical Congress of Pacific Basin Societies, 16-21 December 1984, in Honolulu, Hawaii. The Symposium was held in honour of the five Nobel Laureates who have contributed so extensively to the development of Applied Quantum Chemistry. K. Fukui, G. Herzberg, R. Hoffmann, W.N. Lipscomb and R.S. Mulliken. Professors Fukui, Hoffmann and Lipscomb attended and presented plenary lectures to the Symposium. Their lectures and the other invited papers and invited poster presentations brought into focus the current state of Applied Quantum Chemistry and showed the importance of the interaction between quantum theory and experiment. We are indebted to the Subdivision of Theoretical Chemistry and the Division of Physical Chemistry of the American Chemical Society, the Division of Physical Chemistry of the Chemical Institute of Canada, Energy Conversion Devices, Inc., the IBM Corporation, and the Congress for their financial support which helped to make the Symposium possible. We would like to thank Dr. Philip Payne for making some of the local arrangements, and Mrs. Betty McIntosh for her assistance in arranging the Symposium and in the preparation of these proceedings for publication.

The NATO Advanced Research Workshop from which this book derives was conceived during Biotec-88, the Second Spanish Conference on Biotechnology, held at Barcelona in June 1988. The President of the Conference, Dr. Ricardo Guerrero, had arranged sessions on bacterial polymers which included lectures by five invited participants who, together with Dr. Guerrero, became the Organizing Committee for a projected meeting that would focus attention upon the increasing international importance of novel biodegradable polymers. The proposal found favour with the NATO Science Committee and, with Dr. R. Clinton Fuller and Dr. Robert W. Lenz as the co-Directors, Dr. Edwin A. Dawes as the Proceedings Editor, and Dr. Hans G. Schlegel, Dr. Alexander J.B. Zehnder and Dr. Ricardo Guerrero as members of the Organizing Committee, the meeting quickly took shape. To Dr. Guerrero we owe the happy choice of Sitges for the venue, a pleasant coastal resort 36 kilometres from Barcelona, which proved ideal. The sessions were held at the Palau de Maricel in appropriately impressive surroundings, and invaluable local support was provided by Mr. Jordi Mas-Castella and by Ms. Merce Piqueras. Much of the preparatory work fell upon the broad shoulders of Mr. Edward Knee, whose efforts are deeply appreciated. The Organizing Committee hopes that this Workshop will prove to be the first of a series which will aim to keep abreast of a rapidly expanding and exciting area of research that is highly relevant to environmental and industrial interests.

The past decade has witnessed an explosion of information on the molecular biology of insect viruses and a frenzy of activity in applying this information to medicine and agriculture. Genetically engineered baculoviruses are presently being tested for commercial use as pesticides, and the study of such viruses is also revealing remarkable insights into basic cellular processes such as apoptosis. This comprehensive volume provides readers with knowledge of basic and applied baculovirology so that current literature in the field can be appreciated.

This valuable new addition to the Encyclopaedia of Sports Medicine series provides a comprehensive and logical look at the principles and mechanisms of endocrinology and the study of such viruses is also revealing remarkable insights into basic cellular processes such as apoptosis. This comprehensive volume provides readers with knowledge of basic and applied baculovirology so that current literature in the field can be appreciated.

This valuable new addition to the Encyclopaedia of Sports Medicine series provides a comprehensive and logical look at the principles and mechanisms of endocrinology and the study of such viruses is also revealing remarkable insights into basic cellular processes such as apoptosis. This comprehensive volume provides readers with knowledge of basic and applied baculovirology so that current literature in the field can be appreciated.

This volume contains the Proceedings of the Nobel Laureate Symposium on Applied Quantum Chemistry held during the International Chemical Congress of Pacific Basin Societies, 16-21 December 1984, in Honolulu, Hawaii. The Symposium was held in honour of the five Nobel Laureates who have contributed so extensively to the development of Applied Quantum Chemistry. K. Fukui, G. Herzberg, R. Hoffmann, W.N. Lipscomb and R.S. Mulliken. Professors Fukui, Hoffmann and Lipscomb attended and presented plenary lectures to the Symposium. Their lectures and the other invited papers and invited poster presentations brought into focus the current state of Applied Quantum Chemistry and showed the importance of the interaction between quantum theory and experiment. We are indebted to the Subdivision of Theoretical Chemistry and the Division of Physical Chemistry of the American Chemical Society, the Division of Physical Chemistry of the Chemical Institute of Canada, Energy Conversion Devices, Inc., the IBM Corporation, and the Congress for their financial support which helped to make the Symposium possible. We would like to thank Dr. Philip Payne for making some of the local arrangements, and Mrs. Betty McIntosh for her assistance in arranging the Symposium and in the preparation of these proceedings for publication.

The NATO Advanced Research Workshop from which this book derives was conceived during Biotec-88, the Second Spanish Conference on Biotechnology, held at Barcelona in June 1988. The President of the Conference, Dr. Ricardo Guerrero, had arranged sessions on bacterial polymers which included lectures by five invited participants who, together with Dr. Guerrero, became the Organizing Committee for a projected meeting that would focus attention upon the increasing international importance of novel biodegradable polymers. The proposal found favour with the NATO Science Committee and, with Dr. R. Clinton Fuller and Dr. Robert W. Lenz as the co-Directors, Dr. Edwin A. Dawes as the Proceedings Editor, and Dr. Hans G. Schlegel, Dr. Alexander J.B. Zehnder and Dr. Ricardo Guerrero as members of the Organizing Committee, the meeting quickly took shape. To Dr. Guerrero we owe the happy choice of Sitges for the venue, a pleasant coastal resort 36 kilometres from Barcelona, which proved ideal. The sessions were held at the Palau de Maricel in appropriately impressive surroundings, and invaluable local support was provided by Mr. Jordi Mas-Castella and by Ms. Merce Piqueras. Much of the preparatory work fell upon the broad shoulders of Mr. Edward Knee, whose efforts are deeply appreciated. The Organizing Committee hopes that this Workshop will prove to be the first of a series which will aim to keep abreast of a rapidly expanding and exciting area of research that is highly relevant to environmental and industrial interests.

The past decade has witnessed an explosion of information on the molecular biology of insect viruses and a frenzy of activity in applying this information to medicine and agriculture. Genetically engineered baculoviruses are presently being tested for commercial use as pesticides, and the study of such viruses is also revealing remarkable insights into basic cellular processes such as apoptosis. This comprehensive volume provides readers with knowledge of basic and applied baculovirology so that current literature in the field can be appreciated.

This valuable new addition to the Encyclopaedia of Sports Medicine series provides a comprehensive and logical look at the principles and mechanisms of endocrinology and the study of such viruses is also revealing remarkable insights into basic cellular processes such as apoptosis. This comprehensive volume provides readers with knowledge of basic and applied baculovirology so that current literature in the field can be appreciated.

This valuable new addition to the Encyclopaedia of Sports Medicine series provides a comprehensive and logical look at the principles and mechanisms of endocrinology and the study of such viruses is also revealing remarkable insights into basic cellular processes such as apoptosis. This comprehensive volume provides readers with knowledge of basic and applied baculovirology so that current literature in the field can be appreciated.

Discover the benefits of applying algorithms to solve scientific, engineering, and practical problems. Providing a combination of theory, algorithms, and simulations, Handbook of Applied Algorithms presents an all-encompassing treatment of applying algorithms and discrete mathematics to practical problems in "hot" application areas, such as computational biology, computational chemistry, wireless networks, and computer vision. In eighteen self-contained chapters, this timely book explores: * Localized algorithms that can be used in topology control for wireless ad-hoc or sensor networks * Bioinformatics algorithms for analyzing data * Clustering algorithms and identification of association rules in data mining * Applications of combinatorial algorithms and graph theory in chemistry and molecular biology * Optimizing the frequency planning of a GSM network using evolutionary algorithms * Algorithmic solutions and advances achieved through game theory

Complete with exercises for readers to measure their comprehension of the material presented, Handbook of Applied Algorithms is a much-needed resource for researchers, practitioners, and students within computer science, life science, and engineering. Amiya Nayak, Ph.D, has over seventeen years of industrial experience and is Full Professor at the School of Information Technology and Engineering at the University of Ottawa, Canada. He is on the editorial board of several journals. Dr. Nayak's research interests are in the areas of fault tolerance, distributed systems/ algorithms, and mobile ad-hoc networks. Ivan Stoimenovici?, PhD, is Professor at the University of Ottawa, Canada (www.site.uottawa.ca/~ivan), and Chair Professor of Applied Computing at the University of Birmingham, United Kingdom. Dr. Stoimenovici? received the Royal Society Wolfson Research Merit Award. His current research interests are mostly in the design and analysis of algorithms for wireless ad-hoc and sensor networks.

Properties of nanosilicon in the form of nanoparticles, nanowires, nanotubes, and as porous material are of great interest. They can be used in finding suitable components for future miniature devices, and for the more exciting possibilities of novel optoelectronic applications due to bright luminescence from porous silicon, nanoparticles and nanowires. New findings from research into metal encapsulated clusters, silicon fullerenes and nanotubes have opened up a new paradigm in nanosilicon research and this could lead to large scale production of
nanoparticles with control on size and shape as well as novel quasi one-dimensional structures. There are possibilities of using silicon as an optical material and in the development of a silicon laser. In Nanosilicon, leading experts cover state-of-the-art experimental and theoretical advances in the different forms of nanosilicon. Furthermore, applications of nanosilicon to single electron transistors, as photonic material, chemical and biological sensors at molecular scale, and silicon nanowire devices are also discussed. Self-assemblies of silicon nanoflakes are important for applications. These developments are also related to cage structures of silicon in clathrates. With an interesting focus on the bottlenecks in the advancement of silicon based technology, this book provides a much-needed overview of the current state of understanding of nanosilicon research. Latest developments in nanosilicon, nanowires and nanotubes of silicon Focus on nanosilicon - a very timely subject attracting large interest Novel chapters on metal encapsulated silicon clusters and nanotubes No available as softcover No other book available that gives insight into so many reactions of importance, while the field of homogeneous catalysis is becoming more and more important to organic chemists, industrial chemists, and academia. Gives real insight in the many new and old reactions of importance, based on the author's extensive experience in both teaching and industrial practice. Provide background to chemists trained in a different discipline and graduate and masters students who take catalysis as a main or secondary topic. Semiconductor Gas Sensors, Second Edition, summarizes recent research on basic principles, new materials and emerging technologies in this essential field. Chapters cover the foundation of the underlying principles and sensing mechanisms of gas sensors, include expanded content on gas sensing characteristics, such as response, sensitivity and cross-sensitivity, present an overview of the nanomaterials utilized for gas sensing, and review the latest applications for semiconductor gas sensors, including environmental monitoring, indoor monitoring, medical applications. CMOS integration and chemical warfare agents. This second edition has been completely updated, thus ensuring it reflects current literature and the latest materials systems and applications. Includes an overview of key applications, with new chapters on indoor monitoring and medical applications Reviews developments in gas sensors and sensing methods, including an expanded section on gas sensor theory Discusses the use of nanomaterials in gas sensing, with new chapters on single-layer graphene sensors, graphene oxide sensors, printed sensors, and much more

Edited by one of the leading experts in the field, this handbook emphasizes why solid-state issues are important, which approaches should be taken to avoid problems and exploit the opportunities offered by solid state properties in the pharmaceutical and agricultural industries. With its practical approach, this is at once a guideline for development chemists just entering the field as well as a high-quality source of reference material for specialists in the pharmaceutical and chemical industry, structural chemists, physicochemists, crystallographers, inorganic chemists, and patent departments.

This second edition of Water Activity in Foods furnishes those working within food manufacturing, quality control, and safety with a newly revised guide to water activity and its role in the preservation and processing of food items. With clear, instructional prose and illustrations, the book’s international team of contributors break down the essential principles of water activity and water–food interactions, delineating water’s crucial impact upon attributes such as flavor, appearance, texture, and shelf life. The updated and expanded second edition continues to offer an authoritative overview of the subject, while also broadening its scope to include six newly written chapters covering the latest developments in water activity research. Exploring topics ranging from deliquescence to crispiness, these insightful new inclusions complement existing content that has been refreshed and reconfigured to support the food industry of today.

Most current state-of-the-art overview of this important class of compounds, encompassing many new and emerging applications The number of articles on organic azides continues to increase tremendously; on average, there are more than 1000 new publications a year Covers basic chemistry as well as state-of-the-art applications in life science and materials science World-ranked authors describe their own research in the wider context of azide chemistry Includes a chapter on safe synthesis and handling (azides can decompose explosively)

Fundamentals and Applications of Nano Silicon in Plasmonics and Fullerines: Current and Future Trends addresses current and future trends in the application and commercialization of nanosilicon. The book presents current, innovative and prospective applications and products based on nanosilicon and their binary system in the fields of energy harvesting and storage, lighting (solar cells and nano-capacitor and fuel cell devices and nanoLEDs), electronics (nanotransistors and nanomemory, quantum computing, photodetectors for space applications; biomedical (substance detection, plasmonic treatment of disease, skin care, implantable glucose sensor, capsules for drug delivery and underground water and oil exploration), and art (glass and pottery). Moreover, the book includes material on the use of advanced laser and proximal probes for imaging and manipulation of nanoparticles and atoms. In addition, coverage is given to carbon and how it contrasts and integrates with silicon with additional related applications. This is a valuable resource to all those seeking to learn more about the commercialization of nanosilicon, and to researchers wanting to learn more about emerging nanosilicon applications. Features a variety of designs and operation of nano-devices, helping engineers to make the best use of nanosilicon Contains underlying principles of how nanomaterials work and the variety of applications they provide, giving those new to nanosilicon a fundamental understanding Assesses the viability of various nanosilicon devices for mass production and commercialization, thereby providing an important source of information for engineers This book provides an up-to-date overview of the Mössbauer effect in physics, chemistry, electrochemistry, catalysis, biology, medicine, geology, mineralogy, archaeology and materials science. Coverage details the most recent developments of the technique especially in the fields of nanoparticles, thin films, surfaces, interfaces, magnetism, experimentation, theory, medical and industrial applications, and many experiments.

Because of a lack of appreciation for his efforts in developing modern polymer science, the contributions of Hermann Staudinger were disregarded for decades. There have also been delays in recognizing the contributions of other pioneers in polymer science. Hence, it is gratifying to note that Professor Seymour chaired an American Chemical Society Symposium focusing on the contributions of these pioneers and that Kluwer Academic Publishers has published the proceedings of this important symposium. H. Mark v DEDICATION This book on Pioneers in Polymer Science is dedicated to Nobel Laureate Polymer Scientists Hermann Staudinger, Emil Fischer, Herman Mark, Paul J. Flory, Linus Pauling, Carl S. Marvel, M. Polanyi, Giulio Natta, Karl Ziegler, and Bruce Merrifield as well as to those pioneers such as J.C. Patrick, Robert Thomas, William Sparks, Maurice Huggins, Otto Bayer, Leo Baekeland, Anselm Payer, Roger Boyer, Waldo Semon, Robert Banks, J.P. Hogan, and other pioneers who, to a large degree, were responsible for the development of the world’s second largest industry. ACKNOWLEDGEMENT The editor appreciates the contribution of co-authors Herman Mark, C.H. Fisher, and G. Alan Stahl who co chaired the Symposium on Pioneers in Polymer Science at the National Meeting of the American Chemical Society at Seattle, WA in 1984 and who contributed a chapter in this book. The editor is particularly grateful to Mischa Thomas who typed this manuscript. Written by an author with over 38 years of experience in the chemical and petrochemical process industry, this handbook will present an analysis of the process steps used to produce industrial hydrocarbons from various raw materials. It is the first book to offer a thorough analysis of external factors effecting production such as: cost, availability and environmental legislation. An A-Z
Plants interact with a large number of microorganisms which have a major impact on their growth either by establishing mutually beneficial symbiotic relationships or by developing as pathogens at the expense of the plant with deleterious effects. These microorganisms differ greatly not only in their nature (viruses, phytoplasmas, bacteria, fungi, nematodes, ... ) but also in the way they contact, penetrate and invade their host. Histology and cytology have brought an essential contribution to our knowledge of these phenomena. They have told us for instance, how specialized structures of the pathogen are often involved in the adhesion and penetration into the plant, how the interface between both organisms is finely arranged at the cellular level, or what structural alterations affect the infected tissues. They have thus set the stage for the investigations of the underlying molecular mechanisms could be undertaken. Such investigations have been remarkably successful in the recent years, expanding considerably our understanding of plant-microorganism interactions in terms of biochemical changes, rapid modifications of enzymatic activities, coordinated gene activation, signal reception and transduction. Biochemistry, molecular biology and cellular physiology have taken precedence in the phytopathologist's set of methods.

Present technologies and key concepts to produce suitable smart materials and intelligent structures for sensing, information and communication technology, biomedical applications (drug delivery, hyperthermia therapy), self-healing, flexible memories and construction technologies. Novel developments of environmental friendly, cost-effective and scalable production processes are discussed by experts in the field.

From weather-proof tires and artificial hearts to the o-rings and valve seals that enable successful space exploration, rubber is an indispensable component of modern civilization. Stiff competition and stringent application requirements foster continuous challenges requiring manufacturers to fund ever-expanding research projects. However, this vast

Humans have been “manually” extracting patterns from data for centuries, but the increasing volume of data in modern times has called for more automatic approaches. Early methods of identifying patterns in data include Bayes' theorem (1700s) and Regression analysis (1800s). The proliferation, ubiquity and incre- ing power of computer technology has increased data collection and storage. As data sets have grown in size and complexity, direct hands-on data analysis has - ceasingly been augmented with indirect, automatic data processing. Data mining has been developed as the tool for extracting hidden patterns from data, by using computing power and applying new techniques and methodologies for knowledge discovery. This has been aided by other discoveries in computer science, such as Neural networks, Clustering, Genetic algorithms (1950s), Decision trees (1960s) and Support vector machines (1980s). Data mining commonlyinvolves four classes of tasks: • Classification: Arranges the data into predefined groups. For example, an e-mail program might attempt to classify an e-mail as legitimate or spam. Common algorithms include Nearest neighbor, Naive Bayes classifier and Neural network. • Clustering: Is like classification but the groups are not predefined, so the algorithm will try to group similar items together. • Regression: Attempts to nd a function which models the data with the least error. A common method is to use Genetic Programming. • Association rule learning: Searches for relationships between variables. For example, a supermarket might gather data of what each customer buys.

Valence Bond MethodsTheory and ApplicationsCambridge University Press

Based on the success of the first edition, this second edition continues to build upon fundamental principles of biosensor design and incorporates recent advances in intelligent materials and novel fabrication techniques for a broad range of real world applications. The book provides a multi-disciplinary focus to capture the ever-expanding field of biosensors.

Smart Biosensor Technology, Second Edition includes contributions from leading specialists in a wide variety of fields with a common focus on smart biosensor design. With 21 chapters organized in five parts, this compendium covers the fundamentals of smart biosensor technology, important issues related to material design and selection, principles of biosensor design and fabrication, advances in bioelectronics, and a look at speciﬁc applications related to pathogen detection, toxicity monitoring, microﬂuidics and healthcare. Features Provides a solid background in the underlying principles of biosensor design and breakthrough technologies for creating more intelligent biosensors. Focuses on material design and selection including cutting-edge developments in carbon nanotubes, polymer nanowires, and porous silicon Examines machine learning and introduces concepts such as DNA-based molecular computing for smart biosensor function. Explores the principles of bioelectronics and nerve cell microelectrode arrays for creating novel transducers and physiological biosensors. Devotes several chapters to biosensors developed to detect and monitor a variety of toxins and pathogens. Offers expert opinions on the future directions, challenges and opportunities in the field.

This book covers in detail the various aspects of joining materials to form parts. A conceptual overview of rapid prototyping and layered manufacturing is given, beginning with the fundamentals so that readers can get up to speed quickly. Unusual and emerging applications such as micro-scale manufacturing, medical applications, aerospace, and rapid manufacturing are also discussed. This book provides a comprehensive overview of rapid prototyping technologies as well as support technologies such as software systems, vacuum casting, investment casting, plating, infiltration and other systems. This book also: Reflects recent developments and trends and adheres to the ASTM, SI, and other standards Includes chapters on automotive technology, aerospace technology and low-cost AM technologies Provides a broad range of technical questions to ensure comprehensive understanding of the concepts covered.

Nitrogen is an essential element for plant growth. During the green revolution nitrogenfertilisation was responsible for spectacular yield increases. At present yield is balanced with commitments towards the environment and sustainable
agriculture. For agro-biotechnology comprehensive knowledge of plant functioning is needed. Yield improvement and accumulation of essential nitrogen compounds is relying on selection and gene technologies. Research on the uptake, acquisition and assimilation of nitrogen, as well as the synthesis and storage of reserve and defence N-compounds, therefore, is essential. The third volume in the Plant Ecophysiology series integrates functional and molecular physiology with ecophysiological and sustainable agricultural approaches to get a better understanding of the regulation and the impact of environmental and stress signals on nitrogen acquisition and assimilation. The book is of interest for advanced students and junior researchers and supplies comprehensive information for scientists working in the field of nitrogen metabolism and readers interested in sustainable development.