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Fully updated and expanded to reflect recent advances, this Fourth Edition of the classic text provides students and professional chemists with an excellent introduction to the principles and general properties of organometallic compounds, as well as including practical information on reaction mechanisms and detailed descriptions of contemporary applications. Based on Collman et al.'s best-selling classic book, Principles and Applications of Organotransition Metal Chemistry, Hartwig's text consists of new or thoroughly updated and restructured chapters and provides an in-depth view into mechanism, reaction scope, and applications. It covers the most important developments in the field over the last twenty years with great clarity with a selective, but thorough and authoritative coverage of the fundamentals of organometallic chemistry, the elementary reactions of these complexes, and many catalytic processes occurring through organometallic intermediates, making this the Organotransition Metal Chemistry text for a new generation of scientists. This two-volume text reviews the field and pinpoints the types of organometallics which are most promising for further exploration. Although no organometallic compound is currently in therapeutic use, the success of Cisplatin and related platinum complexes shows the promise that some organometallics may have equal or superior therapeutic value. Many have already been tested as cancerostatics, and some have exhibited remarkable activity. Thus, new paths of exploration have been opened in this field, and it is important at this stage to analyze these results and evaluate the prospects. The book is intended as a communication link between the synthetic chemist and the physician involved in testing and therapy. It also provides a better and more beneficial understanding of organometallics for the nonchemist involved in the long process from the chemist's bench to the clinician's syringe. Provides detailed procedures and useful hints on organometallic reactions of Cu, Rh, Ni, and Au With contributions from leading organic chemists who specialize in the use of organometallics in organic synthesis, this acclaimed Manual offers an especially valuable resource for all

synthetic chemists, providing a practical reference for conducting transition metal-mediated synthetic reactions. This Fourth Manual is divided into four chapters: Chapter I: Organocopper Chemistry Chapter II: Organorhodium Chemistry Chapter III: Organonickel Chemistry Chapter IV: Organogold Chemistry Each of these newly written chapters features detailed, practical examples from the literature that guide readers through the preparation of organometallic reagents and their applications in organic synthesis. Procedures are presented in the Manual's acclaimed step-by-step recipe format, enabling both novices and experienced synthetic chemists to perform all the reactions with ease. In addition, the Manual features: Extensive background information on the organometallic chemistry of Cu, Rh, Ni, and Au References to the primary literature facilitating further investigation of all the reactions covered in the Manual Mechanistic considerations to help readers better understand how the desired products are formed Future research opportunities for each organometallic class Organometallics in Synthesis provides extensive and detailed information enabling synthetic chemists to readily assess the applicability of a synthetic method to a given need, and then to perform the reaction with confidence. The Manual covers both established organometallic procedures along with the most recently published protocols. Industrial processes are increasingly relying on organometallic chemistry. In this Manual, readers will find applications to such fields as natural products total synthesis, pharmaceuticals, fine chemicals, biotechnology, agricultural science, polymers, and materials science. Organometallic chemistry belongs to the most rapidly developing area of chemistry today. This is due to the fact that research dealing with the structure of compounds and chemical bonding has been greatly intensified in recent years. Additionally, organometallic compounds have been widely utilized in catalysis, organic synthesis, electronics, etc. This book is based on my lectures concerning basic organometallic chemistry for fourth and fifth year chemistry students and on my lectures concerning advanced organometallic chemistry and homogeneous catalysis for Ph.D. graduate students. Many recent developments in the area of organometallic chemistry as well as homogeneous catalysis are presented. Essential research results dealing with a given class of organometallic compounds are discussed briefly. Results of physicochemical research methods of various organometallic compounds as well as their synthesis, properties, structures, reactivities, and applications are discussed more thoroughly. The selection of tabulated data is arbitrary because, often, it has been impossible to avoid omissions. Nevertheless, these data can be very helpful in understanding properties of organometallic compounds and their reactivities. All physical data are given in SI units; the interatomic distances are given in pm units in figures and tables. I am indebted to Professor S. A. Duraj for translating and editing this book. His remarks, discussions, and suggestions are greatly appreciated. I also express gratitude to Virginia E. Duraj for editing and proofreading. The Chemistry of the Metal-Carbon Bond is a multi-volume work within the well established series of books covering The Chemistry of Functional Groups. It aims to cover the chemistry of the metal-carbon bond as a whole, but lays emphasis on the carbon end. It should therefore be of particular interest to the organic chemist. This fourth volume is concerned with the use of organometallic compounds in organic synthesis. It includes material concerned with carbon-carbon bond formation together with

chapters concerned with the formation of carbon-hydrogen and other carbon- element bonds. The material is divided into two parts: the first part is concerned with the preparation of the main group organometallic compounds and their Use in organic synthesis. The second part includes the use of transition metal organometallics in organic synthesis as well as chapters on hydrogenation, saturated carbon-hydrogen bond activation and the rapidly expanding field of supported metal complex catalysts. Organic Synthesis via Organometallics is an interdisciplinary project sponsored by the Volkswagen Stiftung to stimulate research and discussion of advances in the field. To improve international communication , leading experts are invited to regular symposia. In this volume, 17 lectures presented at the second symposium in Würzburg, October 1988, are collected. From the topics covered it complements the previous volume, edited by A. de Meijere and H. tom Dieck. to thank Messrs J. R. Sanders, W. E. Lindsell and M. G. Swanwick for helping to check the text and references and prepare indexes. Finally, I should like to thank my wife for the very considerable assistance she has given me in the writing and production of this book. M. L. H. G. Contents Preface to the Third Edition, Volume Two Page v

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Inorganic Chemistry: Inorganic Chemistry: A Textbook Series This series reflects the breadth of modern research in inorganic chemistry and fulfils the need for advanced texts. The series covers the whole range of inorganic and physical chemistry, solid state chemistry, coordination chemistry, main group chemistry and bioinorganic chemistry. Synthesis of Organometallic Compounds A Practical Guide Edited by Sanshiro Komiyama Tokyo University of Agriculture and Technology, Japan. This book describes the concepts of organometallic chemistry and provides an overview of the chemistry of each metal including the synthesis and handling of its important organometallic compounds. Synthesis of Organometallic Compounds: A Practical Guide provides: an excellent introduction to organometallic synthesis detailed synthetic protocols for the most important organometallic syntheses an overview of the reactivity, applications and versatility of organometallic compounds a survey of metals and their organometallic derivatives The purpose of this book is to serve as a practical guide to understanding the general concepts of organometallics for graduate students and scientists who are not necessarily specialists in organometallic chemistry. Transition-Metal Organometallic Chemistry: An Introduction presents the basic facts and principles of transition-metal organometallic chemistry. The

book discusses the general principles of transition-metal organometallic chemistry; the organometallic derivatives of the early transition metals; and the organometallic derivatives of chromium, molybdenum, and tungsten. The text also describes the organometallic derivatives of manganese, technetium, and rhenium; the organometallic derivatives of iron, ruthenium, and osmium; and the organometallic derivatives of cobalt, rhodium, and iridium. The organometallic derivatives of nickel, palladium, platinum, copper, silver, and gold are also considered. Chemists and chemistry students will find the book invaluable. Bridges the gap between the typical organic and organometallic texts by providing a current overall description of the chemistry of organometallics in organic synthesis in a digested form. Offers a highly systematic and logical account of virtually all the important aspects of the use of organometallics in organic synthesis. Primarily treats the reactant-product relationship, as well as some tentative but reasonable interpretations provided by the authors of individual papers and the author of this book. Over 1,200 references are cited, along with the great majority of relevant reviews and monographs. A succinct review of the essential concepts of organometallic chemistry, enriched throughout with examples that demonstrate how our understanding of organometallic chemistry has led to new applications in research and industry - not least in relation to catalysis. This widely acclaimed serial contains authoritative reviews that address all aspects of organometallic chemistry, a field which has expanded enormously since the publication of Volume 1 in 1964. Almost all branches of chemistry now interface with organometallic chemistry-the study of compounds containing carbon-metal bonds. Organometallic compounds range from species that are so reactive that they only have a transient existence at ambient temperatures to those that are thermally very stable. They are used extensively in the synthesis of useful compounds on both small and large scales. Industrial processes involving plastics, polymers, electronic materials, and pharmaceuticals all depend on advances in organometallic chemistry. In basic research, organometallics have contributed inter alia to: Metal cluster chemistry Surface chemistry The stabilization of highly reactive species by metal coordination Chiral synthesis The formulation of multiple bonds between carbon and the other elements and between the elements themselves Each volume of *Advances in Organometallic Chemistry* contains an index, and each chapter includes references *Nontransition-Metal Compounds* is the second volume in the series *Organometallic Syntheses* and presents various procedures for the nontransition-metal compounds. Topics also covered in this volume include sensitive liquids, sample transfer, and inert atmosphere provision. The text is divided into two major parts. Part I is mostly procedural as it offers directions and suggestions in different processes such as (a) establishment of an inert atmosphere and solvent medium; (b) evaluation of purity, mode of mixing, and solvent type; and (c) isolation and purification of reaction products. Organometallic products, particularly its physical and chemical characteristics, are also tackled. In Part II, around 85 nontransition-metal organometallic compounds and the reliable procedures used for their synthesis are presented. This particular volume will be of help to students both in the fields of chemistry and biology. Volume 7, devoted to the vital and rapidly expanding research area around metal-carbon bonds (see also MILS-6), focuses on the environment. With more than 2500 references, 35 tables, and nearly 50 illustrations, many of these in color, it is an essential

resource for scientists working in the wide range from organometallic chemistry, inorganic biochemistry, environmental toxicology all the way through to physiology and medicine. In 14 stimulating chapters, written by 29 internationally recognized experts, *Organometallics in Environment and Toxicology* highlights in an authoritative and timely manner environmental cycles of elements involving organometal(loid) compounds as well as the analytical determination of such species. This book examines methane formation involving the nickel coenzyme F430, as well as the organometal(loid) compounds formed by tin, lead, arsenic, antimony, bismuth, selenium, tellurium, and mercury. In addition, it deals with the environmental bioindication, biomonitoring, and bioremediation of organometal(loid)s, and it terminates with methylated metal(loid) species occurring in humans by evaluating assumed and proven health effects caused by these compounds. Metal Vapour Synthesis (MVS) can be defined as; "The use in synthesis of high temperature gaseous species such as metal atoms by their reactions with themselves or other materials in a condensed phase." This short book, covering the literature up to the middle of 1979, describes MVS in organic chemistry; i. e. the reactions of metal atoms with various, predominantly organic, substrates in the synthesis and reactivity studies of organic and organometallic compounds. In order to effectively describe all the underlying principles and to present a cohesive picture of pertinent metal atom processes in condensed organic phases, some inorganic substrates such as rare gases, dinitrogen, dioxygen, dihalogens, and inorganic halides have been included. For similar reasons, we have used, where relevant, information provided by the closely related technique of Matrix Isolation Spectroscopy (MIS). After an introductory chapter which gives the basic principles and includes a brief critique of the technique, the book is divided into three further chapters dealing respectively with (a) experimental techniques, (b) behaviour of metal atoms in matrices, and (c) results of preparative experiments. While not being encyclopaedic the book describes or refers to all noteworthy areas if not in the deliberately short text in the many tables and figures. The series *Topics in Organometallic Chemistry* presents critical overviews of research results in organometallic chemistry. As our understanding of organometallic structure, properties and mechanisms increases, new ways are opened for the design of organometallic compounds and reactions tailored to the needs of such diverse areas as organic synthesis, medical research, biology and materials science. Thus the scope of coverage includes a broad range of topics in pure and applied organometallic chemistry, where new breakthroughs are being achieved that are of significance to a larger scientific audience. The individual volumes of *Topics in Organometallic Chemistry* are thematic. Review articles are generally invited by the volume editors. Designed for teaching, this book can be used as an introductory text for chemistry undergraduates and will also provide a bridge to more advanced courses. Over 160 detailed and tested procedures for the preparation of specific organometallic compounds are given in Volume 4. Part I contains procedures for the synthesis of 76 types of transition metal organometallic compounds, and Part II procedures for the synthesis of 85 nontransition metal organometallic compounds. In both parts, the editors have sought to include procedures that give the safe, reliable synthesis of organometallic compounds that can lay some claim to significance in current chemical research. This significance may be based on various factors

such as: (a) the synthesis describes the formation of an unusual or less common structural type; (b) the compound prepared is a useful intermediate in other syntheses; (c) the compound is a model reagent for investigating the mechanisms of various fundamental or industrial processes, such as the Fischer-Tropsch reaction; (d) the compound is a useful reagent in organic synthesis; and (e) the techniques employed in the synthesis of the compound are unusual and worthy of further application, such as metal-atom and electrochemical procedures. The Book Is A Revised Edition Of A Lucid And Stimulating Introductory Account Of Organometallic Chemistry, An Exciting And Rapidly Developing Interdisciplinary Branch Of Science. A Characteristic Feature Of This Book Is The Presentation Of An Integrated (Covering Different Facets Usually Dealt With Either In Organic Or/And Inorganic Texts) View Of The Rapidly Developing Field Of Organometallic Chemistry. Attempts Have Been Made To Choose The Latest Examples To Illustrate The Fundamental Properties As Well As The Synthetic Procedures Of Organometallic Chemistry. Other Features Include: (A) An Interesting Brief Historical Background Of The Subject Including Some Quotations From Relevant Nobel Lecture Accounts Of Epoch Making Advances By The Discoverers Themselves, (B) The Adoption As Far As Possible Of The Iupac Rules Of Nomenclature, (C) A Brief Account Of The Rapidly Emerging Organometallic Chemistry Of The F-Elements, And (D) Inclusion Of Study Questions At The End Of Each Chapter. During The Revision Of The Book, The Latest Examples Have Replaced The Older Ones Wherever Feasible. The Book Would Be Extremely Useful As A Basic Text For B.Sc. (Hons.) And M.Sc. Chemistry Students. More and more possible applications of organometallic compounds in organic synthesis have been uncovered and a growing number of scientists are attracted to this area of research. This book presents an state-of-the-art account of the successful application of main- and transition metal mediated syntheses. It will stimulate new ideas and initiate further research in all areas of this fascinating chemistry. The individual chapters in this volume cover the scope and impact of main group organometallic compounds and reagents on organic synthesis during the last ten to fifteen years. In a number of chapters, topics are dealt with in detail that either were not covered at all in COMC (eg selenium, tellurium) or were given scant attention (eg oxymercuration, organoantimony compounds). Certain topics, like directed metallation and LiKOR bases have only achieved prominence in synthesis in the last ten years, and are now reviewed by leading experts. Comprehensive Organometallic Chemistry, 3rd Edition (COMC-III), is aimed at the specialist and non-specialist alike. It covers the major developments in the field in a carefully presented way with extensive cross-references. COMC-III provides a clear and comprehensive overview of developments since 1993 and attempts to predict trends in the field over the next ten years. Applications of organometallic chemistry continue to expand and this has been reflected by the significant increase in the number of volumes devoted to applications in COMC-III. Organic chemists have edited the volumes on organometallic chemistry towards organic synthesis - this is now organized by reaction type so as to be readily accessible to the organic community. Like its predecessors, COMC (1982) and COMC-II (1995), this new work is the essential reference text for any chemist or technologist who needs to use or apply organometallic compounds. Comprehensive Organometallic Chemistry III will be available via the proven

platform ScienceDirect providing the user with enhanced features such as cross-referencing and dynamic linking. COMC-III online will be sold with the original COMC and COMC-II works providing the user with an additional 19,200 pages of content! * Presents a comprehensive overview of the major developments in the field since 1993 providing general and significant insights. * Highlights the expansion of applications in organometallic chemistry with a strong organic synthesis focus. * Provides a structured first point of entry to the key literature and background material for those planning research, teaching and writing about the area. The Chemistry of the Metal-Carbon Bond is a multi-volume work within the well established series of books covering The Chemistry of Functional Groups. It aims to cover the chemistry of the metal-carbon bond as a whole, but lays emphasis on the carbon end. It should therefore be of particular interest to the organic chemist. This fourth volume is concerned with the use of organometallic compounds in organic synthesis. It includes material concerned with carbon-carbon bond formation together with chapters concerned with the formation of carbon-hydrogen and other carbon- element bonds. The material is divided into two parts: the first part is concerned with the preparation of the main group organometallic compounds and their Use in organic synthesis. The second part includes the use of transition metal organometallics in organic synthesis as well as chapters on hydrogenation, saturated carbon-hydrogen bond activation and the rapidly expanding field of supported metal complex catalysts. "One impressive and compressive book. . . . This review would have to be book size to do full justice to all the insights in this volume." —Journal of Metals Online Fully updated and expanded to reflect recent advances, this Fifth Edition of the classic text provides students and professional chemists with a comprehensive introduction to the principles and general properties of organometallic compounds, as well as including practical information on reaction mechanisms and detailed descriptions of contemporary applications. With increased focus on organic synthesis applications, nanoparticle science, and green chemistry, the Fifth Edition brings this vital resource up to date. New to the Fifth Edition: Chapters have been updated with relevant examples in the field, modern trends, and new applications; the organic applications chapter has been completely rewritten New end-of-chapter problems, along with their solutions Coverage enhanced with developments in nanoparticle science Increased focus on green chemistry An unparalleled pedagogic resource as well as a valuable working reference for professional chemists, with comprehensive coverage and up-to-date information, students and researchers in organic and organometallic chemistry will turn to The Organometallic Chemistry of the Transition Metals, Fifth Edition for the critical information they need on organometallic compounds, their preparation, and their use in synthesis. The design of efficient syntheses of medicinal agents is one of the prime goals of the process chemist in the pharmaceutical industry. The expanding list of metal-mediated reactions has had a major impact on this endeavor over the last two decades. This volume will highlight some of the areas of organometallic chemistry that have played a particularly important role in development. The chapters are written by chemists who work in the process groups of major pharmaceutical companies and fine chemical manufacturers. Having demonstrated the power of organometallics in their processes the authors herein expand upon their experiences with examples from the literature as reported by process groups

within the industry. The chapters are organized either by the application of a particular metal or reaction class. Removal of the residual metal(s) from the isolated active pharmaceutical ingredient (API) is key to the release of the material for human consumption, and hence, is reviewed here as well. This volume of *Topics in Organometallic Chemistry* is presented to offer a representative cross section of organometallic applications in the pharmaceutical industry as well as to give an appreciation for the creativity possible in process chemistry. *Transition Metal Organometallics in Organic Synthesis, Volume II* covers chapters on the applications of arene and alkyne complexes, as well as cluster compounds, in organic synthesis. The book discusses the potential utility of transition metal-alkyne complexes and derived cluster compounds as reagents in organic synthesis, as well as the complexation reactions of arenes. The text also describes the oxidation, reduction, rearrangement, and other synthetically useful processes. Chemists will find the book invaluable. A series of critical reviews and perspectives focussing on specific aspects of organometallic chemistry interfacing with other fields of study are provided. For this volume, the critical reviews cover topics such as the activation of "inert" carbon-hydrogen bonds, ligand design and organometallic radical species. For example, Charlie O'Hara discusses how mixed-metal compounds may perform the highly selective activation of C-H bonds and, in particular, how synergic relationships between various metals are crucial to this approach. The chemistry of a remarkable series of air-stable chiral primary phosphine ligands is discussed in some depth by Rachel Hiney, Arne Ficks, Helge Müller-Bunz, Declan Gilheany and Lee Higham. This article focuses on the preparation of these ligands and also how they may be applied in various catalytic applications. Bas De Bruin reports on how ligand radical reactivity can be employed in synthetic organometallic chemistry and catalysis to achieve selectivity in radical-type transformations. As well as highlighting ligand-centered radical transformations in open-shell transition metals, an overview of the catalytic mechanism of Co(II)-catalysed olefin cyclopropanation is given, showing that enzyme-like cooperative metal-ligand-radical reactivity is no longer limited to real enzymes. Valuable and informative comprehensive reviews in the field of organometallic chemistry are also covered in this volume. For example, organolithium and organocuprate chemistry are reviewed by Joanna Haywood and Andrew Wheatley; aspects in Group 2 (Be-Ba) and Group 12 (Zn-Hg) compounds by Robert Less, Rebecca Melen and Dominic Wright; metal clusters by Mark Humphrey and Marie Cifuentes; and recent developments in the chemistry of the elements of Group 14 - focusing on low-coordination number compounds by Richard Layfield. This volume therefore covers many synthetic and applied aspects of modern organometallic chemistry which ought to be of interest to inorganic, organic and applied catalysis fields. The number of organometallic compounds containing heteronuclear metal-metal bonds has grown tremendously in the last ten years. Also known as cluster compounds, these compounds have been found to exhibit a rich diversity of molecular structures and reactivities. Descriptions of the structures and transformations of the complexes are central features. Separate chapters have been prepared for compounds containing bonds between transition metals and the metals of the copper and zinc subgroups. Unlike COMC, this volume contains an entire chapter devoted to studies of heteronuclear metal compounds in catalysis. *Organometallic Reaction Mechanisms of the Nontransition Elements* provides

selected significant developments in organometallic reaction mechanisms and outlines a self-consistent set of interpretations of these mechanisms. This book is organized into eight chapters and begins with discussions on bonding in theoretically important types of organometallic compounds and the potential surfaces and their relation to mechanisms. This is followed by significant chapters on electrophilic displacement reactions. Polar 1,2-addition and elimination reactions are covered in a separate chapter. Radical and photochemical reactions are described in the concluding chapters of the book, including the reverse reaction involving incorporation of a free metal and an organic halide into an organometallic compound. Organic chemists and researchers will find this book invaluable.

THE textbook on organometallic chemistry. Comprehensive and up-to-date, the German original is already a classic, making this third completely revised and updated English edition a must for graduate students and lecturers in chemistry, inorganic chemists, chemists working with/on organometallics, bioinorganic chemists, complex chemists, and libraries. Over one third of the chapters have been expanded to incorporate developments since the previous editions, while the chapter on organometallic catalysis in synthesis and production appears for the first time in this form. From the reviews of the first English editions: 'The selection of material and the order of its presentation is first class ... Students and their instructors will find this book extraordinarily easy to use and extraordinarily useful.' -Chemistry in Britain 'Elschenbroich and Salzer have written the textbook of choice for graduate or senior-level courses that place an equal emphasis on main group element and transition metal organometallic chemistry. ... this book can be unequivocally recommended to any teacher or student of organometallic chemistry.' - Angewandte Chemie International Edition 'The breadth and depth of coverage are outstanding, and the excitement of synthetic organometallic chemistry comes across very strongly.' - Journal of the American Chemical Society This succinct text outlines the main classes of transition metal organometallic complexes and introduces the reader to the chemistry of compounds with metal-carbon σ -bonds: metal carbonyls, metal alkyls, and metal alkylidenes and alkylidnes. The synthetic methods leading to each class of compounds are illustrated with pertinent examples, followed by the discussion of characteristic structures and reactivity patterns. The aim is to allow undergraduate students a quick overview over this area of chemistry. Highlights and excursions stress general principles and relate the material to specific applications such as catalytic processes. This two-volume text reviews the field and pinpoints the types of organometallics which are most promising for further exploration. Although no organometallic compound is currently in therapeutic use, the success of Cisplatin and related platinum complexes shows the promise that some organometallics may have equal or superior therapeutic value. Many have already been tested as cancerostatics, and some have exhibited remarkable activity. Thus, new paths of exploration have been opened in this field, and it is important at this stage to analyze these results and evaluate the prospects. The book is intended as a communication link between the synthetic chemist and the physician involved in testing and therapy. It also provides a better and more beneficial understanding of organometallics for the nonchemist involved in the long process from the chemist's bench to the clinician's syringe. The making and breaking of carbon-metal bonds is fundamental to all the processes of organometallic chemistry and metal mediated homogeneous or

heterogeneous catalysis. The ever expanding scope of highly specific stoichiometric and catalytic transformations of organic substrates involving metals requires a thorough physical and theoretical understanding of fundamental principles of organometallic structure and reactivity. Diffraction experiments form the basis of tailoring the molecular architecture of organometallic compounds for specific functions. Mass spectrometric techniques possess the power to provide direct information on the energetics of transient species generated in the gas-phase. Computational chemistry with ab initio or density functional methods make a reliable numerical assessment of structures and (relative) energies increasingly feasible. Embedding methods, combining quantum chemistry with force field of semiempirical MO treatments, quantum dynamic studies and the computational modelling of solvent effects extend the utility of the basic methods. This volume in the series Topics in Organometallic Chemistry presents a survey by renowned experts of important experimental and theoretical developments to elucidate basic aspects of bonding, energetics, reaction mechanisms, molecular geometries and solid-state structures of organometallic compounds. Written by authors with frontier research expertise in their fields, both experimental and quantum chemical techniques, methodologies, results and interpretations are detailed in a manner suitable for the non-specialist, who seeks state-of-the-art information in the respective field.

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