

## Cobalt In Organic Synthesis

Carbon Monoxide in Organic Synthesis A thoroughly up-to-date overview of carbonylation reactions in the presence of carbon monoxide In Carbon Monoxide in Organic Synthesis: Carbonylation Chemistry, expert researcher and chemist Bartolo Gabriele delivers a robust summary of the most central advances in the field of carbonylation reactions in the presence of carbon monoxide. Beginning with a brief introduction on the importance of carbon monoxide as a building block in modern organic synthesis, the author goes on to describe metal-catalyzed carbonylations utilizing iron, cobalt, nickel, copper, and manganese. Descriptions of palladium, ruthenium, and rhodium-catalyzed reactions follow, as do discussions of metal-free carbonylation processes. The book is organized by metal to make the book useful as a guide for researchers from both academia and industry whose work touches on the direct synthesis of carbonyl compounds, carboxylic acid derivatives, and heterocycles. It aims to stimulate further discoveries in this rapidly developing field. Readers will also enjoy: A thorough introduction to carbonylations promoted by first row transition metal catalysts, including cobalt-catalyzed and nickel-catalyzed carbonylations An exploration of carbonylations promoted by second row transition metal catalysts, including ruthenium-, rhodium-, palladium(0)-, and palladium (II)-catalyzed carbonylations Practical discussions of miscellaneous carbonylation reactions, including carbonylations promoted by third row transition metal catalysts and metal-free carbonylation processes Perfect for catalytic and organic chemists, Carbon Monoxide in Organic Synthesis: Carbonylation Chemistry is also an indispensable resource for chemists working with organometallics and industrial chemists seeking a summary of important processes used to synthesize value-added products.

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This is the first handbook to cover in detail all aspects of this fascinating field of chemistry. In this handy two-volume set, readers will instantly find the information they need, clearly structured according to the individual metals in the main groups, hitherto only accessible after much time-consuming research. The result is an indispensable aid for everyday work in the lab. Alongside all the classical organic reactions, this book focuses on the modern variations as well as novel, current reactions in organic synthesis that are closely linked to main group elements - both stoichiometric and catalytic. With this work the two prizewinning editors have succeeded in producing a comprehensive compendium of the main group metals as reagents for organic reactions. In short, this is a must for every organic chemist, whether as an efficient introduction to current research, for retaining an overview or for looking up detailed information.

The second edition of Comprehensive Organic Synthesis—winner of the 2015 PROSE Award for Multivolume Reference/Science from the Association of American Publishers—builds upon the highly respected first edition in drawing together the new common themes that underlie the many disparate areas of organic chemistry. These themes support effective and efficient synthetic strategies, thus providing a comprehensive overview of this important discipline. Fully revised and updated, this new set forms an essential reference work for all those seeking information on the solution of synthetic problems, whether they are experienced practitioners or chemists whose major interests lie outside organic synthesis. In addition, synthetic chemists requiring the

essential facts in new areas, as well as students completely new to the field, will find *Comprehensive Organic Synthesis, Second Edition* an invaluable source, providing an authoritative overview of core concepts. Winner of the 2015 PROSE Award for Multivolume Reference/Science from the Association of American Publishers Contains more than 170 articles across nine volumes, including detailed analysis of core topics such as bonds, oxidation, and reduction Includes more than 10,000 schemes and images Fully revised and updated; important growth areas—including combinatorial chemistry, new technological, industrial, and green chemistry developments—are covered extensively

*Organic Chemistry: A Series of Monographs, Vol. 33.2*

*Annual Surveys : Transition Metals in Organic Synthesis, Organic Reactions of Selected  $\pi$ -complexes*

*Cobalt Catalysis in Organic Synthesis*

*Targets in Heterocyclic Systems*

*Advances and Applications*

*Fischer-Tropsch Synthesis, Catalysts, and Catalysis*

*The Pauson-Khand reaction is an important reaction in the field of organic chemistry. It involves the transition-metal catalysed cycloaddition of an alkyne, an alkene and carbon monoxide, to produce cyclopentenones. The importance of this reaction originates from its high value in transforming simple components into the synthetically useful cyclopentenone unit, in which a high degree of molecular complexity can be achieved in a single step, with impressive stereochemical and regiochemical control. The Pauson-Khand Reaction investigates the nature and many variations of this reaction. Topics covered include: the mechanisms of Pauson-Khand-type reactions non chiral intramolecular and intermolecular versions of Pauson-Khand reactions asymmetric Pauson-Khand reaction using chiral auxiliaries the enantioselective Pauson-Khand reaction Pauson-Khand reactions catalysed by metals other than cobalt unconventional Pauson-Khand reactions the Pauson-Khand reaction in total synthesis Presenting a comprehensive overview of this fundamental reaction, The Pauson-Khand Reaction will find a place on the bookshelves of any organic or organometallic chemist.*

*ABSTRACT: Metalloporphyrins have been shown to catalyze many fundamental and practically important chemical transformations, some of which represent the first demonstrations of these catalytic processes. The most notable examples include an assortment of atom/group transfer reactions, such as oxene, nitrene, and carbene transfers. Atom/group transfer reactions allow for the direct conversion of abundant and inexpensive alkenes and alkanes into value-added functional molecules. Previous reports from our group have shown that cobalt-porphyrin based carbene and nitrene transfer reactions are some of the most selective and practical catalytic systems developed for cyclopropanation and aziridination. Backed by a family of D<sub>2</sub>-symmetric chiral cobalt porphyrins our group continues the development of stereoselective carbene and nitrene transfer reactions. Metal-catalyzed cyclopropanation of olefins with diazo reagents has attracted great research interest because of its fundamental and practical importance. The resulting cyclopropyl units are recurrent motifs in biologically important molecules and can serve*

*as versatile precursors in organic synthesis. Supported by a family of D<sub>2</sub>-symmetric chiral cobalt porphyrins, we have demonstrated the use of succinimidyl diazoacetate as carbene source for a highly diastereo- and enantioselective cyclopropanation process. The resulting cyclopropyl succinimidyl esters are highly reactive and serve as valuable synthons for generating cyclopropylcarboxamides. We have also developed the first cobalt-porphyrin based intramolecular cyclopropanation, which is able to produce the resulting bicyclic lactones in high yields and enantioselectivity. Nitrene transfer reactions are also an attractive route to produce biologically and synthetically important molecules such as amines and aziridines. Although much progress has been made in nitrene transfer reactions utilizing [N-(p-toluenesulfonyl) imino]phenyliodinane (PhI=NTs) the nitrene source suffers from several drawbacks. Consequently, there has been growing interest in developing catalytic nitrene transfer reactions using alternate nitrene sources. To this end, we have utilized arylsulfonyl azides as nitrene source to explore their use in the development of a cobalt-porphyrin catalyzed enantioselective aziridination system. The cobalt catalyzed process can proceed under mild and neutral conditions in low catalyst loading without the need of other reagents, while generating nitrogen gas as the only byproduct. We have also explored the use of arylsulfonyl azides as nitrene source in a cobalt-catalyzed intramolecular C-H amination process.*

*This new book on this hot topic summarizes the key achievements for the synthesis and catalytic applications of pincer and pincer-type complexes, providing readers with the latest research highlights. The editors have assembled an international team of leaders in the field, and their contributions focus on the application of various pincer complexes in modern organic synthesis and catalysis, such as C-C and C-X bond forming reactions, C-H bond functionalization, and the activation of small molecules, as well as asymmetric catalysis. A must-have for every synthetic chemist in both academia and industry intending to develop new catalysts and improved synthetic protocols.*

*Chiral titanium complexes are low-cost, low-toxicity and high-efficiency catalysts. Impressive progress on enantioselective titanium-catalysed transformations has been achieved in the past seven years, with exciting new discoveries ranging from basic reactions to novel methodologies. Despite this, the field has not been substantially reviewed since 2008. This book contains up to date research and covers all types of enantioselective transformations using chiral titanium catalysts. It illustrates the economic, health, and environmental benefits of chiral titanium catalysts, showing the types of highly enantioselective reactions that they are able to induce are unlimited. Work presented here is aimed at researchers in organic and catalytic chemistry, and has been carefully curated to encourage future research possibilities.*

*Contents: Enantioselective Titanium-Promoted Alkylation, Arylation, Alkynylation, Allylation, and Vinylation Reactions of Carbonyl Compounds  
Enantioselective Titanium-Catalysed Cyanation Reactions of Carbonyl Compounds and Derivatives  
Enantioselective Titanium-Catalysed Thioether Oxidations  
Enantioselective Titanium-Catalysed Epoxidation Reactions  
Enantioselective Titanium-Catalysed Cycloaddition Reactions  
Enantioselective Titanium-Catalysed Aldol-Type Reactions  
Enantioselective Titanium-Catalysed Reduction Reactions  
Enantioselective Titanium-Catalysed Ring-Opening Reactions of Epoxides and Aziridines  
Enantioselective Titanium-Catalysed Domino and Tandem Reactions  
Enantioselective Titanium-Catalysed Miscellaneous Reactions  
Readership: Researchers in organic and catalytic chemistry, and industrial companies. Key Features: First book of its kind collecting and presenting all types of enantioselective titanium-catalysed transformations  
Highlights the chemistry of titanium to a vast audience  
Contains all types of asymmetric reactions catalysed by chiral titanium catalysts  
Keywords: Asymmetric Catalysis; Asymmetric Synthesis; Chirality; Titanium*

*The Beginning : Special Issue Dedicated to Professor Richard F. Heck  
Green Chemistry and Catalysis*

### *Metal-Based Catalysts in Organic Synthesis*

### *Applications in Organic Synthesis and Catalysis*

### *Organometallic Chemistry*

### *Cobalt and Palladium Reagents in Organic Synthesis*

Kurti and Czako have produced an indispensable tool for specialists and non-specialists in organic chemistry. This innovative reference work includes 250 organic reactions and their strategic use in the synthesis of complex natural and unnatural products. Reactions are thoroughly discussed in a convenient, two-page layout--using full color. Its comprehensive coverage, superb organization, quality of presentation, and wealth of references, make this a necessity for every organic chemist. \* The first reference work on named reactions to present colored schemes for easier understanding \* 250 frequently used named reactions are presented in a convenient two-page layout with numerous examples \* An opening list of abbreviations includes both structures and chemical names \* Contains more than 10,000 references grouped by seminal papers, reviews, modifications, and theoretical works \* Appendices list reactions in order of discovery, group by contemporary usage, and provide additional study tools \* Extensive index quickly locates information using words found in text and drawings

Radical intermediates appear frequently in organic synthesis due to the fact that they are highly reactive and can be used to generate a variety of useful products. However, the traditional synthesis of radicals involves hazardous reagents and carcinogens, and generates a large amount of waste. Therefore, it would be desirable to use safer, inexpensive, and abundant starting materials, such as alcohols, which are relatively simple to synthesize. The approach that will be studied in this research is the activation of alcohols using a cobalt metal catalyst and visible light energy to generate radical intermediates that can be used in a variety of reactions. Once a radical intermediate is obtained from the starting alcohol, it can undergo a few transformations, including the loss of carbon dioxide to effect deoxygenation or cross-coupling, or alternatively formation of various ester products. The goal of the project is to identify an efficient cobalt catalyst that gives high yields across a variety of substrates. The objective is achieved by synthesizing several cobalt complexes, testing their photochemical properties and evaluating their performance in several reactions.

The continually growing contribution of transition metal chemistry to synthetic organic chemistry is, of course, widely recognized. Equally well known is the difficulty in keeping up-to-date with the multifarious reactions and procedures that seem to be spawned at an ever-increasing rate. These can certainly be summarized on the basis of reviews under the headings of the individual transition metals. More useful to the bench organic chemist, however, would be the opposite type of concordance based on the structural type of the desired synthetic product. This is the approach taken in the present monograph, which presents for each structural entity a conspectus of the transition metal-mediated processes that can be employed in its production. The resulting comparative survey should be a great help in devising the optimum synthetic approach for a particular goal. It is presented from an essentially practical viewpoint, with detailed directions interspersed in the Houben-Weyl style. The wide scope of the volume should certainly encourage synthetic organic chemists to utilize fully the range and versatility of these transition metal-mediated processes. This will certainly be a well-thumbed reference book! R. A. RAPHAEL Cambridge University v Preface In recent years an enormous amount of work has been done on the catalysis of organic reactions by various transition metal species and on the

organic reactivity of organo-transition-metal compounds.

It is well known that heterocyclic derivatives represent almost half of the several million chemical species discovered to date. The importance of these compounds in many branches of chemistry ensures further investigation and attention. This series aims to stimulate creativity and innovation by including research by leading authorities. As well as highlights of interesting developments in specific areas, there are also comprehensive reviews reporting the overall state-of-the-art. Targets in Heterocyclic Systems Volume 2 will be welcomed by researchers in areas as diverse as polymeric, medicinal and agricultural chemistry, as well as in the dyestuffs and biochemical industries.

Catalysis from A to Z

Synthesis of Cobalt-Based Nanomaterials from Organic Precursors

Aspects of the Organic Chemistry of Alkali Metals, Uranium, Tin and Cobalt

Chemistry and Properties

Synthesis of a Cobalt Porphyrin Complex to be Used as a Catalyst in Reactions Involving Organic Radical Intermediates

A Concise Encyclopedia

This first book to focus on catalytic processes from the viewpoint of green chemistry presents every important aspect of catalytic reductions and oxidations methods · Solid-acid and solid-base catalysis · C-C bond formation reactions · Biocatalysis · Asymmetric catalysis · Novel reaction media like e.g. ionic liquids, supercritical CO<sub>2</sub> · Renewable raw materials Written by Sheldon -- without doubt one of the leaders in the field with much experience in academia and industry -- and his colleagues the result is a unified whole, an indispensable source for every scientist looking to improve catalytic reactions, whether in a university or company lab.

The Porphyrin Handbook, Volume 12: The Iron and Cobalt Pigments: Biosynthesis, Structure, and Degradation provides comprehensive information pertinent to every aspect of the chemistry, synthesis, spectroscopy, and structure of phthalocyanines. It covers the biochemical and clinical aspects of genetically transmitted or drug-induced diseases associated with errors in heme biosynthesis. Organized into eight chapters, this volume begins with an overview of the comparison of regulatory principles in animal and tetrapyrrole biosynthesis. This text then examines the biology and medical implications of porphyrin systems. Other chapters consider the transformation of hemes into bile pigments, the organic synthesis of bilins, and the pathways of degradation of chlorophyll in senescent plants. This book discusses as well the biosynthesis of porphyrins, vitamin B12, and chlorophyll. A final chapter deals with genome sequencing projects that provide sources of genes encoding the enzymes needed for the synthesis of intermediates. This book is a valuable resource for research scientists, engineers, and clinicians.

Transition Metal Organometallics in Organic Synthesis, Volume II covers chapters on the applications of arene and alicyclic complexes, as well as cluster compounds, in organic synthesis. The book discusses the potential utility of transition metal complexes and derived cluster compounds as reagents in organic synthesis, as well as the complexation reactions of

also describes the oxidation, reduction, rearrangement, and other synthetically useful processes. Chemists will find invaluable.

With petroleum prices spiraling upward, making synthetic fuels-or "synfuels"-from coal, natural gas, and biomass has become economically competitive. Advanced energy companies now focus exclusively on alternative fuels, and many oil companies have programs dedicated to developing synthetic fuels. The Fischer-Tropsch process, which uses a cobalt catalyst, is one of the most important processes for the production of synthetic fuels.

Pincer and Pincer-Type Complexes

The Pauson-Khand Reaction

Transition Metal-Catalyzed Carbene Transformations

Organic Synthesis Using Transition Metals

Formation of Carbon-carbon Bonds

Organic Synthesis with Palladium Compounds

This unique book highlights the most important reactions in the presence of homogeneous manganese catalysts, e.g. reduction reactions, C-H functionalization, cross-coupling reactions etc.

A complete guide to the most important reduction method in organic synthesis The most comprehensive reference in the field, *Handbook of Heterogeneous Catalytic Hydrogenation for Organic Synthesis* provides synthetic chemists and chemical engineers in fine chemicals and pharmaceuticals with detailed experimental guidelines for heterogeneous catalytic hydrogenation. Organized by functional groups for ready reference and featuring detailed examples of hundreds of reactions, this handbook covers hydrogenations of alkenes, alkynes, aldehydes and ketones, nitriles, imines, nitro and nitroso compounds, carboxylic acids and esters, and aromatic and heterocyclic compounds. In addition, coverage includes the preparation of amines by reductive alkylation and the hydrogenolysis of a variety of compounds. Examples of hydrogenation of functional groups and reaction pathways are illustrated with numerous equations and schemes. Practitioners will appreciate the plenitude of experimental details given for most of the reactions selected, including amounts of reagents and catalysts, reaction temperatures, hydrogen pressures, and reaction times. They will also find helpful the more than one hundred tables included throughout the book detailing the effects of key factors governing rate and selectivity, such as compound structure, the nature of catalysts and supports, and the nature of solvents. Researchers will benefit from the introductory chapters covering an array of hydrogenation catalysts, including nickel, cobalt, copper, iron, platinum group metals, rhenium, and other oxide and sulfide catalysts, as well as reactors and reaction conditions.

Transition metals open up new opportunities for synthesis, because their means of bonding and their reaction mechanisms differ from those of the elements of the s and p blocks. In the last two decades the subject has mushroomed - established reactions are seeing both technical improvements and increasing numbers of applications, and new reactions are being developed. The practicality of the

subject is demonstrated by the large number of publications coming from the process development laboratories of pharmaceutical companies, and its importance is underlined by the fact that three Nobel prizes have been awarded for discoveries in this field in the 21st Century already. Organic Synthesis Using Transition Metals, 2nd Edition considers the ways in which transition metals, as catalysts and reagents, can be used in organic synthesis, both for pharmaceutical compounds and for natural products. It concentrates on the bond-forming reactions that set transition metal chemistry apart from "classical" organic chemistry. Each chapter is extensively referenced and provides a convenient point of entry to the research literature. Topics covered include: introduction to transition metals in organic synthesis coupling reactions C-H activation carbonylative coupling reactions alkene and alkyne insertion reactions electrophilic alkene and alkyne complexes reactions of alkyne complexes carbene complexes allyl-allyl complexes diene, dienyl and arene complexes cycloaddition and cycloisomerisation reactions For this second edition the text has been extensively revised and expanded to reflect the significant improvements and advances in the field since the first edition, as well as the large number of new transition metal-catalysed processes that have come to prominence in the last 10 years – for example the extraordinary progress in coupling reactions using "designer" ligands, catalysis using gold complexes, new opportunities arising from metathesis chemistry, and C-H activation – without neglecting the well established chemistry of metals such as palladium. Organic Synthesis Using Transition Metals, 2nd Edition will find a place on the bookshelves of advanced undergraduates and postgraduates working in organic synthesis, catalysis, medicinal chemistry and drug discovery. It is also useful for practising researchers who want to refresh and enhance their knowledge of the field.

Provides a much-needed account of the formidable "cobalt rush" in organic synthesis and catalysis Over the past few decades, cobalt has turned into one of the most promising metals for use in catalytic reactions, with important applications in the efficient and selective synthesis of natural products, pharmaceuticals, and new materials. Cobalt Catalysis in Organic Synthesis: Methods and Reactions provides a unique overview of cobalt-catalysed and -mediated reactions applied in modern organic synthesis. It covers a broad range of homogeneous reactions, like cobalt-catalysed hydrogenation, hydrofunctionalization, cycloaddition reactions, C-H functionalization, as well as radical and biomimetic reactions. First comprehensive book on this rapidly evolving research area Covers a broad range of homogeneous reactions, such as C-H activation, cross-coupling, synthesis of heterocyclic compounds (Pauson-Khand), and more Chapters on low-valent cobalt complexes as catalysts in coupling reactions, and enantioselective cobalt-catalyzed transformations are also included Can be used as a supplementary reader in courses of advanced organic synthesis and organometallic chemistry Cobalt Catalysis in Organic Synthesis is an ideal book for graduates and researchers in academia and

industry working in the field of synthetic organic chemistry, catalysis, organometallic chemistry, and natural product synthesis.

Practical Applications of Transition Metals

Carbon Monoxide in Organic Synthesis

Scope, Variations and Applications

Organic Syntheses Via Metal Carbonyls

Handbook of Heterogeneous Catalytic Hydrogenation for Organic Synthesis

Nickelocene, Cobaltocene, and Cyclopentadienyl (tributylphosphine)-copper in Organic Synthesis

*Catalysts play a crucial role in the path towards the transformation of organic compounds. This book describes the recent development of metal-based catalysis in organic synthesis. Applications of various catalysts to interesting organic transformations are discussed. It covers important organic reactions such as cyclohexane oxidation under different energy stimuli, use of Pd-nanoparticles for carbonylation of aniline, ammoximation of methyl ethyl ketone by Ni-modified TS-1 and carbozincation of substituted 2-alkynylamines. This book will be a useful reference for researchers in the field of catalysis, organic chemistry and materials science. It is also intended to attract the attention of researchers with an industrial interest.*

*Textbook on modern methods of organic synthesis.*

*This book reviews some important reactions of carbon monoxide in organic chemistry: hydroformylation, metal carbonyl- and acid catalyzed carbonylation and ring closure reactions with carbon monoxide. It is not merely a translation of the German edition which appeared in 1967 but the text has been completely revised. This was necessary because this chemistry is rapidly developing in research as well as in technical application, which is underlined by the increase of production of e. g. oxo chemicals from about 1.4 million tons in 1967 to 2.7 million tons in 1969, nearly a doubling within 2 years. Quite a number of new research results were published during the last two years, and these additional references have been cited in the English edition. Most of the new papers cited deal with hydroformylation reactions: however, a number of the papers reviewed also report important new aspects in carboxylation and ring closure reactions. The author is indebted to a number of colleagues who helped to collect these new data and*

have given him valuable hints and would like to thank Miss I. Forster, Dr. B. Cornils, Dr. D. Hahn, Dr. P. Schneller, Dr. H. Tummes, and Dr. J. Weber for their cooperation, and to Prof. Dr. F. Piacenti (University of Pisa, Italy) for discussions on reaction mechanisms. The author is especially grateful to Dr. Charles R. Adams of the Shell Development Company, Emeryville, California, for his cooperation in translating the German text. Development of efficient and low-cost methods for the production of cobalt and cobalt oxide nanoparticles is of great interest. Such nanoparticles are typically prepared via transformation of precursors under controlled conditions. In the case of organic precursors, the production of said nanoparticles takes place through thermal decomposition of the organic moiety. The decomposition pathway of the precursor is greatly dependent on the type (*id est* inert, reducing or oxidizing) of the gaseous atmosphere prevailing during heating, as well as on the heating schedule itself. The characteristics of the organic group have also an important influence on the structure of the final material. The goal of the current work is to present a comprehensive review of the research work focusing on the synthesis of cobalt-based nanomaterials from activation of organic precursors.

*New Pathways for Organic Synthesis*

*Manganese Catalysis in Organic Synthesis*

*Main Group Metals in Organic Synthesis*

*Transition Metal Organometallics in Organic Synthesis*

*Radicals in Organic Synthesis*

*New Applications of Cobalt-alkyne Complexes in Organic Synthesis*

*Provides a complete and accessible A to Z collection of information on catalysis This updated and enlarged must-have edition of a classic book on catalysis explains the important terms of all aspects of the subject - including biocatalysis, homogeneous catalysis, heterogeneous catalysis - as well as the terms associated with it. It also looks at related topics like spectroscopy or analytical methods. Featuring 20% more content than the previous edition, it comprehensively covers the topic in a clear and concise manner, and includes abbreviations, brief biographic entries of important scientists who have worked in catalysis, trade names, important catalytic processes, named reactions, reactions, and other important keywords in the general field of catalysis. Written by*

*more than 200 top scientists and with more than 15,000 entries on all aspects of catalysis, Catalysis from A to Z: A Concise Encyclopedia, 5th Edition is filled with figures, tables, cross-references, and references. It covers acids, ligands, catalytic reactions in organic synthesis, kinetics and thermodynamics of catalytic reactions, and catalyst labeling. The book also looks at theoretical backgrounds of catalytic reactions, industrial catalytic processes, autoclaves, colloids, nanomaterials, spectroscopically methods for catalyst analysis, and more. -Provides all the knowledge scientists need to know about homogeneous, heterogeneous, and biochemical catalysis -Includes more than 15,000 keywords in compact entries -Newly updated and expanded edition of the bestselling classic -Comprehensive, succinct, and easy to use -Edited by an experienced team of top editors and authors with contributions from over 200 scientific experts -Offers German and French translations of the keywords to help students and non-native English speakers Catalysis from A to Z: A Concise Encyclopedia is an ideal resource for every student, chemist, scientist, and engineer involved in catalytic chemistry, chemical engineering, biochemistry, organic chemistry, and more.*

*The use of abundantly available feedstock such as ethylene, carbon monoxide, hydrogen cyanide, alkyl acrylates, in fine chemical synthesis is a major challenge in organic synthesis, and developing asymmetric versions of reactions which makes use of these feedstock chemicals is an even bigger challenge. The detailed mechanism of a recently discovered cobalt-mediated hydrovinylation of prochiral dienes has been studied. The role of trimethyl aluminum employed as an activator of the cobalt(II)-dihalide complex employed for the cobalt-mediate hydrovinylation has been determined to be: reduction of Co(II)-complex to Co(I)-complex and generation of cationic-Co(I) species as active catalyst. Well defined Co(I)-complexes were synthesized and characterized via NMR spectroscopy and crystallography. Treatment of these Co(I) complexes with various activators such as NaBARF, ZnCl<sub>2</sub>, B(C<sub>6</sub>F<sub>5</sub>)<sub>3</sub>, generates cationic Co(I) which mediates the reaction. This new protocol for hydrovinylation was successfully employed for a broadly applicable asymmetric heterodimerization of acrylates and 1,3-dienes. The reaction tolerates other functional groups such as olefins, alcohols, alkyl halides, trialkylsiloxy-, and even sensitive silyl enol ethers.*

*Greener than conventional methods, C-H activation methods have flourished during the last decade and become especially attractive to organic chemists. Edited by a practitioner in this rapidly developing field, C-H Bond Activation in Organic Synthesis provides an overview of this exciting playground of chemistry. The book summarizes the state of the art in C-H activation for functionalization, enabling you to carry out reactions in the most environmentally friendly fashion with the least contamination of by-products. The most popular C-H activation reactions are catalyzed by transition metals. This book dedicates a chapter to each of the following catalysts: palladium, rhodium, nickel, iron, copper, and cobalt. In addition, it covers radical-mediated C-H*

*activation, fluorination via C-H activation, and C-H activation of heterocycles. Using a pedagogically practical approach, each chapter is divided by the transition metal catalyst, not a specific transformation. This gives you an up-to-date review of the most important topics of C-H activation. The area of C-H activation has experienced a flurry of activity over the past two decades, so the time is right for a resource that summarizes these powerful tools with which you can design and construct heteroaromatic molecules. Thus, direct C-H functionalization methods are expected to continue to greatly contribute to the mission of green chemistry: low-energy, waste-free, and atom-economic transformations for the synthesis of organic materials and biologically active molecules in the twenty-first century. Using this book, you can carry out environmentally friendly reactions that enable the conversion of cheap and abundant alkanes into valuable functionalized organic compounds.*

*With a foreword from leading organic chemist Professor Paul Wender, this book collects the major developments reported in the past thirty years in the field of enantioselective reactions promoted by chiral cobalt catalysts, illustrating the power of these green catalysts to provide all types of organic reactions from the basic to completely novel methodologies. The search for new methodologies to prepare optically pure products is one of the most active areas of research in organic synthesis. Of the methods available for preparing chiral compounds, catalytic asymmetric synthesis has attracted the most attention. In particular, asymmetric transition-metal catalysis is a powerful tool for performing reactions in a highly enantioselective fashion. Efforts to develop new asymmetric transformations have previously focused on the use of rare metals such as titanium, palladium, iridium and gold. However, the ever-growing need for environmentally friendly catalytic processes has prompted chemists to focus on the more abundant and less toxic first-row transition metals, such as cobalt, to develop new catalytic systems. The ability of cobalt catalysts to adopt unexpected reaction pathways has led to an impressive number of enantioselective cobalt-promoted transformations being developed over the past three decades. These have included the synthesis of many different types of products, often under relatively mild conditions and with remarkable enantioselectivities. This book is a useful reference resource for chemists, both academic and industrial, working in organic synthesis and interested in greener or more economical catalytic alternatives.*

*C-H Bond Activation in Organic Synthesis*

*From Mechanistic Insights to Reaction Discovery*

*Strategic Applications of Named Reactions in Organic Synthesis*

*Methods and Reactions*

*Enantioselective Cobalt-catalysed Transformations*

*Organometallic Chemistry Reviews*

*Around 30 years ago the transition metal chemistry received great impulses. In the focus have been reactions of nickel and cobalt and herein*

especially their carbonyls. Also industrial processes have been developed. When the technical oxidation of ethylene with palladium chloride had been discovered, and a great number of laboratory reactions, many groups have turned towards this subject. Apart from two important industrial processes - acetaldehyde and vinylacetate from ethylene - a great number of conversions and catalytic reactions with palladium compounds have been researched. Their mechanisms have been cleared up and have contributed to a better understanding of the complex chemistry of palladium. Last but not least these reactions have also served for more understanding of organic transition metal compounds and catalyses in general. Numerous conventional reactions appear today in a different light. The effects of co-

Specialist Periodical Reports provide systematic and detailed review coverage of progress in the major areas of chemical research. Written by experts in their specialist fields the series creates a unique service for the active research chemist, supplying regular critical in-depth accounts of progress in particular areas of chemistry.

Presents an up-to-date overview of the rapidly growing field of carbene transformations Carbene transformations have had an enormous impact on catalysis and organometallic chemistry. With the growth of transition metal-catalyzed carbene transformations in recent decades, carbene transformations are today an important compound class in organic synthesis as well as in the pharmaceutical and agrochemical industries. Edited by leading experts in the field, Transition Metal-Catalyzed Carbene Transformations is a thorough summary of the most recent advances in the rapidly expanding research area. This authoritative volume covers different reaction types such as ring forming reactions and rearrangement reactions, details their conditions and properties, and provides readers with accurate information on a wide range of carbene reactions. Twelve in-depth chapters address topics including carbene C-H bond insertion in alkane functionalization, the application of engineered enzymes in asymmetric carbene transfer, progress in transition-metal-catalyzed cross-coupling using carbene precursors, and more. Throughout the text, the authors highlight novel catalytic systems, transformations, and applications of transition-metal-catalyzed carbene transfer. Highlights the dynamic nature of the field of transition-metal-catalyzed carbene transformations Summarizes the catalytic radical approach for selective carbene cyclopropanation, high enantioselectivity in X-H insertions, and bio-inspired carbene transformations Introduces chiral N,N'-dioxide and chiral guanidine-based catalysts and different transformations with gold catalysis Discusses approaches in cycloaddition reactions with metal carbenes and polymerization with carbene transformations Outlines multicomponent reactions through gem-difunctionalization and transition-metal-catalyzed cross-coupling using carbene precursors Transition Metal-Catalyzed Carbene Transformations is essential reading for all chemists involved in organometallics, including organic and inorganic chemists, catalytic chemists, and chemists working in industry.

Stereoselective Carbene and Nitrene Transfer Reactions

Cobalt(II)-catalyzed Atom/group Transfer Reaction

Modern Methods of Organic Synthesis South Asia Edition

Cationic Cobalt(i)-mediated Heterodimerizations

The Iron and Cobalt Pigments: Biosynthesis, Structure and Degradation

The Porphyrin Handbook