Homogeneous Catalysis

Over the last decade, the area of homogeneous catalysis with transition metal has grown in great scientific interest and technological promise, with research in this area earning three Nobel Prizes and filing thousands of patents relating to metallocene and non-metallocene single site catalysts, asymmetric catalysis, carbon-carbon bond forming metathesis and cross coupling reactions. This text explains these new developments in a unified, cogent, and comprehensible manner while also detailing earlier discoveries and the fundamentals of homogeneous catalysis. Serving as a self-study guide for students and all chemists seeking to gain entry into this field, it can also be used by experienced researchers from both academia and industry for referring to leading state of the art review articles and patents, and also as a quick self-study manual in an area that is outside their immediate expertise. The book features: • Topics including renewable feed stocks (biofuel, glycerol), carbon dioxide based processes (polycarbonates), fluorous solvents, ionic liquid, hydroformylation, polymerization, oxidation, asymmetric catalysis, and more • Basic principles of organometallic chemistry, homogeneous catalysis, and relevant technological issues • Problems and answers, industrial applications (case studies), and examples from proven industrial processes with clear discussions on environmental and techno-commercial issues • Extensive references to cutting edge research with potential and leading patents • Tables and illustrations to help explain difficult concepts

Homogeneous Catalysis with Metal Complexes

Catalysis is a multidisciplinary activity which is reflected in this book. The editors have chosen a novel combination of basic disciplines - homogeneous catalysis by metal complexes is treated jointly with heterogeneous catalysis with metallic and non-metallic solids. The main theme of the book is the molecular approach to industrial catalysis. In the introductory section Chapter 1 presents a brief survey of the history of industrial heterogeneous and homogeneous catalysis. Subsequently, a selection of current industrial catalytic processes is described (Chapter 2). A broad spectrum of important catalytic applications is presented, including the basic chemistry, some engineering aspects, feedstock sources and product utilisation. In Chapter 3, kinetic principles are treated. The section on fundamental catalysis begins with a description of the bonding in complexes and to surfaces (Chapter 4). The elementary steps on complexes and surfaces are described. The chapter on heterogeneous catalysis (5) deals with the mechanistic aspects of three groups of important reactions: syn-gas conversion, hydrogenation, and oxidation. The main principles of metal and metal
oxide catalysis are presented. Likewise, the chapter on homogeneous catalysis (6) concentrates on three reactions representing examples from three areas: carbonylation, polymerization, and asymmetric catalysis. Identification by in situ techniques has been included. Many constraints to the industrial use of a catalyst have a macroscopic origin. In applied catalysis it is shown how catalytic reaction engineering deals with such macroscopic considerations in heterogeneous as well as homogeneous catalysis (Chapter 7). The transport and kinetic phenomena in both model reactors and industrial reactors are outlined. The section on catalyst preparation (Chapters 8 and 9) is concerned with the preparation of catalyst supports, zeolites, and supported catalysts, with an emphasis on general principles and mechanistic aspects. For the supported catalysts the relation between the preparative method and the surface chemistry of the support is highlighted. The molecular approach is maintained throughout. The first chapter (10) in the section on catalyst characterization summarizes the most common spectroscopic techniques used for the characterisation of heterogeneous catalysts such as XPS, Auger, EXAFS, etc. Temperature programmed techniques, which have found widespread application in heterogeneous catalysis both in catalyst characterization and simulation of pretreatment procedures, are discussed in Chapter 11. A discussion of texture measurement, theory and application, concludes this section (12). The final chapter (13) gives an outline of current trends in catalysis. Two points of view are adopted: the first one focusses on developments in process engineering. Most often these have their origin in demands by society for better processes. The second point of view draws attention to the autonomous developments in catalysis, which is becoming one of the frontier sciences of physics and chemistry. In this book emphasis is on those reactions catalyzed by heterogeneous and homogeneous catalysts of industrial relevance. The integrative treatment of the subject matter involves many disciplines, consequently, the writing of the book has been a multi-author task. The editors have carefully planned and harmonized the contents of the chapters.

**Homogeneous Catalysts**

This book concentrates on industrially relevant reactions which are catalyzed by heterogeneous and homogeneous catalysts. Homogeneous catalysis by metal complexes is treated jointly with heterogeneous catalysis using metallic and non-metallic solids. In both areas the high degree of sophistication of spectroscopic techniques and theoretical modelling has led to an enormous increase in our understanding at the molecular level. This holds for the kinetics of the reactions and the reactivities of the catalysts, as well as for the syntheses of the catalytic materials. The development of catalysis science since the first edition of this book has necessitated a thorough revision, including special chapters on biocatalysis, catalyst characterization and adsorption methods. The multidisciplinary nature of catalysis is reflected in the choice of a novel combination of basic disciplines which will be refreshing and inspiring to readers.

**INDUSTRIAL APPLICATIONS OF HOMOGENEOUS CATALYSIS.**

**Industrial Applications of Homogeneous Catalysis**

Finally as softcover: Homogeneous catalysis is the success story of organometallic chemistry. Since the discovery of hydroformylation by O. Roelen in 1938, catalytic applications have paved the way of organometallic compounds in industry. Bulk and fine chemicals, and even natural products are being produced via homogeneous organometallic catalysis. The enormous breadth of this topic in view of both basic research and industrial application is met congenially in this handbook edited jointly by W. A. Herrmann (Technical University Munich) and B. Cornils (Hoechst AG, Frankfurt). The list of over 90 contributors reads like a who-is-who in organometallic chemistry and homogeneous catalysis. In this handbook, experts will find the current state-of-the-art in their field and advanced students will benefit from the concise treatment of important catalytic reactions and processes. With its balanced presentation of the truly interdisciplinary topic and its outstanding editor- and authorship, the 'Cornils/Herrmann' is beyond common standards.

**Applied Homogeneous Catalysis with Organometallic Compounds**

In chemistry, homogeneous catalysis is a sequence of reactions that involve a catalyst in the same phase as the reactants. Topics discussed in this book include the
catalytic applications of metallic nanoparticles nanocomposites; olefin oxidation chemistry based on Mo catalysts; homogeneous catalysts based on Bis(imino) pyridine complexes of iron, cobalt, vanadium, and chromium; Ru catalysts in asymmetric hydrogenation; supramolecular gel catalysts; glycerol as a sustainable solvent for homogeneous catalysis; homogeneous catalysis in carboxylative coupling reactions and methods for enhancing the activity and selectivity of homogeneous catalysts in the oxidation process.

**Catalysis in Ionic Liquids**

This book reviews advances in important and practically relevant homogeneous catalytic transformations, such as single-site olefin polymerizations and chemo- and stereo-selective oxidations. Close attention is paid to the experimental investigation of the active sites of catalytic oxidation systems and their mechanisms. Major subjects include the applications of NMR and EPR spectroscopic techniques and data obtained by other physical methods. The book addresses a broad readership and focus on widespread techniques available in labs with NMR and EPR spectrometers.

**Mechanisms in Homogeneous Catalysis**

Homogeneous catalysis by soluble metal complexes has gained considerable attention due to its unique applications and features such as high activity and selectivity. Catalysis of this type has demonstrated impressive achievements in synthetic organic chemistry and commercial chemical technology. Homogeneous Catalysis with Metal Complexes: Kinetic Aspects and Mechanisms presents a comprehensive summary of the results obtained over the last sixty years in the field of the kinetics and mechanisms of organic and inorganic reactions catalyzed with metal complexes. Topics covered include: Specific features of catalytic reaction kinetics in the presence of various mono- and polynuclear metal complexes and nanoclusters Multi-route mechanisms and the methods of their identification, as well as approaches to the kinetics of polyfunctional catalytic systems Principles and features of the dynamic behavior of nonlinear kinetic models The potential, achievements, and limitations of applying the kinetic approach to the identification of complex reaction mechanisms The development of a rational strategy for designing kinetic models The kinetic models and mechanisms of many homogeneous catalytic processes employed in synthetic and commercial chemistry Written for specialists in the field of kinetics and catalysis, this book is also relevant for post-graduates engaged in the study

**Applications of EPR and NMR Spectroscopy in Homogeneous Catalysis**

Contains a balanced discussion of homogeneous catalytic reactions that are used in industry, featuring every documented example employed in a current commercial process, or that have a broad application in the organic synthesis laboratory. Incorporates synthesis with chiral catalysts in chapters on hydrogenation, CO chemistry and olefin oxidation. New additions include Tennessee Eastman's coal-based acetic anhydride plant and IFP's Dimersol process for dimerizing propylene as well as major changes in the areas on pharmaceuticals, flavors, fragrances, agricultural and electronic chemicals.

**Ferrocenes**

The field of transition metal catalysis has experienced incredible growth during the past decade. The reasons for this are obvious when one considers the world's energy problems and the need for new and less energy demanding syntheses of important chemicals. Heterogeneous catalysis has played a major industrial role; however, such reactions are generally not selective and are exceedingly difficult to study. Homogeneous catalysis suffers from on-site engineering difficulties; however, such reactions usually provide the desired selectivity. For example, Monsanto's synthesis of optically-active amino acids employs a chiral homogeneous rhodium diphosphine catalyst. Industrial uses of homogeneous catalyst systems are increasing. It is not by accident that many homogeneous catalysts contain tertiary phosphine ligands. These ligands possess the correct steric and electronic properties that are necessary for catalytic reactivity and selectivity. This point will be emphasized throughout the book. Thus the stage is set for a comprehensive be treatment of the many ways in which phosphine catalyst systems can designed, synthesized, and studied.
Heterogenized Homogeneous Catalysts for Fine Chemicals Production

Adopting a didactic approach at an advanced, masters level, this concise textbook provides an array of questions & answers and features numerous industrial case studies and examples, with references for further, more detailed reading and to the latest peer-reviewed articles at the end of each chapter. A significant feature is the book’s treatment of more recently developed catalytic processes and their applications in the pharmaceutical and fine chemical industries, with an indication of their present and future commercial impact. Written by a dedicated lecturer with a wealth of experience in industry, this is an invaluable tool for practicing chemical engineers and chemists who need to advance their education in this vibrant and expanding field.

Homogeneous Hydrogenation

Table 1 E factors (tonnes of waste generated per tonne of product manufactured [7] Industry segment Annual product tonnage E factor 6 8 Oil refining 10 –10 Approx. 0.1 4 6 Bulk chemicals 10 –10

New Materials for Catalytic Applications

The broadening technical advances in the production of pharmaceuticals, flavors, and fragrances have more than doubled the industrial applications of soluble transition metal catalysts. Indeed, transition metal catalysts have become an ascendant feature of a heightened academic interest in organometallic chemistry. This Second Edition of the landmark text offers a clear, systematic look at the state-of-the-science of homogeneous catalytic reactions. Focusing on specific processes, rather than principles of coordination or organometallic chemistry, this updated edition is an A-to-Z compilation of the homogeneous catalytic reactions commonly used in industry or that have broad application in the organic synthesis laboratory. Documenting examples of homogeneous catalytic reactions used in current commercial processes, this newest edition features Tennessee Eastman's coal-based acetic anhydride plant and IFP's Dimersol processes for dimerizing propylene as well as Du Pont's hydrocyanation process. Detailed coverage also includes isomerization of simple olefins, mechanism of olefin hydrogenation, oligomerization of olefins, chain transfer catalysis, reactions of carbon monoxide, specialty chemicals, reactions of acetylenes, esterification, polycondensation, and related processes. Featuring the latest findings in its existing coverage on pharmaceuticals, agricultural chemicals, flavors, fragrances, and electronic chemicals, this Second Edition clearly details the science's growing influence and practicality in industry and the lab. Organic and inorganic chemists, instructors, and students will find Homogeneous Catalysis, Second Edition a clear, up-to-date compendium of the catalytic reactionssharping chemistry's cutting edge.

Catalysis

This unique handbook fills the gap in the market for an up-to-date work that links both homogeneous catalysis applied to organic reactions and catalytic reactions on surfaces of heterogeneous catalysts.

Bridging Heterogeneous and Homogeneous Catalysis

Homogeneous Catalysis

Heterogeneous Catalysis in Organic Chemistry
This book reviews advances in important and practically relevant homogeneous catalytic transformations, such as single-site olefin polymerizations and chemo- and stereo-selective oxidations. Close attention is paid to the experimental investigation of the active sites of catalytic oxidation systems and their mechanisms. Major subjects include the applications of NMR and EPR spectroscopic techniques and data obtained by other physical methods. The book addresses a broad readership and focuses on widespread techniques available in labs with NMR and EPR spectrometers.

**Applied Homogeneous Catalysis**

This publication is the first to present the quantitative application of quantum chemistry to organometallic reactions. Great progress has been made in recent years in the calculation of transition states of organometallic conversions in both homo and heterogeneous catalysis. This volume, which contains seven contributions by leading scientists, deals with key reactions of homogeneous catalysis including oxidative addition, migratory insertions, 2+2 additions, the Wacker reaction, and epoxidation. The book provides experimental chemists with an up-to-date overview of the state of the art in this field, and will stimulate an adjustment of views previously based on semiempirical calculations. For researchers and advanced graduate students whose work involves organometallics and catalysis.

**Applications of EPR and NMR Spectroscopy in Homogeneous Catalysis**

While chemists using spectroscopic methods need to learn from the specialists, they do not normally read the spectroscopists' original papers. This book provides this very information -- summarizing some recent advances in the mechanistic understanding of metallocene polymerization catalysts and the role of NMR spectroscopy in these endeavors. Adopting a real practice-oriented approach, the authors focus on two of the most important spectroscopic techniques with two parts devoted to each of NMR and IR spectroscopy - as well as on important industrial applications with regard to the reaction discussed. Rather than providing a complete and exhaustive review of homogeneous hydrogenation and its detailed mechanisms, the book focuses on the specific spectroscopic techniques and the mechanistic information that has been obtained from their application. The result is unique in its scope, allowing chemists from different fields to learn which techniques can be applied for their specific synthetic problems. The prizewinning editor, Professor Brian Heaton, is the key player in the field, and has brought together here a team of authors to cater for specialists, and researchers in industry and academia.

**Computational Modeling of Homogeneous Catalysis**

With applications ranging from asymmetric catalysis to magnetic materials, ferrocene is one of the most versatile building blocks in synthesis. This book captures the multidisciplinary nature of ferrocene research, including topics such as ferrocene-containing polymers, ferrocene-containing thermotropic liquid crystals, chiral ferrocene derivatives, and ferrocene-containing charge-transfer materials. In addition, the reader will find "valuable information for planning syntheses" over 70 tables, making relevant data available at a glance "carefully selected references, providing an easy access to the primary literature Up-to-date, and written by leading international experts in the field, among them R. Deschenaux, C. D. Hall, Y. Butsugan, and R. Herrmann, this book is a welcome source of in-depth information for graduate students and professionals in organic, organometallic, and polymer chemistry, as well as in materials science.

**Homogeneous catalysis**

After the great success now in its 2nd Edition: This textbook covers all aspects of catalysis, including computational methods, industrial applications and green chemistry.

**Homogeneous Catalysis**
Theoretical Aspects of Homogeneous Catalysis

Research on designing new catalytic systems has been one of the most important fields in modern organic chemistry. One reason for this is the predominant contribution of catalysis to the concepts of atom economy and green chemistry in the 21st century. Gold, considered catalytically inactive for a long time, is now a fascinating partner of modern chemistry, as scientists such as Bond, Teles, Haruta, Hutchings, Ito and Hayashi opened new perspectives for the whole synthetic chemist community. This book presents the major advances in homogeneous catalysis, emphasizing the methodologies that create carbon–carbon and carbon–heteroatom bonds, the applications that create diversity and synthesize natural products, and the recent advances and challenges in asymmetric catalysis and computational research. It provides readers with in-depth information about homogeneous gold-catalyzed reactions and presents several explanations for the scientific design of a catalyst. Readers will be able to understand the entire gold area and find solutions to problems in catalysis. Gold Catalysis — An Homogeneous Approach is part of the Catalytic Science Series and features prominent authors who are experts in their respective fields. Contents: From Gold in Nature to Gold Catalysts (Søren Kramer and Fabien Gagosz) Homogeneous Gold-Catalyzed Oxidation and Reduction Reactions (Liming Zhang) Homogeneous Gold-Catalyzed Addition of Carbon Nucleophiles to C–C Multiple Bonds, Carbonyls, and other Electrophiles (Bryon L Simmons and Hong C Shen) Homogeneous Gold-Catalyzed Addition of Heteroatom Nucleophile to C–C Multiple Bond (Naoki Asao, Naoya Hatakeyama and Yoshinori Yamamoto) Gold-Catalyzed Synthesis of Heterocycles (Antonio Arcadi) Gold-Catalyzed Multi-Component Reactions (Rachid Skouta and Chao-Jun Li) Gold Catalysis on Tandem and Cascade Reactions (Rai-Shung Li) Cycloisomerization Reactions of 1, N-Enynes (Núria Huguet and Antonio M Echavarren) Gold-Catalyzed Reactions of Propargylic Esters (Louis Fensterbank, Jean-Philippe Goddard, Max Malacria and Antoine Simonneau) Gold-Catalyzed Cross-Coupling Reactions (Suzanne A Blum) Gold-Catalyzed Reactions: A Computational Approach (Elena Soriano and José Marco-Contelles) Recent Developments in Asymmetric Catalysis (Patrick Y Toullec, Alexandre Pradal and Véronique Michelet) Gold Catalysis in Natural Product Synthesis (Michael R Gesinski and F Dean Toste) Readership: Graduate students and researchers in organic chemistry. Key Features: First book on homogeneous gold catalysis Prominent authors From catalysts design to target-oriented applications A fascinating partner for modern chemistry Keywords: Gold; Catalysis; Heterocycles; Tandem; Cascade Reactions Reviews: "Gold Catalysis gives an excellent overview of a rapidly growing field. All of the thirteen chapters are written by the best practitioners. This book is certainly a "must" for laboratories working with coinage metals, but also for any organometallic group." Guy Bertrand Distinguished Professor, University of California, San Diego Director of the UCSD/CNRS Joint Research Chemistry Laboratory (UMI 3555)

Principles and Applications of Homogeneous Catalysis

The features of this book which will be of special interest to academic organic chemists are the introduction (Chapter 1), which presents a short course on the concepts and language of heterogeneous catalysis, covers organic reaction mechanisms of hydrogenation (Chapter 2), hydrogenolysis (Chapter 4), and oxidation (Chapter 6), a presents problems and solutions specific for running heterogeneous catalytic organic reactions in solution. These materials can supplement advanced chemistry courses. Most synthetic organic chemists use a variety of "protecting groups" which they attach to functional groups (reactive groups of atoms) while some reaction is being conducted on another part of the molecule. These protecting groups prevent reactions of the functional groups during other reactions and are removed later by a heterogeneous catalytic method called hydrogenolysis. One unique feature of this book, not found in other books on catalysis, is an exhaustive chapter (Chapter 4) on hydrogenolysis, which is dredged from the recent synthetic literature published by modern organic chemists. Academic organic chemists should find this chapter extremely useful and may wish to adopt the book as a supplement for advanced organic chemistry courses designed for seniors and for graduate students. It will also be useful for professors and their research groups engaged in synthetic organic chemistry. Many academic organic chemists are not aware of recent advances in heterogeneous enantioselective catalysis (Chapter 3) or in selective low temperature, liquid phase heterogeneous catalytic oxidations by hydrogen peroxide (Chapter 6). These specialty topics are timely and may be new to academic organic chemists and can be used to supplement their advanced courses. Several features of this book will also be of special interest to industrial chemists who are unfamiliar with heterogeneous catalysis. Many good organic chemists are hire by industry. They synthesize a new compound using standard organic synthetic techniques but are informed by their supervisor that they must convert some of their synthetic steps into heterogeneous catalytic steps. They may not have been exposed to heterogeneous catalysis and have few places to turn. This book offers them a crash course in heterogeneous catalysis.
catalysis as well as many examples of reactions and conditions with which they can start their search. Those industrial organic chemists already familiar with heterogeneous catalysis will find this book useful as a reference to many examples in the recent literature. They will find recent surface science discoveries correlated with heterogeneous catalysis or organic reactions and mechanistic suggestions designed to stimulate innovative nontraditional thinking about organic reactions on surfaces. Written by organic chemists for organic chemists Introduces heterogeneous catalysis concepts and language Presents a comprehensive compilation of protecting group removal procedures Covers liquid-phase hydrogenations, hydrogenolysis, and oxidations Addresses heterogeneous methods for producing pure enantiomers of chiral products Examines the emerging field of heterogenized homogeneous catalysts Mixes practical applications with mechanistic interpretations

**Homogeneous Catalysis; Industrial Applications and Implications**

Over the last decade, the area of homogeneous catalysis with transition metal has grown in great scientific interest and technological promise, with research in this area earning three Nobel Prizes and filing thousands of patents relating to metallocene and non-metallocene single site catalysts, asymmetric catalysis, carbon-carbon bond forming metathesis and cross coupling reactions. This text explains these new developments in a unified, cogent, and comprehensible manner while also detailing earlier discoveries and the fundamentals of homogeneous catalysis. Serving as a self-study guide for students and all chemists seeking to gain entry into this field, it can also be used by experienced researchers from both academia and industry for referring to leading state of the art review articles and patents, and also as a quick self-study manual in an area that is outside their immediate expertise. The book features: Topics including renewable feed stocks (biofuel, glycerol), carbon dioxide based processes (polycarbonates), fluororous solvents, ionic liquid, hydroformylation, polymerization, oxidation, asymmetric catalysis, and more Basic principles of organometallic chemistry, homogeneous catalysis, and relevant technological issues Problems and answers, industrial applications (case studies), and examples from proven industrial processes with clear discussions on environmental and techno-commercial issues Extensive references to cutting edge research with application potential and leading patents Tables and illustrations to help explain difficult concepts

**Applied Homogeneous Catalysis with Organometallic Compounds**

The shift towards being as environmentally-friendly as possible has resulted in the need for this important volume on homogeneous catalysis. Edited by the father and pioneer of Green Chemistry, Professor Paul Anastas, and by the renowned chemist, Professor Robert Crabtree, this volume covers many different aspects, from industrial applications to atom economy. It explains the fundamentals and makes use of everyday examples to elucidate this vitally important field. An essential collection for anyone wishing to gain an understanding of the world of green chemistry, as well as for chemists, environmental agencies and chemical engineers.

**Homogeneous Catalysts**

Catalysts are now widely used in both laboratory and industrial-scale chemistry. Indeed, it is hard to find any complex synthesis or industrial process that does not, at some stage, utilize a catalytic reaction. The development of homogeneous transition metal catalysts on the laboratory scale has demonstrated that these systems can be far superior to the equivalent heterogeneous systems, at least in terms of selectivity. An increasing interest in this field of research from both an academic and industrial point of view. In connection with the rapid developments in this area, four universities from the E.E.C (Aachen, FRG; Liege, Belgium; Milan, Italy; and Lille, France) have collaborated to organize a series of seminars for high-level students and researchers. These meetings have been sponsored by the Commission of the E.E.C and state organizations. The most recent of these meetings was held in Lille in September 1985 and this book contains updated and expanded presentations of most of the lectures given there. These lectures are concerned with the field of homogeneous transition metal catalysis and its application to the synthesis of organic intermediates and fine chemicals from an academic and industrial viewpoint. The continuing petroleum crisis which began in the early 1970s has given rise to the need to develop new feedstocks for the chemical industry.

**Homogeneous Catalysis**
The completely revised third edition of this four-volume classic is fully updated and now includes such topics as as CH-activation and multicomponent reactions. It describes the most important reaction types, new methods and recent developments in catalysis. The internationally renowned editors and a plethora of international authors (including Nobel laureate R. Noyori) guarantee high quality content throughout the book. A "must read" for everyone in academia and industry working in this field.

**Homogeneous Catalysis**

**Catalysis**

Although ionic liquids have only been studied in depth during the last decades, the field is now maturing to such a degree that the focus is on larger scale applications for use in real processes such as catalysis. Current information is scattered across the literature and Catalysis in Ionic Liquids provides a critical analysis of the research published to date on ionic solvents in all areas of the catalytic science. The book covers both catalyst synthesis using ionic liquids as solvents and green syntheses using both ionic liquids as well as mixtures of ionic liquids and carbon dioxide (as a subcritical and supercritical liquid), including enzymatic, homogeneous, and heterogeneous catalysis, electrocatalysis and organocatalysis. As well as the catalysis community, the book will also be of interest to postgraduates, postdoctoral workers and researchers in academia and industry working in organic synthesis, new materials synthesis, renewable sources of energy and electrochemistry. Written by leading experts in the field, this is the reference source to find about catalysis in ionic liquids.

**Gold Catalysis**

The book about homogeneous catalysis with metal complexes deals with the description of the reductive-oxidative, metal complexes in a liquid phase (in polar solvents, mainly in water, and less in nonpolar solvents). The exceptional importance of the redox processes in chemical systems, in the reactions occuring in living organisms, the environmental processes, atmosphere, water, soil, and in industrial technologies (especially in food-processing industries) is discussed. The detailed practical aspects of the established regularities are explained for solving the specific practical tasks in various fields of industrial chemistry, biochemistry, medicine, analytical chemistry and ecological chemistry. The main scope of the book is the survey and systematization of the latest advances in homogeneous catalysis with metal complexes. It gives an overview of the research results and practical experience accumulated by the author during the last decade.

**Homogeneous Catalysis**

This first book to illuminate this important aspect of chemical synthesis improves the lifetime of catalysts, thus reducing material and saving energy, costs and waste. The international panel of expert authors describes the studies that have been conducted concerning the way homogeneous catalysts decompose, and the differences between homogeneous and heterogeneous catalysts. The result is a ready reference for organic, catalytic, polymer and complex chemists, as well as those working in industry and with/on organometallics.

**Homogeneous Catalysis**

Homogeneous hydrogenation is one of the most thoroughly studied fields of homogeneous catalysis. The results of these studies have proved to be most important for an understanding of the underlying principles of the activation of small molecules by transition metal complexes. During the past three decades homogeneous hydrogenation has found widespread application in organic chemistry, including the production of important pharmaceuticals, especially where a sophisticated degree of selectivity is
required. This volume presents a general account of the main principles and applications of homogeneous hydrogenation by transition metal complexes. Special attention is devoted to the mechanisms by which these processes occur, and the role of the recently discovered complexes of molecular hydrogen is described. Sources of hydrogen, other than H2, are also considered (transfer hydrogenation). The latest achievements in highly stereoselective hydrogenations have made possible many new applications in organic synthesis. These applications are documented by giving details of the reduction of important unsaturated substrates (alkenes, alkynes, aldehydes and ketones, nitrocompounds, etc.). Hydrogenation in biphasic and phase transfer catalyzed systems is also described. Finally, a discussion of the biochemical routes of H2 activation highlights the similarities and differences in performing hydrogenation in both natural and synthetic systems. For researchers working in the fields of homogeneous catalysis, especially in areas such as pharmaceuticals, plastics and fine chemicals.

**Homogeneous Catalysis with Metal Complexes**

**Homogeneous Catalysis**

New Materials for Catalytic Applications proposes the use of both new and existing materials for catalytic applications, such as zeolites, metal oxides, microporous and mesoporous materials, and monocrystals. In addition, metal-oxides are discussed from a new perspective, i.e. nano- and photocatalytic applications. The material presents these concepts with a new focus on strategies in synthesis, synthesis based on a rational design, the correlation between basic properties/potential applications, and new catalytic solutions for acid-base, redox, hydrogenation, photocatalytic reactions, etc. Presents organometallic concepts for the synthesis of nanocatalysts. Details the nature of sites in MOFs generating catalytic properties immobilization of triflates in solid matrices for organic reactions.

**Green Catalysis**

**Homogeneous catalysis: industrial applications and implications: a symposium sponsored by the Division of Industrial and Engineering Chemistry, at the 152nd**

**Catalysis: An Integrated Approach**

Gives a unifying concept of homogeneous catalysis, ranging widely from proton catalysis to metalloenzyme catalysis. Treats important principles underlying catalysis concisely. Presents many typical examples of homogeneous catalysis using transition metal complexes with probable mechanisms. New developments in homogeneous catalysis are included as much as possible in this book, the first to treat the subject in a concise but fundamental manner.
Homogeneous Catalysis with Metal Phosphine Complexes

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.

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