J|A|C|S
BOOK REVIEWS

Carbon Materials for Catalysis. Edited by Philippe Serp (Toulouse University, France) and José Luís Figueiredo (Universidade do Porto, Portugal). John Wiley & Sons, Inc.: Hoboken, NJ. 2009. xxii + 580 pp. $150. ISBN 978-0-470-17885-0.

The 15 chapters of this book are written by world authorities in the field and cover all aspects of carbon materials with emphasis on their applications in catalysis. The introductory chapter by Radovic gives a detailed account of various forms of carbons, their methods of preparation, and properties. The mutual effects of surface structure and bulk properties of carbons on catalysis are highlighted, and both the chemical and physical natures of carbon surfaces are discussed in terms of their catalytic role. The chemistry and structure of carbons relevant to the formation of surface groups interacting with sulfur-, nitrogen-, and oxygen-containing compounds are discussed by Bandosz in the next chapter. This includes the role of surface groups in the catalytic conversion of pollutants, i.e., NO_x, SO_x, H_2S, and halogen-containing species, as well as methods for the modification of carbon surfaces to improve activity in these and other applications.

Molecular simulation appears to be a powerful tool to study the electronic properties of molecular systems, i.e., structural, chemical, and physical properties as well as reactivities. This method is used to describe gas−carbon and metal−carbon reactions in the chapter by Zhu, which covers research in this area during the past four decades. The gases and metals covered include H_2, O_2, H_2O, CO_2, NO_x, N_2O, Cu, Ni, Au, Pt, Pd, and Rh.

In the next chapter, Rodriguez-Reinoso and Sepúlveda-Escrivano describe the properties of various forms of carbons, e.g., graphite, carbon black, activated carbon, carbon fibers, carbon nanotubes, etc., in terms of their relevance as supports for industrial catalysts and discuss their industrial applications in processes such as hydroprocessing, hydrogenation, and synthesis of ammonia. The same forms of carbon materials are considered for the preparation of carbon-supported metal catalysts in the chapter by Bitter and de Jong. Several methods of preparation, such as conventional impregnation and adsorption as well as deposition and/or precipitation, are compared. Emerging methods for preparing the carbon-supported metal catalysts for applications in fuel cells are also described. In a later chapter, Aranujatesan et al. discuss the preparation and properties of carbon-supported catalysts for applications in the chemical industry and use the hydrogenation of fatty acids, nitrobenzene, and dinitrotoluene, reductive alkylation, purification of tetraphthalic acid, etc. as examples.

There are various chemical reactions in which carbon itself is catalytically active, and Figueiredo and Pereira provide a summary of them, e.g., oxidative dehydrogenation, dehydration of alcohols, hydrogen peroxide reactions, etc., in their chapter "Carbon as catalyst". They also discuss environmentally relevant reactions catalyzed by carbon, including reduction of NO_x and oxidation of SO_x and H_2S. The changes in carbon structure and its catalytic properties caused by incorporating nitrogen are reviewed in the next chapter by Boehm. He discusses the methods for preparing and characterizing such carbons, as well as catalysis of oxidation reactions with dioxygen, e.g., the oxidation of aqueous sulfurous acid, oxalic acid, SO_2, ferrous ions, and odorous species (like H_2S and mercaptans), and dehydrochlorination.

Activated carbon, carbon blacks, carbon xerogels, and carbon nanotubes as supports for the immobilization of transition metal complexes are compared by Freire and Silva in their chapter "Carbon anchored metal complex catalysts". The activities and chemo- or enantioselectivities of the immobilized systems are enhanced compared with free analogues because of the concept of confinement and site isolation. Methods used for immobilization as well as catalytic activity of the immobilized systems for hydrogenation, hydroformylation, and polymerization are reviewed.

The chapter by Serp gives a detailed account of the preparation of carbon nanotubes and carbon nanofibers. The role of surface pretreatment for the active dispersion of metals during the preparation of catalysts supported on such carbons is identified. The potential for use of enzymes supported on these materials for catalysis is also addressed. He also discusses the advantages of carbon nanotubes and nanofibers in catalysis, which include a high purity, mesoporous nature, high thermal conductivity, well-defined structure, rich surface chemistry, and specific metal−supported interactions.

Novel forms of nanostructured carbons such as carbon gels have potential in heterogeneous catalysis. Moreno-Castilla reviews the surface properties and methods for preparation of such gels as well as their doping with metals. He also discusses the use of carbon gel-supported catalysts in double-bond hydrogenation, skeletal isomerization, hydrodechlorination, and the synthesis of MTBE, as well as in condensation, coupling, and addition reactions.

In the next chapter, de Lathouder et al. describe recent developments in the field of monolithic structures in catalysis, including methods of preparation, support properties, and applications. Monoliths that are carbon coated or composed exclusively of carbon are discussed as potential biocatalysts, as are monolith-based ruthenium catalysts, which show promise for various hydrogenation reactions.

Carbon materials as supports for polymeric electrolytic membrane fuel cells and direct methanol fuel cells are the focus of Chapter 12 by Maillard et al. They analyze how the structure and properties of carbon materials influence the activity of noble metals in the catalytic layer. The preparation and characterization of carbon-supported electrocatalysts and catalytic layers are also examined. This is followed by Faria and Wang's chapter on the synthesis and properties of carbon−TiO_2 composites for photocatalytic applications, with emphasis on the photodegradation of pollutants. They also explore the effect of carbon in composite catalysts on the mechanism of photocatalysis.

Unsigned book reviews are by the Book Review Editor.

10.1021/ja903808y CCC: $40.75

The final chapter by Li is devoted to carbon materials used in developing electrical or electrochemical biosensors. The atomic structure of carbons is described and correlated with properties to enable optimization of specific sensing applications by tuning the carbon structure. Attention is paid to graphitic materials with highly anisotropic properties.

This is a comprehensive book on carbon science relevant to catalysis and is apparently the first of its kind to be published in book form. Selective references at the ends of the chapters direct readers to the source of more detailed information. The book also addresses future perspectives and thus may serve as a guide and/or benchmark for designing and executing new research projects.

Edward Furimsky, *IMAF Group*

JA903808Y

10.1021/ja903808y

Wörterbuch Labor/Laboratory Dictionary, Deutsch-Englisch/English-German, 2. Auflage, 2nd ed. By Theodor C. H. Cole (Heidelberg, Germany). Springer-Verlag: Berlin, Heidelberg. 2009. xvi + 454 pp. $69.95. ISBN 978-3-540-88579-5.

This dictionary should serve as a good reference for the English speaker in a German-speaking laboratory and likewise for the German speaker in an English-speaking one. Some 25 000 general and specialized terms are translated into their English and German counterparts, covering such areas as engineering of facilities, e.g., electricity, plumbing, ventilation; equipment and supplies; glassware, tools, apparatus; servicing, maintenance, repair; ordering, shipment, delivery; analytics; chemicals; and safety. This second edition has been expanded to include the latest vocabulary in use in the laboratory today, based on "extensive comparative linguistic studies of original literature in technology, engineering and analytical methods as well as vast amounts of supplier catalogs in both languages ...", to quote from the Preface. The first half of the book is the German−English section, followed by the English−German one.

JA9048916

10.1021/ja9048916

The Power of Functional Resins in Organic Synthesis. Edited by Judit Tulla-Puche and Fernando Albericio (University of Barcelona, Spain). Wiley-VCH Verlag GmbH & Co. KGaA: Weinheim. 2008. xx + 664 pp. $230. ISBN 978-3-527-31936-7.

This book is aimed at spreading both tutorial and advanced knowledge on a variety of applications of cross-linked functional polymers. Chapter 1 begins with a clear and useful historical *excursus* on the overall topic of the book and is well articulated in its various subunits on linkers/handles and types of solid supports. An introductory review on the concepts and techniques of molecular imprinting and main applications of molecularly imprinted polymers is given clearly and concisely in Chapter 2, which is written in the form of a tutorial addressed to newcomers in the field. Applications of organic and inorganic nanoparticles functionalized with bioactive molecules are the subject of Chapter 3, which frankly appears to be rather outside the scope of the book. Chapter 4, which is also directed to newcomers, is devoted to polymer-supported oxidizing and reducing agents. The following chapter concerns base and acid reagents and also seems disconnected from the rest of the book, although the topic is chemically interesting.

Chapter 6, on functional resins as nucleophilic, electrophilic, and radical reagents, is a concise but critical application-oriented and well-written chapter that will certainly be useful to people looking for supported reagents of this kind. It is followed by a chapter dealing mainly with supported reagents for the activation of carbonyl functions, especially in esterification and amidation reactions. Different classes of such reagents are illustrated under separate headings, where their preparation and applications are described, and the relevant advantages and drawbacks are discussed in some detail. This chapter offers a valuable survey for both newcomers and scientists already acquainted with the subject. Chapter 8 comprehensively covers polymer-supported (or tagged) scavengers and reviews much more than resin supports, encompassing silica supports, linear polymer tags, fluorous tags, etc. Besides providing an exhaustive listing of effective, easily removable scavengers that have been proposed in the literature, the chapter also focuses on applications in high-throughput chemistry, where scavengers are particularly useful. Questions related to the dispersion of trace metal ions in a variety of physicochemical systems in the biosphere are addressed in Chapter 9. Functional resins are suitable for scavenging metals, and the last part of the chapter deals with the existence of gel-type resins that are particularly effective in scavenging species containing Pd, Pt, Ru, Fe, Cu, and Sn.

The application of organocatalysts supported on both insoluble and soluble organic polymers is comprehensively surveyed in Chapter 10. A number of different classes of catalysts, e.g., acidic, basic, phase-transfer, oxidation, etc., are discussed, distinguishing between nonchiral and chiral ones where appropriate. Proper attention is paid to the comparison of these supported catalysts with their unsupported molecular counterparts, and some fundamental concepts regarding the catalytic applications of polymeric materials, such as hydrophilicity/-phobicity of the carrier, accessibility of the catalytic sites, effects of spacers, multifunctionality, etc., are conveniently highlighted. In summary, this chapter should be valuable to newcomers but could also provide some inspiration to scientists already acquainted with the subject.

Noteworthy applications of cross-linked functional polymers as supports of defined metal coordination compounds, i.e., metal complexes; individual metal ions fixed to polymer frameworks via ion-exchange; and nanostructured metal(0) aggregates, i.e., metal nanoclusters, are well discussed in Chapter 11. Chapter 12 focuses on supported chiral auxiliaries. It provides a comprehensive overview of the subject, although it could have been more critical, particularly concerning the comparison between the performance of the supported auxiliaries with that of the homogeneous analogues. The succeeding chapter introduces immobilized enzymes and their use in organic synthesis. The approach to the subject is in the form of short highlights based on selected examples, of enzymes useful for biocatalysis, immobilization procedures, and applications. Compared to the other chapters, there is less general discussion of the topic, although references to specific and more comprehensive reviews can be found.

In this respect, it could be a convenient starting point for newcomers to grasp some ideas about the subject.

Chapters 14−17 offer a comprehensive and exhaustive overview of the types of resins available for solid-phase synthesis. These chapters group the resins according to the cleavage conditions of the molecules built on the solid support: acid-labile (Chapter 14), base/nucleophile-labile (Chapter 15), with "safety-catch" or traceless linkers (Chapter 16), and photocleavable (Chapter 17). Each chapter has its own list of abbreviations, a must when a very large number of molecules and reaction conditions need to be summarized. Some of the common, relevant features among them include handy tables that are full of data; a historical perspective in which the route followed by chemists to modify the first proposed resins into a variety of new moieties is clearly described; numerous chemical formulas and schemes to illustrate the discussion; and rich reference sections citing pertinent scientific literature. All of these characteristics make this section of the book approachable to nonspecialized readers. At the same time, the detailed, well-organized, and scientifically sound descriptions should serve as valuable tools for all researchers operating in the field of solid-supported organic synthesis. Finally, the material presented here might be the basis for advanced academic courses.

The next four chapters compose a section in which a fairly comprehensive overview of applications of solid supports in multistep synthetic processes is presented. The promised emphasis on the role of polymer support is surprisingly the least assiduously pursued in Chapter 18 on peptides, written by the editors of the book. However, a very interesting discussion of the specific properties of a wide range of solid supports (including inorganic ones) is presented in Chapter 19, which also covers various types of linkers useful for oligonucleotide preparation. Similarly, the applications of solid supports in the synthesis of oligosaccharides are thoroughly discussed in Charter 20. The last chapter of the book gives selected examples illustrating the usefulness of polymer materials in complex synthetic procedures, not only as solid supports but also as isolation tags facilitating separation of compounds by selective precipitation.

In conclusion, this book is a valid scientific work that will be useful to scientists interested in the chemistry of functional polymers, in general, and in their applications in diverse sectors of chemical technology, e.g., supported metal catalysis, especially in complex multistep synthetic processes. Its acquisition should be a must for all chemistry libraries.

Benedetto Corain, Fernando Formaggio, Marco Zecca, and Andrea Biffis, *University of Padova*

Karel Jerabek, *Czech Academy of Sciences*

JA9041737

10.1021/ja9041737