Book Reviews

Electron Deficient Boron and Carbon Clusters

Edited by G. A. Olah, K. Wade and R. E. Williams, published by John Wiley and Sons, New York, 1991.

This book, which is dedicated to Nobel laureate Bill Lipscomb on his 70th birthday, is a compilation and enlargement of papers presented at a biannual research symposium of the Loker Hydrocarbon Research Institute on Electron Deficient Clusters. The contents of the papers are thus directed at an audience which is already well-informed in the area of electron deficient compounds and clusters, and who wish to delve more deeply into recent ideas and research results.

The short introductory chapter by Olah, Wade and Williams, is an essential reminder to the reader of philosophy, concepts and definitions, together with a summary of the historical development of the bonding theories which have resulted from work in the field. It is perhaps a reflection of the character of the book that the authors of most of the chapters also present introductions which cover much similar material. This is acceptable if the reader is delving into one or two topics in isolation for reference purposes, but is distracting for a reader who wishes to get an overall view of the field. The authors of the thirteen principal chapters are all noted authorities in their special areas. Chapters 2–5 are essentially theoretical in nature, and cover systematics of bonding, structure, ^{11}B NMR spectra and rearrangements of boranes and carboranes. Chapters 6–9 cover recent preparative and structural studies on boranes, carboranes, metallaboranes and heteroboranes with the emphasis on clusters which are boron-rich. Chapters 10–12 cover recent chemistry primarily involved with clusters involving transition metals, boron and carbon in which the transition metal cluster atoms play a more dominant role. Chapter 13 is a liberal interpretation of the electron deficient theme, since it is primarily concerned with oxidative addition of C–H bonds to monometallic complexes of iridium and osmium. The final Chapter 14 returns to the theme of clusters involving hypercarbon hydrocarbons and carbonium ions, and electrophilic reactions of alkanes.

Chapter 2 by R. E. Williams is a massive summary of the systematic structural behaviour of *nido*-boranes, -carboranes and -carbocations. Dr Williams develops his earlier published systematics to a new degree of sophistication, and develops the styx skeletal architecture description introduced by Lipscomb to a more general stx scheme. He is able to correlate observed *nido*-structures with the size of the open face and aperture-dependent electron distribution, and is able to predict structures for compounds which are currently unknown or of doubtful configuration. An excellent and thought-provoking chapter is marred only by the unduly gimmicky nomenclature and terminology which has become prevalent in the field.

Chapter 3 by K. Wade discusses bonding in terms of two- and three-centre bonds, and then develops to a schematic vertex electron pair approach. The chapter concludes with a correlation of ^{11}B chemical shifts with MOBI bond index calculations on a series of icosahedral carborane derivatives.

Chapter 4 by M. Buehl and P. von R. Schleyer discusses geometries and ^{11}B chemical shifts calculated on a combined *ab initio* (MO)–IGLO approach for a number of smaller boranes and borane anions.

In Chapter 5, D. M. P. Mingos and D. J. Wales apply tensor surface harmonic theory to an analysis of the diamond-square-diamond and related rearrangement mechanisms in boranes and clusters. N. N. Greenwood in Chapter 6 discusses his group's recent research results in two areas. These are the structure and thermolysis of some small boranes, and some recently determined metallaborane structures.

T. Onak and K. Fuller describe in Chapter 7 some nucleophilic reactions of small carboranes and their derivatives, and correlate reactivities with *ab initio* calculations at several levels.

In Chapter 8, S. O. Kang and L. G. Sneddon examine the preparation and reactions of *hypho*-dithiaborane clusters, and compare them with carbon and transition metal clusters.

C-trimethylsilyl derivatives of *nido*-2,3-$C_2B_4H_8$, and their chemistry, are described in Chapter 9 by N. S. Hosmane and J. A. Maguire. The work includes the incorporation of some early main group elements in the clusters.

Chapter 10 by D. P. Workman and S. G. Shore describes hydroboration reactions of $(\mu\text{-H})_2Os_3(CO)_{10}$, including the preparation of clusters involving Os_3 and B and C atoms.

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R. N. Grimes, in Chapter 11, describes his group's extensive work on multidecker/multicluster sandwich compounds derived from cyclocarboranes.

T. P. Fehlner, in Chapter 12, discusses recent progress in synthesising new metal-rich metallaboranes, and other derivatives with metal–boron bonds.

It is clear that the book contains a wealth of recent information and discussion on electron deficient clusters. It will be an essential reference book for researchers in the general area of clusters, and should also be read by all practicing organic, inorganic and theoretical chemists.

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Aquatic Chemical Kinetics. Reaction Rates of Processes in Natural Waters

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The objectives of this book are to treat features of chemical kinetics in aquatic systems, to improve the understanding of reaction rates and mechanisms in natural water, and to stimulate innovative research in aquatic chemical kinetics. To achieve these objectives the editor has selected 23 authors that contribute 18 chapters to this volume, emphasizing explanation and intellectual stimulation over extensive documentation. The authors include physical and inorganic chemists, surface and colloid chemists, geochemists, oceanographers, aquatic chemists, chemical engineers and environmental engineers. This book is the offspring of a workshop and its stimulating discourses which took place in March 1989 in Switzerland. With such a multi-author production, the book reminds one of a 'Conference proceedings', although the editor strongly denies this in his editorial remarks. The styles and presentation of the different chapters are indeed very different and do not produce a continuity as one would like to have seen for a teaching book. On the other hand it really presents a complete cover of all relevant aspects of chemical kinetics that concerns aquatic systems.

The first five chapters deal with the basic principles of aquatic chemical kinetics in which the authors focus on the kinetics of chemical transformation in the environment, the formulation and calibration of environmental reaction kinetics, catalysis in aquatic environments, the kinetics of trace metal complexation, and the principles of linear free-energy and structure–reactivity relationships. Chapter 6 is devoted to the frontier-molecular orbital approach in geochemical processes and presents important theoretical information for the understanding of observed kinetic behaviours. The following two chapters deal with chemical transformations of organic pollutants and the role of extracellular enzymatic reactions in natural waters. The remaining ten chapters all deal directly or indirectly with multiphase systems, starting with a treatment of *ab initio* quantum-mechanical calculations of surface reactions. Topics treated thereafter include: adsorption kinetics of organic solutes at phase boundaries; redox reactions of metal ions at mineral surfaces; modelling of dissolution of multiple oxides; dissolution of oxide and silicate minerals; photoredox reactions at hydrous metal oxide surfaces; dissolution of carbonates; kinetics of colloid chemical processes; kinetics of chemical weathering; and transport and kinetics in surficial processes.

The authors of the various chapters have all done a good job in presenting their material and citing appropriate literature for more detailed information. The editor should be complimented on achieving a high standard of presentation in such a multidisciplinary edition. This book is a must for all environmental students and scientists dealing with aquatic systems.

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Inorganic Syntheses. Volume 27

Edited by Alvin P. Ginsberg (AT & T Bell Laboratories), published by John Wiley & Sons, New York, 1990, XXV+433 pp., £47.50, ISBN 0-471-50976-0.

This book is a continuation in the series of monographs devoted to Inorganic Syntheses and maintains the tradition of earlier volumes by compiling recently developed procedures for the synthesis of inorganic and organometallic compounds of current interest. The present volume contains over 200 preparative procedures organized in 68 numbered sections in the usual carefully described manner, and they are, as always, independently checked for reproducibility. They correspond for the most part of currently active areas of research. Each contribution includes a brief introduction, a detailed