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Structure and Bonding

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The series *Structure and Bonding* publishes critical reviews on topics of research concerned with chemical structure and bonding. The scope of the series spans the entire Periodic Table. It focuses attention on new and developing areas of modern structural and theoretical chemistry such as nanostructures, molecular electronics, designed molecular solids, surfaces, metal clusters and supramolecular structures. Physical and spectroscopic techniques used to determine, examine and model structures fall within the purview of *Structure and Bonding* to the extent that the focus is on the scientific results obtained and not on specialist information concerning the techniques themselves. Issues associated with the development of bonding models and generalizations that illuminate the reactivity pathways and rates of chemical processes are also relevant.

As a rule, contributions are specially commissioned. The editors and publishers will, however, always be pleased to receive suggestions and supplementary information. Papers are accepted for *Structure and Bonding* in English.

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Preface

The present issue of Structure and Bonding is dedicated to applied group 13 chemistry, particularly for the elements boron and aluminum, and to a lesser degree gallium and indium. Although boron is a trace element (0.01 g kg^{-1}) in the earth's crust, it has been concentrated in a few locations by geochemical processes and is relatively easy to mine as borax. Aluminum, on the other hand, is the most abundant metal in the earth's crust (82 g kg^{-1}) and dispersed widely throughout the globe. Thus, boron and aluminum are readily available and their associated products or compounds are usually inexpensive and thereby easy to commercialize.

The chapters were chosen to encompass both applied *and* fundamental aspects of their subjects. The first chapter 'Borates in Industrial Use' provides a complete, and perhaps, quintessential, coverage of compounds containing boron-oxygen bonds. In the chapter Schubert explains the close relationship between the basic properties of the boron compounds and their associated uses. The remaining four chapters focus, to some degree, on aluminum. Since a great deal of literature exists in this area, these chapters are more focused on areas of emerging utility, and contain a great deal of fundamental information.

Uhl's contribution in Chapter 2 provides basic synthesis and structural information for aluminum and gallium hydrazides. These types of compounds are being explored as potential molecular precursors to metal nitrides such as the important blue-green laser material gallium nitride.

In the third chapter Wheatley and Linton describe new developments in the remarkable chemistry of aluminum and oxygen. While compounds featuring an aluminum-oxygen bond find widespread utility (as catalyst supports and co-catalysts, for example) there is still a great deal that is not understood in how these compounds form. This chapter provides the necessary basic information upon which further applications may be developed.

Aluminum reagents are used in a wide range of catalytic and polymerization processes. Karl Ziegler's 1950s discovery of the now legendary 'Aufbau Reaktion' is one dramatic example of aluminum used in this way. In this and many other reactions the ability of the aluminum atom to undergo insertions or hydride transfer reactions is of key importance. Budzelaar and Talarico, in Chapter 4, describe how both of these processes occur, and in so doing provide a great deal of guidance for the use of alkyl aluminum reagents for much broader applications.

Chapter 5 surveys the remarkable structural diversity associated with compounds containing five-coordinate group 13 elements. There is a growing awareness that many of these compounds can be used as Lewis acidic reagents or catalysts. Their coordination numbers are more fixed in comparison to 'traditional' compounds with four-coordinate elements and they are far less air sensitive. Thus, they should be more amenable to applications.

Overall, these five chapters should provide a general reader with a broad understanding of the uses, both current and potential, associated with the majority of the group 13 elements. The chapters were written to include basic background information for the edification of students and industrial scientists, as well.

November 2002

H.W. Roesky
D.A. Atwood

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