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Book Review

"Organised Molecular Assemblies in the Solid State", edited by J.K. Whitesell, John Wiley & Sons, Ltd., Chichester, 1999; ISBN 0 471 95232 X; vii + 260 pages; $199.00.

This book is the second volume in the Wiley series "The Molecular Solid State". The series founding editor is J.D. Dunitz, and the first volume was "Theoretical Aspects and Computer Modeling of the Molecular Solid State", A. Gavezzotti, ed., Wiley, 1997; ISBN 0–471–96187–6. As indicated by Dunitz in the preface to the first volume, the series will have an emphasis on weak intermolecular interactions and crystal structure. The second volume consists of five articles: "Self-assembly of Surfactant Molecules on Solid Surfaces" by A. Ulman, "Design and Synthesis of Complex Conjugated Polymers" by T.M. Swager, "Zeolite as a Medium for Photochemical Reactions" by V. Ramamurthy, R.J. Robbins, K.J. Thomas, and P.H. Lakshminarasimhan, "Statistically Significant Conclusions from the Cambridge Structural Database" by K. Wheeler, and "Strategies for the Design and Assembly of Hydrogen-bonded Aggregates in the Solid State" by D. Chin, J.A. Zerkowski, J.C. MacDonald and G.M. Whitesides. From the back cover, the reader learns that the volume "surveys several areas of current research interest in the field of solid state chemistry", that the "volume introduces the non-specialist to the excitement that is inherent in this multidisciplinary field", and that the volume "is required reading for researchers seeking to expand into materials science". There is no preface, *per se*, written by the volume editor.

Collectively, the articles in this volume are good summaries of the subjects that they cover. As such they will be useful not only to students and other newcomers to the subject, but also to experienced researchers. Overall the volume would have been significantly improved by more careful proofreading by authors and better editing.

The article by Ulman is a detailed review of methods of surfactant assembly largely developed over the last decade that supplement and go beyond the Langmuir-Blodgett technique. These methods are extensively used in current research in nanotechnology. The methods include assemblies of organosilicon derivatives

that require hydroxylated surfaces, the adsorption of organosulfur(and -selenium) compounds on metal surfaces, and alkyl layers on silicon, and layers of diphosphates. The detailed discussions of the structural studies of these layers are a major asset of the article. The shortcomings begin with the title. Using the detailed terminology introduced by J.-M. Lehn(summarized in "Supramolecular Chemistry", VCH Verlagsgesellschaft, 1995, Chapter 9), the processes involved in formation of these layers are not self-assembly, but programmed assembly. Figure 1.9 and the associated discussion contain numerous spelling mistakes, incorrect citations, and incorrect labeling of molecular formulae; *e.g.*, "PO_8^{-2}" should be "PO_3^{-2}".

Swager's article on conjugated polymers begins with an elementary discussion of methods of polymer synthesis and a useful summary of coupling reactions using transition metal reagents and oxidative electrochemical polymerization. It follows with a strong discussion of the structure and properties of phenylene ethynylene, arylene vinylene, and arylene polymers. Applications in the areas of molecular recognition, catalysis, and sensors are discussed.

The article by Ramamurthy, *et al.*, is the longest in the book, 78 pages and 361 literature citations. It contains a strong overview of the structure and nature of zeolites, the nature of their reaction cavities, the location of guests (and its inhomogeneity) in cavities, zeolite acidity and basicity (Bronsted and Lewis) and ground state chemistry of adsorbed species, and the consequences of local electric fields for the electronic spectra, and hence photochemistry and photophysics, of adsorbed molecules. Many of the themes of molecular photochemistry(*e.g.*, heavy atoms effects, role of triplet energy in sensitization) are instructively revisited for the cases of the zeolites.

K. Wheeler's article on the Cambridge Structural Database(CSD) begins with a valuable introduction to the various kinds of information that can be obtained by different types of searches of CSD. It then proceeds with a discussion of crystallographic data with an appropriate emphasis on statistical aspects. It then follows with several examples using bond lengths and bond angles as well as nonbonded distances in discussions of crystal packing and properties. The discussion of hydrogen bonding has some degree of overlap with the final article in this volume. A significant problem with the article is found in the references where at least nine of the listings read as the author's reminders to himself to add the reference. An erratum should be published to correct this, and the author has advised me that he is attempting to do this.

The final article by G.M. Whitesides and collaborators is a strong review of the variety of hydrogen-bonded motifs that have been reported in recent years. Building on the pioneering work of Leiserowitz and Etter, a large array of crystal structures(including cocrystals) of hydrogen-bonded species is discussed with

emphasis on "rules" and selectivity. The cyanuric acid-melamine system, extensively investigated in their laboratories at Harvard, is discussed in detail due to the tape and rosette substructures that are formed. The article also includes a section on current computational methods for the prediction of crystal structures. The authors' conclusions(*e.g.* crystal growth as the rate-determining step in an investigation, the polymorphism problem) will be familiar to investigators in the field, but are nevertheless worth repeating.

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