

Chemistry International Symposium on the industrial applications of surfactants are reprinted.

The work is divided into several sections comprising an introduction, which gives a good review of the market for industrial surfactants for this decade, a section on innovation, which deals with surfactants and the environment and also with polymerisable surfactants and their applications. Sections on anionic, nonionic, cationic and amphoteric surfactants follow and there is a concluding section dealing with applications.

The topics are well chosen and give an informative overview of current developments and trends in surfactant chemistry ranging from showcase presentations of company specialities; comb copolymers, applications of linear alkylbenzene sulfonates; advances in the chemistry of ethoxylated ethanesulfonates; applications of *N*-acyl sarcosines, of 3-alkoxypropylamines, of 2-alkyl imidazolines, of sulfobetaines, for example; to reports on the synthesis of polymerisable surfactants and of alkylglycoside surfactants.

There are also chapters devoted to the use of chemicals in oilfield demulsification, to the discussion of food grade emulsifiers and to the applications of Diacid as a hydrotrope.

Each chapter has a useful list of references and the index is comprehensive enabling a non-specialist to decipher some if not all of the abbreviations that are used in this subject.

The purpose of symposia such as this one is for those attending the meeting to get the opportunity of meeting friends, colleagues and competitors, for specialists to exchange ideas informally over drinks, and for interested onlookers to get the feel of the way in which the subject is developing. No book can replace the excitement of meeting colleagues and being able to compare difficulties, problems and successes, but for those interested in the current state and future prospects of surfactants, this book will fill that need.

But, buyer beware. The editor appears to have done no editing. The text has been prepared directly from the type-written manuscripts of the talks. The appearance of the chapters ranges from excellent to exasperating. If the diagrams and figures represent the slides that were shown at the meeting, my sympathy goes out to the audience who had to cope with a wide variety of styles of chemical structures and some confusing chemical errors. In these days of computer aids for the representation of chemical structures, I expect structures to be elegantly and accurately drawn, especially in a book that is produced by the Royal Society of Chemistry.

The English of some of the chapters could have done with editing too. The success of an international symposium can be judged on the number of contributors it attracts from overseas and allowances are made for speakers who, out of courtesy to the host country, struggle with a foreign language at the time of the meeting, but I would expect an author's manuscript to be tidied up before submitting it for printing.

This book is a valuable source of information for anyone, whether specialist or novice, interested in an up-to-date review of the chemistry and applications of surfactants. However, the price is high for a book that appears to have been thrown together from speakers' manuscripts.

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**Introduction to Cluster Chemistry.** By D. M. P. Mingos and D. J. Wales. Prentice-Hall International Editions, Englewood Cliffs, 1990. Pp. xvi + 318. Price £19.95. ISBN 0-13-474305-9.

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There are special times in science when theory and experiment truly are in phase. Such episodes are infrequent, but

noteworthy, for then the synergy peaks and a true leap in what is known and what is understood follows. In inorganic chemistry one such nexus of experiment and theory took place in the early fifties, with the renaissance of crystal field theory. Another was accomplished a decade later by a single group, that of F. A. Cotton, establishing the metal-metal quadrupole bond. A third one is detailed in this lovely, rich book.

In the last 20 years a wonderful chemistry of cluster molecules has evolved. Just about every geometry conceivable has popped out of some pot, and there is no end to the beauty (built of equal measure of Platonic simplicity and of rococo complexity) of the clusters that chemists have wrought. The first and justifiably long chapter of the Mingos and Wales book is a travelogue through the cluster universe.

Coincident in time with this experimental explosion was the crafting of a theoretical framework for understanding the orbitals in general, and the magic electron counts for stability in particular, of main group and transition metal clusters. This theory evolved from the work of many, but its prime, independent builders were K. Wade and one of the authors of this book, D. M. P. Mingos. The theory is known by different names, but perhaps most commonly as the polyhedral skeletal electron pair theory. Mingos' work in the eighties provided a real explanatory and predictive theory of these clusters, just when the synthetic and structural work needed it. And the theory drew its inspiration in turn from experiment, expanding its scope to include capping and sharing of cluster faces.

'Introduction to Cluster Chemistry' gives us the first balanced experimental and theoretical introduction to the field. It is beautifully written cross between a monograph and textbook, readily accessible to an advanced undergraduate as well as the chemical outsider. Experimental examples abound and there are well chosen problems. Wonderful, informative 'boxes' provide brief excursions, relevant digressions one might call them, on topics as diverse as the synthesis of gold and platinum clusters, solid-state NMR, and the colours of various clusters. Clear drawings, so essential to seeing the clusters, are a strong point of the book.

A minor pedagogical complaint I have is that the authors chose not to derive the important simple electron counting rules for 'non-classical' (four-connected) clusters near the beginning, deferring that derivation until they introduce the tensor surface harmonic (TSH) theory. A mystery is created (for a while) and there is missed, I think, a chance to connect up to a theoretical framework familiar to many chemists, that of ordinary molecular orbital theory. I also have a slight reservation on the use of the TSH formalism. Mingos and Wales surely proceed at a gentle enough pace in introducing Stone's all-encompassing and powerful theory. In fact this book is the best place to learn TSH fundamentals. But it is my opinion that in the end the formalism maybe too complicated to be used with facility by the intelligent people who have made these incredible molecules and will make more. What is complex to one person is, of course, simple to another, and people do get smarter (in just a few ways; read the newspaper...). So my opinion is set up here to be knocked down.

The Mingos and Wales book stands as the only systematic introduction to a major, exciting subfield of chemistry. It documents and teaches, which so few books of our time do. 'Introduction to Cluster Chemistry' tells us a beautiful story of the interaction of theory and experiment, a story still in progress but already a high-point of 20th century inorganic chemistry.

Ronald Hoffmann

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