

groups and representations and its applications in describing the electronic structures of complex ions. Both of these chapters are very well written, especially the former, and the only minor criticism one might make of the latter is that the treatment of double groups is rather short. In the remaining chapters of this section, the methods of calculation of the splitting of the one electron  $d$  orbitals and of the term systems of multielectron ions in ligand fields of various symmetries are treated, using both the weak field and strong field models. This is followed by a further discussion of the molecular orbital method, much of which has already been covered in the first section, and by a treatment of spin orbit coupling and magnetic properties which, although rigorous and of the same high standard as the first three chapters in this section, is rather brief, dealing, as it does, with only the  $d^1$  configuration.

The third part of the book consists of appendices containing a very useful and extensive bibliography, standard results of matrix algebra, operators, and the like, and several character tables. The book is very well produced and the translator appears to have done an excellent job. In spite of the reservations I have mentioned, which arise principally from the division of the main text into two parts, this book can be recommended to those wishing to make a serious study of ligand field theory.

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## ACETYLENE CHEMISTRY

### Chemistry of Acetylenes

Edited by H. G. Viehe. Pp. xv + 1298. (Dekker: New York, 1969.) \$59.50.

EUROPEAN chemists have played an important part in the development of acetylene chemistry and, although this book is printed and published in the United States, the editor and twenty out of twenty-one contributors are European (though none is British). The dearth of British contributors is not to be construed as lack of interest: the Jones-Heilbron Imperial College school of the forties gave the subject considerable impetus and many who came directly or indirectly under its spell have continued to contribute to acetylene chemistry. Indeed, Professor Raphael, who writes the foreword, is a distinguished product of that school and has himself published a most useful critical guide to the field.

Complete coverage of the broad acres of acetylene chemistry is hardly to be expected but, by and large, the treatment is comprehensive. Major areas dealt with include synthesis by means of elimination and substitution, ionic and radical addition, coupling, partial hydrogenation, and propargylic rearrangement. Cyclic acetylenes, which Sondheimer has used to make entry into a new era of aromatic chemistry, and acetylenes as sources of cyclic compounds, are treated: so is the large subject of heterosubstituted acetylenes. Though not specifically included in the title, the chemistry frequently spills over into allenes and cumulenes, and this is both pleasing and unavoidable. A theoretical chapter by Johannes Dale, with its curvaceous diacetylenes, is a valuable contribution. It is especially noteworthy that use of the Linnett approach to bonding theory presents elegant and simple answers to certain problems in the acetylene field.

Although at the margins of the subject, dehydrobenzene and dehydrotetarenes receive fairly extensive coverage (135 pp.). This contrasts strikingly with the section "Acetylenes from Nature", summarily dismissed in ten pages. The chapter has merits as a brief account, but Bohlmann, well known as a most productive and energetic researcher, does not do real justice to either his own work or that of others. The section contains references to only seven original papers and some reviews. There is no mention of a great many interesting topics, old and new.

No specific section is devoted to industrial aspects of acetylene chemistry. The "heavier" side has had its moments of glory, as in the days of Reppe chemistry, but this was an era of distorted economics and the evolution of olefin based petrochemistry has sapped the profitability of many an attractive acetylene method.

The editor and his Continental colleagues are to be complimented on their courtesy in writing in English. Having paid this tribute, it must be recorded that there are authors whose constructions, while not being grossly wrong, jar a native English speaker. A good publisher's reader could set the matter right. This is a long book, but at \$59.50 the well worn comment of very high pricing is inevitable. This high price is especially disappointing because the book is not an esoteric reference work, but an influential text providing an imaginative organic chemist with many clues with which to break away from the vogue areas of the day. Professor Viehe's book is a landmark in the field of acetylene chemistry.

L. CROMBIE

## AIRBORNE PARTICLES

### Introduction to Experimental Aerobiology

Edited by Robert L. Dimmick and Ann B. Akers, in association with Robert J. Heckly and H. Wolohow. (Environmental Science and Technology: a Series of Texts and Monographs.) Pp. xvii + 494. (Wiley (Interscience): New York and London, February 1970.) 225s.

AEROBIOLOGY, or more correctly aero-microbiology, is the study of what happens to microbes while they are becoming airborne, are moving and diffusing in the wind, or depositing from calm or moving air. Thirty years ago the study forked into two branches. Extramural aerobiology concerns plant pathologists, respiratory allergists and ecologists; its microbes are mostly structurally adapted to the risks and advantages of airborne dissemination—suspensions of intrinsically hardy microbes whose dilution by eddy diffusion overshadows dilution by death. By contrast, intramural aerobiology is chiefly concerned with relatively tender pathogens which become airborne when atomized from suspensions, or when coughed, sneezed or desquamated. These microbes can be dangerous in indoor hygiene, hospital cross-infection or bacteriological warfare; their viability, survival and retention of infectivity are of great importance.

Both branches share common problems imposed by behaviour of small particles in suspension and by techniques necessary for their study, but intramural aerobiology is the more difficult discipline. Its subjects have exacting requirements if they are to be made airborne experimentally, they are not readily enumerated, many need special media (or must be detected by animal inoculation or inhalation), they often impose a health hazard for workers handling them and so demand exacting precautions with an array of special microbiological techniques.

At long last, an account of these techniques and some of their applications has been given in an authoritative and readable book by a group of workers who are mostly centred around the editors at the Naval Biological Laboratory, Oakland, California.

Part one deals first with fundamental mechanics of aerosol behaviour (an aerosol for the purposes of aerobiology being a collection of particles temporarily suspended in air, and normally less than 100  $\mu\text{m}$  in diameter). It then discusses methods of producing artificial aerosols with which to experiment, methods of sampling air and assaying its microbial content, and the bioassay of atmospheric pollution. A special chapter is devoted to the insufficiently known effects of atmospheric ions on aerosols.

Part two deals with the three principal tools of experi-