

Metodi Di Separazione Nella Chimica Inorganica. MICHAEL LEDERER, Editor. Consiglio Nazionale Delle Ricerche, Rome, Italy. Vol. 1. 1963. 260 pp. 18 × 25.5 cm. Price, \$12.00.

This book, the first of two volumes, is a collection of some of the lectures given in Rome at a postgraduate summer school course in chemistry. The course was held in September, 1962 and was sponsored by the National Research Council of Italy and the F. Giordani Foundation.

The book contains ten chapters written in four different languages. Four chapters are in Italian, three in English, two in French, and one in German. The different languages cause a minimum of difficulty because each chapter is well written and very well illustrated. The most important contribution of this volume is that it focuses attention on the application of modern separation methods to inorganic systems. The theoretical basis, the useful applications, and the limitations of each technique are presented in a readable fashion by experts in the field. A total of 450 references are given which can be most helpful to one who wants more detailed information on a particular topic.

The topics, the authors, the language, and the number of pages are listed here and a brief comment is made to indicate the content of each chapter. "Liquid-Liquid Extraction" by H. Irving and R. J. P. Williams is in Italian, 50 pages. This is an excellent review of the theory and technique of separations by liquid-liquid extraction methods. The chapter is largely a translation of a chapter written by the same authors in "Treatise on Analytical Chemistry," Vol. I, Interscience, New York, N. Y., 1961. "Liquid Ionic Exchangers" by E. Cerrai is in Italian, 26 pages. This describes the separations of metal ions on inert supports impregnated with anionic and cationic liquid exchangers. "Adsorption Chromatography in Inorganic Chemistry" by L. Sacconi is in Italian, 20 pages. Most of the discussion deals with the properties and applications of alumina. "The Adsorption of Inorganic Substances on Paper" by M. Lederer, is in English, 8 pages. Examples are given of specific systems that show changes in R_f values with changes in solvent and added HCl or LiCl. "Chromatographic Separations on Paper Impregnated with Synthetic Inorganic Exchangers" by G. Alberti is in Italian, 12 pages. Examples are given of separations on paper impregnated with zirconium phosphate and with ammonium phosphomolybdate. "Gas-Liquid Chromatography" by A. T. James is in English, 2 pages. This is an abstract and has no references. "High-Voltage Electrophoresis in Inorganic Chemistry" by D. Grass is in English, 10 pages. The apparatus and technique are described in some detail. "Chromatography and Complex Chemistry" by E. Blasius is in German, 58 pages. This is a very complete treatment providing also details of the author's research on the halogeno and mixed halogeno complexes of the platinum metals. "Chromatography of the Condensed Phosphates and Other Polyanions" by J. P. Ebel is in French, 50 pages. Only a very short survey, 2 pages, is given of the other iso- and hetero-polyanions. "Radiochromatography in the Gas Phase" by J. P. Adloff is in French, 9 pages. The techniques and applications are described and several figures are shown of the apparatus used.

The printing in the book, on glossy paper, is excellent. Its illustrations are good and it has relatively few typographical errors. This is a valuable reference book on inorganic separations, which with the next volume promised should provide a fairly complete treatise on the subject.

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Physical Adsorption of Gases. By D. M. YOUNG, Research Department, Dow Chemical of Canada, Limited, and A. D. CROWELL, Professor of Physics, University of Vermont. Butterworth, Inc., 7235 Wisconsin Avenue, Washington 14, D. C. 1962. 426 pp. 14 × 22 cm. Price, \$13.00.

In 1945, "The Adsorption of Gases and Vapors," by Brunauer, was published. His book, which was Volume I of a projected set, was devoted to physical adsorption. The book under review is an overdue replacement for Brunauer's valuable work. Many of the questions left unanswered in the earlier work have now been solved, and the new book appears to give a definitive treatment of the subject.

The authors have found a reasonable balance between an exhaustive literature survey and a readable treatment that can be used profitably without having to look up the original papers. They appear not only to have read, but understood the large number of papers that they have chosen to digest in whole or part. The book is rich in useful figures and tables.

On the whole, they have chosen a logical scheme of presentation. A chapter on intermolecular forces, with specific emphasis on forces at a surface, is adequate, although necessarily fragmentary. A proper consideration of the fundamentals of this subject would involve considerably more molecular quantum

mechanics than is appropriate in a book of this type, and would take the reader far afield from the specific topic of surfaces. The next chapter presents a consistent account of the thermodynamics of adsorption. The vexed subject of the relationship of pure thermodynamic results to particular molecular models is now at least well-aired and the authors treat this problem thoroughly.

In the next two chapters the authors take up specific adsorption isotherms. A random sampling shows that the treatment of the Hüttig isotherm is correct, although somewhat less severe than the reviewer would have liked. On the other hand, the treatment of the Volmer isotherm, although not incorrect, fails to expose the exact nature of the approximation that makes it inapplicable at high coverages. The authors imply that a comparison between it and the Langmuir equation is valid near $\theta = 1$, which is certainly wrong.

It is perhaps wise to have a separate chapter on surface area estimation, although the subject is inextricably mixed up with isotherm equations or thermodynamics. This arrangement is probably justified, however, because of the large number of readers who will be concerned almost solely with this chapter. A chapter follows on the measurement of isotherms.

Although there is a chapter on the properties of the adsorbed layers, these and related topics are relatively slighted in the book. Noticeably absent are the sorts of things that physicists and what may be called vacuum engineers study in the range of very low pressures and temperatures. Perhaps this omission arises from the arbitrary line that is drawn between physical and chemical adsorption. Certainly, Becker's study of the intermediate state that precedes the chemisorption of gases on tungsten would be relevant to the material in this book.

In sum, the book is very good, and should certainly become the standard work in this area for years to come.

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Mass Spectral Correlations. By FRED W. McLAFFERTY. Eastern Research Laboratory, Dow Chemical Company, Framingham, Mass. American Chemical Society, Applied Publications, 1155 Sixteenth Street, N.W., Washington 6, D. C. 1963. 117 pp. 15.5 × 23.5 cm. Price, \$4.75.

This book consists of a tabulation (85 pages, preceded by a 13-page introduction) listing the most intense peaks in the approximately 4000 mass spectra (a collection larger than any other one publicly available at the present time) existing in the files of the Dow Chemical Company and of those spectra that have appeared in the literature prior to 1960. The three or five most intense peaks are listed up to mass 200, while peaks down to the tenth most abundant are listed up to mass 400.

The table lists first the mass of the ion, the empirical formula assigned to it, the structural characteristics of the compounds in whose spectrum it appeared, and finally the number of spectra (in that particular collection) in which it was found to be the most intense peak, or the second or the third one, etc. From these tabulations one can conclude in which type of compound a peak at a certain mass would be a very significant one.

The table thus aids in the identification of important peaks in a mass spectrum. For example, if one encounters an intense peak at m/e 74, one finds that such a fragment is easily formed from methyl esters, α -methyl carboxylic acids, or amino alcohols; that m/e 31 is most probably due to primary alcohols, ethers, or fluorocarbons; that m/e 95 and 105 are indicative of furates and benzoates, respectively; and that m/e 149 is formed from phthalates, to mention only a few. Obviously, many different but related compounds give rise to a peak at a certain mass, and their higher (or lower) homologs will lead to peaks 14 m/e higher (or lower). This is indicated by "etc.," suggesting to the user to search also up and down the homologous series to find other possibilities.

Because of the origin of the table, one is, of course, not guaranteed to find for each peak in question the correct answer, as this depends on the occurrence of this particular compound type in the Dow collection. In such a case it is important that the user realizes this fact and starts thinking of other possibilities not listed. Sometimes the suggestions in the book may lead him at least on the right track. For example, at mass 89 there is listed the group $C_3H_7SCH_2$, but not $C_2H_5SCH(CH_3)$. This should not imply that the latter group does not give rise to an intense peak at mass 89 (it is, in fact, the most intense peak of ethyl (2-butyl) sulfide) but only that this particular type of compounds is not represented in the Dow collection and thus also not mentioned in the tables (even not indicated by "etc.").

The book will be most useful to those who are using mass spectrometry only occasionally and are therefore not very familiar with the interpretation of mass spectra. The more experienced mass spectrometrist may sometimes get a clue if faced with a spectrum of a compound type he has not previously encountered

but happens to be represented in the Dow collection. It is important to keep in mind that the "Mass Spectral Correlations" are meant to be a source of suggestions rather than a foolproof guide to the interpretation of mass spectra in general.

The number of peaks listed at higher mass decreases rapidly and above mass 200 the selection becomes meager (with the exception of hydrocarbons and halogenated substances), another consequence of restricting the data mainly to the spectra of the Dow collection (only few spectra of larger molecules had been published prior to 1959). The usefulness of the book will, therefore, decrease as a molecule becomes more complex, and it will not provide many clues in the case of substances with two or more different functional groups and molecular weight above 250, except, perhaps the recognition of an acetyl or benzoyl group because of the presence of an intense peak at m/e 43 or 105, respectively.

The approach on which this book is based is an interesting experiment and its success "in the field" as a guide for the beginner will indicate whether its usefulness can be extended to more complex molecules by addition of more data (in a future edition), particularly in the higher mass range. The very moderate price of the booklet will assure its wide distribution, a prerequisite for such an experiment.

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Thin Film Chromatography. By E. VERNON TRUTER, Ph.D., B.Sc., A.R.C.S., D.I.C., Lecturer in Textile Chemistry, University of Leeds, England. Interscience Publishers, John Wiley and Sons, Inc., 605 Third Avenue, New York 16, N. Y. 1963. 205 pp. 14 × 22 cm. Price, \$7.00

This presentation is for those who are new to the field. Details are given for the preparation of the plates, development, and location of the spots. The author points out the advantages of the method as well as indicating those places where caution is needed.

The book is divided into three sections. In the first section the basic principles and methods are described in detail explaining the various factors that can affect the results. The second section is devoted to special techniques and developments that may be useful where the normal development fails to give separations. Thin-layer ionophoresis and partition chromatography are also described as well as quantitative methods which are yet few in number in this field. Part III delves into groups of specific types of compounds with the author presenting brief literature reviews of some of the work that has been done in thin-layer chromatography on the following: amines, amino acids, drugs and alkaloids, indole derivatives and metabolites, insecticides, lipids, nucleotides and related compounds, phenols, steroids, carbohydrates and glucosides, vitamins, organometallics, inorganic ions, and other miscellaneous compounds.

It is an introduction to a rapidly expanding technique and would be useful to those who wish to try the method in their work.

THE COCA-COLA COMPANY
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J. G. KIRCHNER

Diffusion and Membrane Technology. By SIDNEY B. TUWINER, Professional Engineer and Consultant, Technical Director, Markite Development Corporation. Sections by LAWRENCE P. MILLER, Boyce Thompson Institute, and W. E. BROWN, Dow Chemical Company. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1963. 421 pp. 16 × 23.5 cm. Price, \$12.00.

Dr. Sidney B. Tuwiner must be a very practical man. Certainly his book follows this philosophy with membranes of commercial importance receiving most attention. Furthermore, its timeliness is attested to by the growing technical importance of membranes for fuel cells, water purification, biological separation and detection, and many other diverse applications.

Essentially, this book is limited to nonporous organic membranes, where porous is defined as that condition which permits hydrodynamic flow under a pressure gradient. A very strong point is made that diffusion through nonporous membranes "is fundamentally no different from diffusion in liquids," and several early chapters are devoted to this subject. The chapter on "Thermodynamics of Membranes" allows the author to introduce ion-selective transport, osmosis, and the Donnan membrane equilibrium, and with this background he can then proceed to report on the properties of natural and synthetic membranes. Covered in detail are experimental results on brackish water clean-up and use of dialysis in electrolytic copper refining, an area of particular interest to Dr. Tuwiner.

Two chapters which illustrate the author at his best are the ones on "Cellulose Membranes" and "Synthetic Resin Mem-

branes." On the other hand, it is unfortunate that Dr. Tuwiner has chosen to cover "Permeation of Membranes by Gases and Vapors" (co-authored with W. E. Brown) and "Natural Membranes" (written by Lawrence P. Miller), for both sections combined make up little more than 10% of the book. Their presence here should not discourage authors from treating these areas more extensively.

Included in the book is a 30-page appendix giving diffusion data for various organic and aqueous systems, plus cation-transfer numbers and activity coefficients for a wide variety of electrolytes. This is in addition to an equally copious amount of data compiled from the literature and included with the text.

The book is not written to hold the disinterested reader, and frequently contains terms and units which should be explained to the uninitiated. However, for those seriously interested in ion-membrane technology, this book will be a valuable reference.

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Molecular Vib-Rotors. The Theory and Interpretation of High Resolution Infrared Spectra. By HARRY C. ALLEN, JR., National Bureau of Standards, Washington, D. C., and PAUL C. CROSS, Mellon Institute, Pittsburgh, Pennsylvania. John Wiley and Sons, Inc., 605 Third Avenue, New York 16, N. Y. 1963. 324 pp. 18.5 × 26.5 cm. Price, \$13.50.

This monograph gives an introduction to the theory and interpretation of high resolution infrared spectra of polyatomic molecules. At the outset, it should be emphasized that the authors have performed a commendable task in providing an excellent resumé of some of the basic theories required for the interpretation of vibration-rotation spectra observed in the infrared. Their attempt, in bringing together the diverse notations and presenting the derivations with as much completeness as possible, will be extremely helpful to the beginners in this field. Furthermore, they have summarized very clearly their experiences in interpreting infrared spectra, especially those pertaining to the asymmetric-rotor bands.

It is, indeed, true that the study of molecular spectra is one of the most effective means of obtaining information pertaining to the structures of polyatomic molecules. Especially, the observations obtained in infrared enable us to evaluate the structural parameters of polyatomic molecules with a very high degree of precision. Therefore, the sections devoted by the authors for elucidating the methods of determining the molecular parameters from infrared data are entirely pertinent.

Since the termination of the Second World War, there have been phenomenal advances made in the attainment of high resolving power in the near infrared region of the electromagnetic spectrum, particularly because of the availability of highly sensitive photoconductive detectors. These instrumental advances made it necessary to devise adequate techniques for determining the spectral positions of the rotational lines observed in vibration-rotation bands, with as high precision as possible. During the past decade, high resolution combined with precision of measurements enabled the observation, in infrared, of numerous interesting aspects relating to the effect of perturbations in polyatomic molecules. So far as this study of perturbations is concerned, it is unlikely that the data obtained in any other spectral region can provide the unique type of information available from observations of infrared spectra. This monograph is somewhat deficient in pointing to the importance of recently published results on these perturbations, particularly those relating to some of the linear and symmetric top molecules. The bibliography furnished by the authors and the topics included by them are very selective and are not intended to be complete. As a result, a good segment of theoretical work developed for the interpretation of certain aspects of infrared spectra was omitted. For instance, the extensive research work pursued at the University of Paris and published in various scientific journals is related to such theoretical studies and does not form part of this monograph. Also, the recent work pertaining to resonances in the pyramidal-type molecules was omitted; it seems that these results are just as relevant to the subject as the other aspects dealt with by the authors on the analysis of symmetric-rotor spectra. Apparently, the authors considered such investigations to be esoteric extensions of the theory with somewhat ponderous notations in them. To this reviewer, it appears that this is just the reason why it would have been extremely helpful to have available a good summary of these specialized studies since much of future work will undoubtedly relate to them. Although a research investigator can benefit immensely from the vast information summarized by the authors, provision of at least a complete list of references to what the authors considered as "specialized investigations" could have proved invaluable.

The authors have rightly alluded to the studies of the pure rotational spectra observed in the microwave region, and in-