

Structural Methods in Molecular Inorganic Chemistry

The book on hand is a new edition of *Structural Methods in Inorganic Chemistry*, originally by Ebsworth, Rankin, and Cradock, which was first published in 1987 by Blackwell Science. Since then, a lot has changed in the field of structural inorganic chemistry, and therefore the title of the book has also been changed, with the focus on molecular inorganic chemistry. Thus, structure elucidation techniques belonging to the study of “materials chemistry” are not included, and this is also clearly stated by the authors of the present edition, D. W. H. Rankin, Norbert Mitzel, and Carole Morrison. The book aims to provide the reader with all the necessary knowledge and tools for the interpretation of results from measurements. Therefore, the in-depth theoretical introductions that were included at the beginning of each chapter of the earlier book *Structural Methods in Inorganic Chemistry* have been omitted, and instead the reader is referred to the literature cited at the end of each chapter.

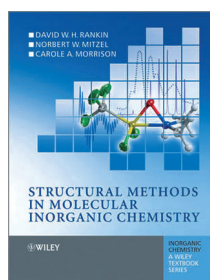
The scientific language used in the book is excellent. In almost all cases, terms such as “signal”, “band”, “peak”, and “reflex”, which describe the type of measurement, are strictly defined and used consistently. However, the terms “structure” and “geometry” are used only in the sense of chemists’ jargon. The writing of point and space groups varies inconsistently throughout the book. On the plus side, the work contains many well done and clearly presented pictures and figures. The use of color in a few places would have not only clarified the figures but also brightened the whole book. To distinguish between four or five different atom types and to recognize HOMO and LUMO orbitals in the gray shades that are used is a virtually impossible task for the reader. Dear publisher, this was certainly not the way the authors meant it to be!

The book provides students with an easy first access to the techniques of structure elucidation. After a historical introduction and a description of the theoretical and quantum-chemical background, the methods of NMR, EPR, Mössbauer, rotational and vibrational, UV/Vis, and photoelectron spectroscopies are discussed in detail, chapter by chapter. The scope of the book is further broadened by the chapters on diffraction methods (using electrons, neutrons, and X-radiation) and on mass spectrometry. The final chapter, “Case Histories”, describes real-life examples, showing how the above methods are used, but also pointing out their shortcomings. In this way, one gets a good overall impression of the strengths and weaknesses

of each method. Each chapter ends with a list of literature references; unfortunately these contain a few typos. A very positive aspect of the book is that it does not glamorize the modern methods as universal remedies or “magic bullets”, but instead frequently reminds the reader that there also exist the traditional methods of qualitative and quantitative chemical analysis and the evidence from the stoichiometry—only this, the authors insist, allows a complete evaluation, interpretation, and final conclusion from the results of measurements. Every chapter deals with methods for analyzing gaseous, liquid, and solid samples, and the differences according to the physical state are described in detail (e.g., by comparing liquid-state and solid-state NMR spectroscopies). The chapter on vibrational spectroscopy not only describes conventional IR and ATR-IR spectroscopies and different types of Raman experiments, but also covers related techniques using neutron or electron radiation. The chapter is completed by an introduction to group theory, band assignment, and qualitative and quantitative spectra analysis for the practical chemist.

Another chapter to serve as an example is the one that reviews diffraction methods. After a short and felicitous introduction to the different diffraction properties of electrons, neutrons, and X-radiation, the applications of X-ray diffraction are described in detail for gases and solids (single crystals and powders), and relatively briefly for liquids. Here, a reader who already has some knowledge of X-ray diffraction on single crystals will notice some small inconsistencies, which might be the result of the necessary simplification for the novice. For example, only 7 of the 11 Laue classes are mentioned. In a table that lists axes and angles for the triclinic and monoclinic crystal systems, where the axes are described as “not equal” and written as “ \neq ”, the description “arbitrary” would have been better. In the “review questions”, which are an illustrative part of each chapter of the book, one finds the incorrect expression $Pa\bar{3}$ (instead of $Pa\bar{3}$) for the space group type 205. However, then the correct symbol $\bar{3}$ is used for the symmetry of the Wyckoff position. I especially liked the discussion in the chapter “How good is a structure?”. There the authors clearly explain how treacherous the usual quality criteria can be, and how easily a crystallographic difficulty can be overlooked. The chapter also discusses modern developments such as the determination of electron densities from single-crystal data, and the Rietveld refinement for powders, thus conveying an excellent impression of the diversity of available methods.

Especially nice is the collection of “Case Histories”, already mentioned as the last chapter of the book. The examples (compounds, spectra, structures) are instructively chosen, and contain classics such as the structure of XeF_6 , as well as



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more recent results (up to and including 2012). The chapter shows how important it is to collect complementary information by a variety of methods to get a “holistic” picture of a chemical compound, but also points out that sometimes not all the questions can be answered.

In summary, with this book the authors have succeeded in giving a really good fundamental introduction to the different methods of structural characterization of chemical compounds in inorganic molecular chemistry. In my opinion, the book is well suited for students, as well as for the experienced practitioner who needs to refresh his

or her knowledge of a method not recently used, without the need to go too much into theoretical detail. The reader obtains a complete description and explanation of every method of structural characterization—this is a book for those who need to apply the techniques. I recommend this book wholeheartedly.

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