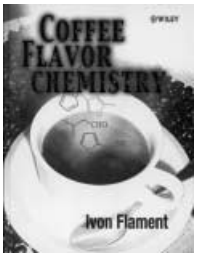
Spilling the Beans

Coffee Flavor Chemistry. By *Ivon Flament*. John Wiley & Sons Inc., New York 2002. 410 pp., hardcover £ 125.00.—ISBN 0-471-72038-0

Of all the food and drink products, coffee undoubtedly heads the list with regard to the number of aroma and flavor substances that have been identified. The subject of coffee aroma has been studied for many years (from the 19th century, through work by Payen and others). Some early groundbreaking investigations were published by Reichstein and Staudinger in 1926. The subject has been returned to sporadically again and again, for example, by research groups led by Tressl (ca. 1980), Vitzhum, Steinhart, and Holscher (up to the end of the 1990s), to name only a few.



This book is concerned with aroma substances in both raw and roasted coffee. Currently there are about 850 known volatile constituents in roasted coffee, and about 300 in raw coffee. The book consists of five chapters. A short introduction outlines the history of coffee, describes the main constituents, and lists some important books and review articles on coffee (which the reader will find very useful). Chapter 2 is devoted to raw coffee. The most important groups of nonvolatile constituents (alkaloids, trigonelline, proteins and amino acids, carbohydrates, fats, chlorogenic acids) and volatile constituents are described briefly. Chapter 3 ("From the Raw Coffee Bean to Roasted Coffee") gives a short description of the Strecker breakdown process and the Maillard reaction, which are the most important processes that produce the volatile aroma constituents in roasted coffee. The author does not attempt to describe in detail the mechanisms involved. The most important modern methods for physical and chemical characterization (including sensor devices) are described, and different approaches to evaluating aroma constituents (e.g., dilution analysis of aroma extracts, the CHARM system, OSME) are discussed. This chapter also contains a summary of results on the most potent aroma substances in coffee from the research group led by Grosch. Chapter 4 describes the history of coffee aroma research, from its beginnings (around 1800) to the present. To give an idea of where the main emphasis lies in this book, these four chapters occupy only about 80 pages, whereas Chapter 5 consists of about 260 pages.

Chapter 5, the main part of the book, lists every compound identified up to now, giving the structural formula, information about its discovery and the group reporting it, its properties, relevant sensor technology, quantity, and mechanism by which it is formed (chemical synthesis, formation during roasting). The CAS Registry number is always given, and the FEMA number if available. The compilation is arranged according to compound types, beginning with hydrocarbons and ending with sulfur-containing compounds. The method of classification by compound types is appropriate and useful.

Some errors and omissions are inevitable in a work of this kind, but those that I found are relatively few and not very serious. Two examples are mentioned here. On page 292 it is stated that pyridine has only been determined quantitatively by one research group; in fact there are at least two other publications reporting concentrations (which are in a similar order of magnitude to the first). On page 229, where 5-(hydroxymethyl)furan-2-carbaldehyde (HMF) is mentioned, no data on concentration are given, despite the fact that a value of about 350 mg/kg in coffee has been detemined. However, these are really only slight shortcomings which do not detract from the usefulness of the compilation.

The keyword index is very useful. For example, under "organoleptic properties … green coffee" the index lists a large number of sub-categories such as "chicory", leading one to individual constituents that have that aroma. The literature coverage is very comprehensive and up-to-date, with over 1300 references extending to 48 pages. The book is of outstanding quality in its factual content, and is essential for everyone working in the area of coffee aroma and flavor or needing information about the subject.

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Structure and Bonding in Crystalline Materials. By *Gregory S. Rohrer*. Cambridge University Press, Cambridge 2000. 539 pp., softcover £ 29.95.—ISBN 0-521-66379-2

This textbook of about 540 pages presents an approach to the subject of structure and bonding in crystalline solids. My choice of the word "approach" is intentional, because if it were not already obvious that such an enormous subject could not be covered exhaustively in a book of this size, that

certainly becomes clear on reading it. To attempt to cover the entire subject would be like trying to square the circle. Nevertheless, Gregory Rohrer has done a very good job here, despite a few weaknesses that one can expect in a first edition.

The contents are based on a lecture series for graduate students in the department of Materials Science and Engineering at Carnegie Mellon University, which the author gives as a one-semester course of 52 lecture units. In his preface he explains that his intention was to bring together the essentials of the available specialist books on crystallography, solid-state physics, and structural inorganic chemistry, in a form that would be useful for students. He certainly did not set out to provide a substitute for those works, and indeed he uses them by recommending appropriate parts of them for further reading and additional study.

There are ten chapters, beginning with an introduction to elementary principles and concepts, including the main trends in the Periodic System. This is followed by three chapters on the fundamentals of crystallography. Starting with the Bravais lattice, the various space groups are described, then the basic structural elements (molecular packing, the filling of interstitial lattice sites, classification schemes, etc.) are explained, and various key structural types are described.

After an introduction to diffraction methods for studying periodic structures, there are four chapters on different types of bonding in crystals, beginning (unusually) with a description of the weaker, so-called secondary, interactions. Ionic, metallic, and covalent bonding types are then treated in turn. These chapters on bonding in solids all follow the same pattern, beginning with phenomenological considerations, then presenting a physical model, with a description of the quantities that can, where possible, be measured. The final chapter is devoted to structure prediction. The book is completed by an appendix listing data relating to the individual chapters (space groups, atomic form factors, ionic radii, and other crystallographic data).

At the end of each chapter there are exercise problems (ranging from 10 to 30 in number, and varying widely in level of difficulty), to provide practice, extend the student's knowledge, and reinforce understanding. There is also a list of references naming sources for further reading which are also mentioned in the main text. A very useful feature is that page numbers in the secondary literature are given, thus avoiding the need for laborious searching in the sources.

Some of the figures could certainly be improved by further editorial work. Better typesetting and a uniform typeface would bring an improvement. The graphs would benefit from a consistent layout, and in many cases one can see that a diagram has been reproduced from a draft with poor resolution. Unfortunately the usefulness of the book as a reference source is limited by the fact that the index is much too brief. It would certainly have been better to provide a separate index of crystal structures, and to greatly extend the subject index. However, neither this nor the aesthetic defects of the typography are very serious drawbacks, and they could be remedied in a future edition without too much extra work. Also, where calculations of the stability of structures are given in the chapters on bonding types, it would be possible to treat the concept of electronic structure in slightly greater detail than here. The treatment given here is not entirely up-to-date and does not take account of the most recent research results. Especially with regard to the last chapter, modern quantum-theoretical methods now appear to have provided a solid basis for the earlier purely phenomenological concepts of Miedema and others, and have even led to a further extension of those ideas. Such concepts are indispensable for a proper understanding of some aspects, especially in the development of new materials.

However, the book provides the reader with the basic fundamentals and much information. As the author explains, the contents are derived from a dozen or so other very good books (in which the topics are probably treated in much greater detail), but his book has the advantage of bringing together within it the main essentials of the structure of solids, with detailed references to the sources, and that is where its main strength lies. The well set out didactic presentation of the individual chapters should prove very suitable for students, and will also provide teachers with a good overview of the material to be covered. Furthermore, experienced researchers too will benefit from the considerable amount of structural data included, and the numerous tables and panels within the main text and in the appendix listing physical quantities. Therefore, the book can be recommended for everyone concerned with crystalline solids in the broadest sense, as a useful compendium and handbook of long-lasting value.

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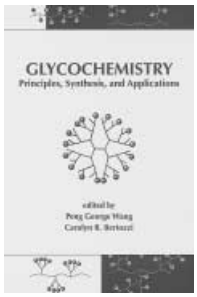
Glycochemistry. Principles, Synthesis, and Applications. Edited by *Peng George Wang* and *Carolyn R. Bertozzi*. Marcel Dekker, New York 2001. 682 pp., hardcover $ 195.00.—ISBN 0-8247-0538-6

The appearance of this 682-page monograph raises high expectations. It aims to give a comprehensive overview of the broad field of modern glycochemistry within a single volume, and to provide an up-to-date literature survey covering the latest developments in the field. We must now consider whether the contributing authors have succeeded in that task.



As the subtitle implies, the articles are arranged in three main sections. The first section consists of six chapters dealing with the chemical synthesis of complex oligosaccharides. In the preface the editors of the monograph state that this section contains a group of comprehensive articles forming a logical sequence. It seems to me that although each individual chapter merits that description, the section as a whole does not fully achieve the stated aim for the enormous subject of oligosaccharide synthesis. In the first chapter (32 pp., 71 references) Peter Seeberger gives a detailed and up-to-date survey of the latest develop-

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