

Media Reviews

Synthesis and Technique in Inorganic Chemistry 3rd Edition. By Gregory S. Girolami, Thomas B. Rauchfuss, and Robert J. Angelici. University Science Books: Sausalito, CA, 1999. 242 pp. \$42.00. ISBN 0-935702-48-2.

This third edition of Angelici's original fine collection of inorganic experiments suitable for the undergraduate lab has been comprehensively updated by the present authors. The second edition appeared some time ago (1977—frighteningly long ago now I come to think of it! Most of the student readers were not born then!) and although it still has an important place on my bookshelf, the revised version will soon edge it out. A few of the earlier experiments have been retained, but there are many new ones to add a broader perspective of the inorganic discipline as it stands today.

The book's style is much the same as that of the successful earlier edition. I particularly like the extensive set of references at the end of each experiment, along with a brief description of the content. There is also a section of independent-study suggestions so that substantial projects can grow from a modest synthesis. An approximate total time is given for each experiment and it is refreshing to see that chemistry happens in blocks of time longer, or shorter, than three hours! In my opinion, this makes the book an invaluable compendium of recipes for instructors running a laboratory course.

The authors, however, have clearly written the textbook for the student to read, and indeed the subtitle defines it as "A Laboratory Manual." There are the usual sections on how to keep a notebook, and the dos and don'ts of laboratory work. It is all sound stuff, but is it there for the lawyers to read? Surely the students will already be familiar with most of this? Perhaps the following comments reflect that the system in which I teach is dissimilar from the U.S. system. I find the explanations for the various spectroscopic techniques are written at a level below those written for the associated experiment. Let me give an example: a well-written, but very basic explanation of mass spectrometry is given in the experiment describing a relatively advanced synthesis of dodecacarbonyltriiron. A similarly basic treatment of NMR is given with the synthesis of chlorotribenzyltin, whereas a thorough explanation of the effect of ^{117}Sn and ^{119}Sn satellites might suffice for a student already expected to be using NMR as a characterization tool on such a compound.

Another reason why this book is perhaps a better resource than a manual is the recipe style in which each experiment is presented. In the tin example mentioned above, the questions posed for the report ask why the methylene protons differ in shift from the phenyl protons. Perhaps we should be encouraging the student to compare the spectrum of the product with that of the starting material as might be the case in an exercise focusing away from the verification style of learning. The scale of each reaction is also strikingly large for today's standards of "green chemistry."

But these are small points, and the instructor can easily override this influence of the book as a laboratory manual. There is something for everyone here, and a wide range of abilities and techniques can be addressed by selecting a handful of experiments from the twenty three discussed. I particularly liked some of the choices: nickelocene as a refreshing change from ferrocene; molybdenum acetate rather

than the chromium analogue; the YBC 1-2-3 experiment is very well-written. Interested in an experiment on magnetic susceptibility? Read the instructor's notes for the experiment on $\text{Mn}(\text{acac})_3$. If you haven't bought a balance from John Matthey (sic) then do so. It makes life so much easier!

In addition to the instructors' notes, there are selected spectra in the appendix. The inclusion of mass spectra must be well-received by readers in institutions not endowed with such an instrument. I would encourage the authors to add the nonstandard (i.e., not proton and carbon) NMR spectra to the next edition and group them with the experiment rather than in an appendix. The rest of the appendices, containing all sorts of useful information, were a great addition to the first edition (1969).

As one might expect, 22 years have seen changes in many safety issues. Happily, the authors now choose toluene over benzene, and chloroform over carbon tetrachloride. I was a little disappointed to still find perchloric acid used in a teaching laboratory, but suitably dire warnings advise the reader of the hazards.

The book is very well-presented and I noted very few typos. More importantly, the chemistry is totally trustworthy as it is written by well-respected practitioners. At a reasonable price, this is good value for the money and well worth the trip out of the lab to the bookstore!

P.S. Can the University of Illinois really afford to teach students how to make a Nujol mull using iridium compounds?

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Ullmann's Encyclopedia of Industrial Chemistry 5th Edition. First International Edition in English, Wolfgang Gerhartz, Gail Schulz, et al., *Editors*; 37 volumes, 18.0 × 25.5 cm., 1985-1996; \$ 14,100, DM 20,720, £ 7,045, ISBN 3-527-20100-9; 6th Edition; Networkable CD-ROM, Annual Releases (each containing the most recent version of the complete encyclopedia), Thomas Kellersohn, Barbara Elvers, Stephen Hawkins, and Ulrike Winter, *Editors*; \$1,150, DM 1,980, £ 615, ISSN 1435-6007 (ISSN indicates that Ullmann's has evolved from a book set to a periodical). John Wiley & Sons: 605 Third Ave., New York, NY 10158, telephone: 1-800-225-5945, FAX: 1-212-850-8888; Wiley-VCH: P.O. Box 10 11 61, D-69451 Weinheim, Germany, FAX: +49 (0) 6201 606 184, email: sales-books@wiley-vch.de. The prices quoted above are valid for continuation orders and assume that the customer already owns the Fifth Edition or equivalent. For further information and prices for new customers, check the Website: <http://www.wiley-vch.de/home/ullmanns>.

Sometime between 1905 and 1913 a German organic chemist in his thirties, who had introduced dimethyl sulfate as an alkylating agent (1900) and finely divided copper as a catalyst (1901) and who was serving as assistant, docent, and then professor at the Technologisch-chemisches Institut (Technological-Chemical Institute) of the Technische Hochschule Berlin (Berlin Technical University), conceived the idea of creating an encyclopedia of industrial chemistry. From this institute, to which numerous inquiries and

controversial issues from all fields of applied chemistry were directed, he was in an ideal position to survey the advances and needs of industrial chemistry. The rapid development and expansion of industrial chemistry and the application of scientific and chemical methods to older branches of handicraft and trade such as tanning, baking, and fabrication of glass, paper, soap, glue, and other industrial products had resulted in a growing need for a comprehensive reference book dealing with the entire field of technical chemistry. The name of the young German chemist? Fritz Ullmann, who lived from 1875 to 1939. The name of his book, which first began to appear in 1914? *Enzyklopädie der technischen Chemie*. And the rest, as they say, is history.

In 1913 Ullmann moved to the Laboratory in the Technological Institute (Technologisches Institut) of the University of Berlin (Universität Berlin), where he dedicated himself primarily to the monumental task of compiling his encyclopedia without abandoning his experimental research and supervision of *Doktoranden* (doctoral candidates) (He published a book, *Organisch-chemisches Praktikum* (Verlag S. Hirzel: Leipzig, 1908) and 124 scientific articles, two with his wife and former *Doktorandin*, Irma Goldberg, whom he had met in Geneva when he was a *Doktorand* under Carl Graebe). Obviously, the task of compiling such a work was extremely difficult because of the heterogeneity of the material to be surveyed. In Ullmann's words, "As is often the case for the chemist in practical work, so too, with the recognition of the difficulties, the pleasure and courage to overcome them grew in me." Ullmann recruited prominent authorities to compose the separate chapters, and despite the disparity of their presentations, he succeeded in unifying these individual contributions into a concise, unified, and authoritative encyclopedia.

The first volume was published in 1914. The success of the first edition of Ullmann's *magnum opus* (12 volumes, 1914-1923) greatly exceeded expectations, and it quickly became the standard reference work in industrial chemistry. It was followed by second (10 volumes, 1928-1932) and third editions (W. Wilhelm Foerst and Hertha Buchholz-Meisenheimer, editors; 20 volumes and an index volume, 1951-1970), both published, as was the first edition, by Verlag Urban & Schwarzenberg of Munich. With the fourth edition (Ernst Bartholomé and Hertha Buchholz-Meisenheimer, editors; 24 volumes and an index volume, 1972-1984) Verlag Chemie of Weinheim (now Wiley-VCH) assumed publication of the encyclopedia.

Wherever industrial chemistry is practiced throughout the world, Ullmann's encyclopedia can be found and is frequently consulted. In fact, for the industrial chemist the perennial "Ullmann" has attained the rank that the similarly eponymous "Beilstein" (*Handbuch der organischen Chemie*) and "Gmelin" (*Handbuch der anorganischen Chemie*) had earlier earned for the organic and inorganic chemist, respectively. Unlike many other scientific publications, "Ullmann" has an editorial staff in the publishing house; it also has a 25-member editorial advisory board composed of experts from the major industrialized countries who are responsible for the encyclopedia's scientific development. Successive editions are completely revised to reflect the progressive nature of science and technology.

Inasmuch as English had become the *lingua franca* of science, the fifth edition became the first to be published in this language rather than in the German of its predecessors, which facilitated obtaining the most experienced authors, expedited publication, and should increase its worldwide readership. New topics have been introduced from emerging disciplines such as biotechnology, materials science, microelectronics, and pharmacology. Added emphasis has been placed on areas of broad concern like the economic and industrial interrelationships among nations, the high cost and limited availability of raw materials and sources of energy, and the necessity of protecting the environment, workers, consumers, and future generations from hazardous chemicals and processes.

This edition is actually two encyclopedias in one. The "Alphabetical Order" series (Volumes A1-A28) contains articles alphabetically arranged by keyword and concentrates on industrial, pharmaceutical, and food chemistry as well as metallurgy—from raw materials and bulk products to standards for commercial sales of chemicals, with articles on inorganic and organic fine and specialty chemicals, polymers, plastics, metals, alloys, product groups, technological concepts, and production processes in all branches of technology and allied industries. For each chemical substance information on physical and chemical properties, production, applications, economic data, toxicology, and occupational health, and, wherever available, on relevant patents is given. Cross-references in the text and reference keywords guide the reader to related subjects, and Chemical Abstracts Service (CAS) registry numbers are given for all important chemicals. The nomenclature follows International Union of Pure and Applied Chemistry (IUPAC) rules, and SI units are used consistently.

The "Basic Knowledge" series (Volumes B1-B8) deals with general, basic aspects of industrial chemistry such as theoretical and practical principles of chemical engineering, the fundamentals of unit operations, process control engineering, process development, reactor design, plant construction, industrial safety precautions, essentials of environmental protection, new analytical methods, and other aspects necessary to ensure a successful business in the chemical industries. The primary advantage of the division into A and B series is that it reduces redundancies and allows more space to be devoted to the detailed description of specific products and processes. Although technical, the presentation should be understandable by undergraduate science or engineering majors.

A final volume consists of a 40-page alphabetical list of the more than 3,000 prominent authors from leading chemical companies, research institutes, or universities in 21 countries (most of the authorities, as would be expected, are German), chosen not only for their expertise but also for their ability to provide the worldwide scope so vital in an encyclopedia for an international audience. Their institutional affiliations and the titles of their articles and volume numbers of the volumes in which they appear are also provided.

The concluding volume also includes a cumulative index of Volumes A through B (625 double-column pages) with more than 80,000 carefully selected keywords; and a German-English dictionary (36 double-column pages) of technical terms, prepared by transferring nontrivial search items from



Figure 1. Screen shot of the electronic releases of Ullmann's Encyclopedia of Industrial Chemistry.

the English index into the German language, in order to facilitate searching of the index by German-speaking readers. The cumulative index on CD-ROM is also included with the print set. The set's more than 27,000 pages and 16 million words contain about 1,000 major articles with many divisions, 10,000 tables and charts, 30,000 figures, and innumerable references. In 1997 the complete fifth edition was made available on CD-ROM (ISBN 0-471-98176-1, \$2,150 for owners of the print edition), thus marking the advent of Ullmann's as an electronic publication—a virtual chemistry library.

Because the third, fourth, and fifth editions of Ullmann's each required more than a decade to complete and because the pace of industrial and technological advances is continually accelerating, in order to update the encyclopedia continuously and to add new articles faster and in a more flexible manner (no alphabetical restrictions on the order of revisions) than has been possible in a printed format, in 1998 Wiley-VCH abandoned the publication of print editions. Instead, it began to publish a sixth edition available only electronically as annual releases in the form of CD-ROMs in order to keep users abreast of new developments and advances in industrial chemistry, accessible by a simple click of a mouse. Each release contains the entire encyclopedia of 37 volumes with about 70-80 new or revised articles, clearly designated as such on their title pages—the equivalent of more than three print volumes or about 10% of the entire information. Revised and updated articles in the 1998 release include those on batteries, dimensional analyses, imaging technology, liquefied petroleum gas, molecular modeling (new), thermosets, uranium alloys and compounds, and wood preservation. Entirely new review articles in the 1999 release include those dealing with combinatorial chemistry, fullerenes, high-throughput screening, metallocenes, microreactors, sonochemistry, sprayforming of metals, and visualization techniques. The 2000 release is scheduled to appear in mid-2000. Subscribers to the annual releases automatically receive a new CD-ROM at an annual rate of \$1,150. Those choosing not to receive annual

releases can apply for an archival license enabling them to access the information on their outdated CD-ROM.

Driven by powerful search engines and retrieval software, the electronic releases feature easy-to-use, extremely convenient, clear screen design, fully compatible with Microsoft Windows (Figure 1), enabling students and professional chemists and chemical engineers to conduct complete and sophisticated searches faster and more efficiently than possible in the print version. Thus the user can search for a word or phrase in the entire text; use wild cards, Boolean operators, and proximity searching to expand the scope of the search and enhance the relevance of the results; browse through articles; follow cross-references by means of hyperlinks; find literature references; print out entries; and copy and paste text into Microsoft Word documents.

Complicated searches that would be time-consuming with printed books can be carried out in seconds by using helpful indexes such as the Table of Contents, Keywords, Subject Areas, Full Text, Authors, Headings, Table Captions, Tables, CAS Registry Numbers, References, and User Notes indexes or by confining the search to selected sections of the encyclopedia or to individual documents such as tables or figure captions. The results of searches can be ranked according to their relevance; the number of occurrences of a search term in an article or document is displayed on the monitor screen. If users have access to the Internet and a browser (e.g., Netscape Navigator or Microsoft Internet Explorer), they can connect immediately via hot links from Ullmann's retrieval system to relevant websites. A detailed help function is provided along with a comprehensive manual that offers sample searches to illustrate suitable search strategies. An online tutorial (<http://www.wiley-vch.de/vch/software/ullmann/tutorial.html>), which is a short compilation of the most frequently needed functions, is available to provide new users with an overview of the versatility of the retrieval program.

An extremely useful extra feature of the electronic release is its networkability. The standard version is provided with a

multiuser single-site network license at no extra cost, permitting it to be accessed from anywhere within a local area computer network. A multiuser license is available for customers needing more than one simultaneous user. An industrial employee need not walk to the library to obtain in-depth information on any chemical substance or process, for it is delivered directly to his or her desk. Similarly, during a meeting, it is possible to retrieve relevant data simply and quickly, display them on the screen of a laptop computer, or overrule an objection immediately, supported by checked facts. If desired, personal annotations can be attached to documents and shared by a group of users. For those concerned with the Y2K problem, the program is certified to be year-2000 compatible.

The hardware and software requirements for client users of the electronic releases are:

- An IBM-compatible personal computer with an 80386 or higher processor (80486 or, better, Pentium recommended), 66 MHz or faster and at least 8 MB of RAM (16 MB or more recommended)
- A VGA or higher graphics adapter and a compatible color monitor (SVGA with at least 256 colors recommended)
- A hard disk drive with at least 8 MB free space
- Microsoft Windows 3.1, 3.11, NT 3.51, 95, 98 or later versions
- MS-DOS version 5.0 or higher
- Microsoft Compact Disk Extensions (MSCDEX) and a compatible CD-ROM drive (at least double speed)
- A Windows-compatible mouse

In both its print and electronic forms the user-friendly *Ullmann's Encyclopedia of Industrial Chemistry* remains the single most authoritative, comprehensive, well-organized, and convenient source book of accurate, reliable information on industrial chemistry and chemical engineering, reflecting current practice around the world. The unparalleled international authority, it is an indispensable gold mine of data for students, individual researchers, patent attorneys, and library collections in industrial chemistry, chemical engineering, materials chemistry, plastics engineering, biotechnology, food technology, and environmental science. A free demonstration version of three volumes of the encyclopedia on CD-ROM, complete with full searching facilities, is available on request by prospective buyers who furnish details concerning the purchasing decision maker within their organization, and a trial subscription version is available to all libraries as well as to industrial and institutional customers.

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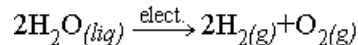
Fxchem, Version 1.0 (software); Efofex Software, P.O. Box 7, Warrona, WA 6215, Australia. It is available from the Efofex Website, <http://www.efofex.com>. A trial version can be downloaded from this site. The current price is \$55 Australian, which is about US \$36.

If you are a chemistry teacher, typing a test is not so bad until you get to the chemical equations. To type a complex chemical equation into a word processor will, in general, not

be an easy task. How do you type arrows, double arrows, catalysts over the arrows? It seems hopeless.

Not with this small software add-in to your word processor. Fxchem.exe was written solely to solve this problem. It works with any Microsoft Windows word processor. This review is based on two years of using Fxchem to type chemistry for tests and manuscripts. I know of no competitor for this software.

Fxchem installs as an "object," so in your word processor you choose "insert object" or "create object," then choose Fxchem. A box pops up, into which you type the equation. But you type it in a way that takes some getting used to. For example, if you wish to enter the equation



you do *not* type what seems natural. You type "2h2o(liq)=elect.>2h2(g)+o2(g)".

Fxchem changes (as you type) "h2o" to H₂O, o2 to O₂, and so forth. When you type the = key it inserts an arrow and positions the cursor over the arrow for a catalyst. If there is no catalyst, then the character > will complete the arrow and ready the equation for the products. For a double arrow just type "<>", which produces

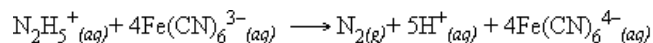


For a double arrow with catalyst type "<cat>", which produces



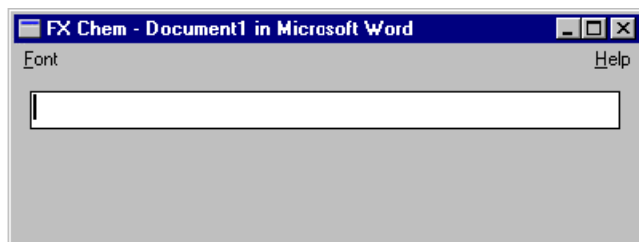
It takes some getting used to in order to type "c12h22o11", but the resulting C₁₂ H₂₂ O₁₁ is worth it. Oddly, the final 1 of the last subscript will not fall into place unless a space is added. Then it pops down into place.

Fxchem seems to know what is to be superscripted and subscripted. Consider the rather complex equation

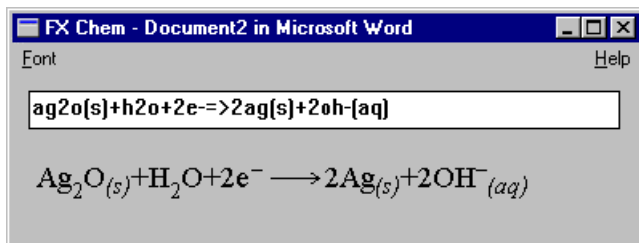


The program knows when to sub and superscript because of the character before and after the number in question. In typing "4fe(cn)63-" the program knew that 4 was a coefficient because of the f that followed. It knew 6 was a subscript because it followed a close parenthesis. It knew 3- was to be superscripted because the hyphen represents a charge (minus sign), and numbers followed by a charge are superscripts. If the minus sign were not there, it would assume (CN)₆₃ was desired.

All of this automatic formatting does not go on without your approval. When *Fxchem* is invoked, a window pops up which looks like this



As you type the equation, the program's interpretation appears below the typing area.



Pressing enter places the equation in your document and the box disappears. If something is amiss and you wish to edit the equation, simply double click on the equation and the box will reappear. You can edit in the white area until the equation below appears as you want it, or change the font type and size

from this box. Help is also available, should you forget, for example, how to make an arrow.

Is Fxchem perfect? No. It cannot be expected to know if you mean NO or No, CO or Co. This is solved in a simple way. If you type "no" it interprets it as NO, always assuming single letter elements, if they exist. If you want No simply capitalize the N and it assumes a lower case letter will follow. I do not much like the way it subscripts the (physical state) notations, but this is a very minor thing.

The only real problem with this program is that word processors differ in how well they accept and position "objects" like Fxchem equations. I have tried Fxchem on four word processors, Microsoft Word 6.0, Lotus Word Pro, Microsoft Word 97, and Corel WordPerfect 8.0. In Word 6.0 the object is placed in a line of text and often needs a little realignment using "format-font-character spacing-lower" commands. In the other three newer word processors the frame that holds the equation can be positioned wherever you want it, not just in the line of text. But to position it properly you must be familiar with that word processor's anchoring commands, usually accessed by right-clicking on the frame.

This is a fine little program which does its job well, and I recommend it for anyone who frequently types chemistry.

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