

Book reviews

Industrial Organic Chemistry

Klaus Weissermel and Hans-Jurgen Arpe

3rd edn. VCH, Weinheim, 1997

xvii + 464 pages. £70

ISBN 3-527-28838-4

This third English edition is an update of the second English version, published in 1993 and translated by Charlet R. Linley from the third edition of Weissermel and Arpe's standard textbook, *Industrielle Organischer Chemie*, which is now in its fourth German edition and has been translated into eight languages. Following the layout of previous editions, a synopsis of the main text, plus tabulation of some of the statistical data, is given in a column (about one-third of the page in width) at the outside of each page as an aid to study, and a series of fold-out flow diagrams are provided at the end of the text to show correlations between the process steps described.

The main purpose of the book is to describe the industrial production of organic compounds in quantities ranging from about 8×10^7 tonnes/year worldwide in 1995 for ethylene to a few thousand tonnes a year for speciality chemicals like vinyl fluoride. The basic chemistry (including thermochemistry for compounds made on a large scale) is laid out so that the reader can understand the descriptions of process technology given, which are sufficiently detailed to provide a clear picture of the problems involved. Much numerical data, often in tabular form, detail annual outputs and/or capacities of specific compounds in the USA, Western Europe, Japan and in some cases the world. Often companies operating a specific process are named, the capacities of their plants given and, where appropriate, the trade names of their products noted. Usually, the main application areas for these chemicals are described and quantified.

The first chapter examines the crucial interplay between the generation of energy and the production of petrochemicals, which is itself a large consumer of energy; the present and predicted world energy requirements are given and oil, natural gas, coal and nuclear energy are considered separately as present and future sources of supply. It notes that over 90% of primary organic chemicals production is now based on oil or natural gas, but although there are regional variations, for the last 30 years about 60% of the world's energy supply has been derived from these same raw materials. It quotes estimates that at current rates of consumption proven reserves of crude oil and natural gas will be exhausted in 43 and 55 years (from 1995–1996), respectively, and considers in some detail ways in which this threat to the future of the organic chemicals industry may first be ameliorated and then resolved. Chapter 2

deals with synthesis gas (CO plus H₂) and C₁ compounds including methanol, cyanogen chloride, methylamines and halogenated compounds of methane. The manufacture of olefins from ethylene up to mixtures of long-chain linear α -olefins and some with branched chains, e.g. 4-methyl-1-pentene, is described in Chapter 3. Chapters 4 and 5 are concerned with the industrial chemistry of acetylene and 1,3-diolefins (including chloroprene and cyclopentadiene), respectively, while syntheses involving carbon monoxide are covered in Chapter 6. Oxidation products of ethylene, including ethylene oxide, acetaldehyde and acetic acid with their derivatives such as ethanolamine and 2-methyl-5-ethylpyridine (from acetaldehyde and ammonia) are covered in Chapter 7, but the synthesis of ethanol, higher alcohols and aliphatic polyols, e.g. pentaerythritol, are described in Chapter 8. Chapter 9, 'Vinyl-Halogen and Vinyl-Oxygen Compounds', deals with polyhalogeno compounds such as vinylidene chloride and tetrafluoroethylene as well as vinyl chloride, vinyl esters and vinyl ethers. Acrylonitrile manufacture is described in Chapter 11, which also deals with propylene oxide, acetone, methacrylates and other 'Propene Conversion Products'. The intervening Chapter 10, 'Components for Polyamides', deals with dicarboxylic acids, diamines and lactams. Industrial aromatic chemistry is covered in the last three chapters. Chapter 12, 'Aromatics—Production and Conversion' covers the isolation of high-tonnage aromatics, especially benzene, toluene and xylenes (the BTX compounds) and important interconversion reactions such as hydrodealkylation of toluene to benzene. 'Benzene Derivatives', Chapter 13, describes alkylation to ethylbenzene (for conversion to styrene), conversion to phenol and to dihydroxy derivatives (including Bisphenol A), oxidation to maleic anhydride, and nitration then reduction to aniline and to diaminotoluenes. Finally, Chapter 14 describes the oxidation of naphthalene or *o*-xylene to phthalic anhydride and several routes to terephthalic acid and its derivatives.

The dissertation in this English edition is much the same as that given in the previous one both in length (464 pages compared with 457 in the second edition) and treatment, but many of the numerical data concerning production capacities have been updated to 1995 (compared with 1989–1990 in the second edition), enhancing the value of the book as a work of reference. There are a few minor errors, for example 'Inorganic' in the third line of the Preface to the third edition should be 'Organic' and in the fourth line of the second paragraph on p. 190 the acid amide (not the acid) is made by reaction of the acid esters with ammonia.

This book will provide chemistry students with an authoritative description of industrial organic chemistry and will be useful to professionals requiring technical

and techno-commercial information about the industry. It is well indexed and the references, which are given for each chapter, provide a helpful introduction to the detailed literature.

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Infrared and Raman Spectra of Inorganic and Coordination Compounds

Kazuo Nakamoto

5th edn. Wiley, Chichester, 1997

Part A: xiii + 387 pages; Part B: xiii + 384 pages. £95
ISBN 0-471-19406-9 (set)

The publication of the fifth edition of this book is greatly to be welcomed. This is because, ever since the production of the first edition in 1963, it has been a classic reference work for vibrational data on inorganic materials of all sorts. The current edition is the first to be published in two volumes, Part A being on *Theory and Applications in Inorganic Chemistry* and Part B being on *Applications in Coordination, Organometallic and Bioinorganic Chemistry*. The author has made many additions to earlier editions so as to include significant new work, and carried out much updating and revision of tabulated material. Nevertheless, the contents of the book must necessarily be selective in order to be kept within the bounds even of two volumes. The author has sought to achieve a broad and balanced coverage of the mass of published material in the area, and I believe that he has been very successful in this regard.

The following comments relate to the five different sections.

In Part A, Section I, 'Theory of Molecular Vibrations', the author struggles somewhat, in only 152 pages, to do justice to the many different essential topics which need to be covered. For instance, he fails to make clear that rotational and electronic Raman scattering can be detected, as well as vibrational Raman scattering. Section II, 'Applications in Inorganic Chemistry', is

one of the most valuable sections (157 pages) of the book, and includes much excellent tabular material and 1362 references.

Part A ends, as in earlier editions, with useful appendices on point groups, character tables, matrix algebra, correlation tables etc., as well as general formulae for calculating the number of normal vibrations for each species, *G* and *F* matrices of typical molecules, etc.

Part B consists of sections on 'Applications in Coordination Chemistry' (Section III, 256 pages, 1396 references), 'Applications in Organometallic Chemistry' (Section IV, 62 pages, 438 references), and 'Applications in Bioinorganic Chemistry' (Section V, 51 pages, 195 references). These are well written, are virtually free of misprints and, like the rest of the book, are accompanied by excellent diagrams and tables.

The principal criticism of the book concerns the author's disregard for the SI system, now established for a generation (at least) of students in Europe and in most of the rest of the world. This includes cases of giving a physical quantity without any units at all, viz. the molar decadic absorption coefficient (referred to as the 'molecular extinction coefficient' in Part B, p. 107 and as in Part B, p. 344), with incorrect ones (frequency for wavenumber), or with archaic ones (wavelength, ; Part B, p. 300, etc.). The worst situation occurs for the diagrams in which it would appear that the author has in every case simply taken each diagram from the journal and reproduced it unchanged from its form therein. Thus ordinates of spectral diagrams are given a dozen or so different labels (including no label at all!), while the abscissae are given a staggering 27 different labels without once using the correct one, Wavenumber/cm⁻¹. The diagrams even include cases in which neither axis is labelled, and one in which the ordinate is written in English and the abscissa in German. The publisher is as much at fault as the author on these matters, which certainly detract seriously from what is otherwise an excellent new edition of a justifiably well-known book.

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