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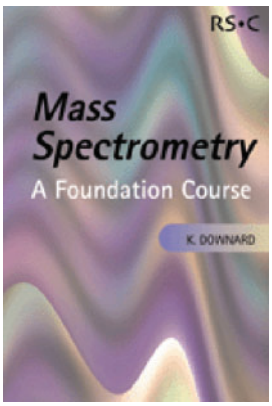

Mass Spectrometry: A Foundation Course

By K. Downard
RSC, Cambridge
2004, 210 pp
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Softcover, £40

In mass spectrometry tremendous changes have taken place in the past decade. These are largely due to the developments of the ionization methods of electrospray and matrix-assisted laser desorption ionization, but also to technologically advanced developments of instrumentation such as time-of-flight and Fourier transform ion cyclotron resonance mass spectrometry. This has widened essentially the applications of mass spectrometry to biochemistry, biology, and medicine in addition to the traditional areas of physics and chemistry, including environmental chemistry.

This book is aimed at providing in a concise, but still comprehensive way the present status of mass spectrometry with regard to its techniques and applications in the various areas mentioned above, so as to form the basis for a general university course in mass spectrometry at the undergraduate or postgraduate level. This almost impossible goal is achieved by the presentation of mass spectrometry in chapters focussed on its applications in gas-phase ion chemistry, biology, medical research, environmental and surface studies, archaeology, and cosmology, following introductory chapters including the principles of mass spectrometry, the basic components of various types of mass spectrometers, and the large variety of techniques of tandem mass spectrometry.

The chapters are presented in a logical order and are written in a highly readable, sometimes loosely formulated, and entertaining style with presentation of examples from very recently published research (up to 2003), such as on the sequencing of peptides, proteins, oligonucleotides, oligosaccharides, structure and folding of proteins, imaging of peptides and proteins in mammalian tissue sections, identification and quantification of drugs and metabolites, determination of metabolic pathways, upper atmosphere and ionosphere chemistry, space research (Apollo, Viking, and Mars Missions), and radiocarbon dating by use of accelerator mass spectrometry, such as the determination of the age of the Shroud of Turin. Each chapter finishes with a list of selected key references for further study. The book concludes with 11 Appendices, covering among others comparison of common ionization techniques and the performance of different mass analyzers, giving amino acid, mononucleotide and monosaccharide residue masses, and providing web sites on mass spectrometry, all being very useful. Highly appreciated is also the Guide to a Foundation Course in Mass Spectrometry given in the beginning of the book at page xv, being of assistance to lecturers who are teaching classes of students in either physics or chemistry, biology, medicine, or environmental sciences.

Typing or other small, yet disturbing, errors are common in books. A few of them in this book are: the misspelling of the name Wien (pp. 1, 2); the wrong name for NO_2 (p. 7) and for the benzene ion in eqn (2.5) being called a phenyl ion (p. 13); internal energy which should be kinetic energy (p. 69, line 3 of section 4.2.2); the isopropyl species (p. 90) given in eqn (5.13) as the *n*-propyl cation (p. 91); an H missing in the propene product ion in eqn (5.14) (p. 91) and in the product ion in eqn (5.33) (p. 97); the loss of ethylene which should be acetylene in eqn (5.19) (p. 92) where the charge in the ion *m*/*z* 65 is missing (as in eqn (5.31), p. 96); the wrong name of benzyl ion for *m*/*z* 77 (p. 98); with reference to eqn (6.2) (p. 104) either the appearance of the detached electron or the disappearance of the negative ion signal is measured rather than the mentioned formation of the neutral molecule; IE(M) in eqn (6.4) and E_i(M) in eqn (6.6) which both should be IE(H) (p. 105); intermolecular at which should be intramolecular (p. 112); glutamic acid which should be glutamine (p. 115); and the presence of the C—C bond between the two aldehyde groups in the top of Fig. 7.25 which should not be there (p. 146). Confusing is the use of both the symbols MH and M for neutral molecules in section 6.1.2 (pp. 105, 106).

More serious errors are found: application of eqn (1.2) leads to a wrong peak height ratio of 0.076 for (M+2)/M of Cl_2 (p. 6); NO_2 cannot be distinguished from C_2H_6O on the basis of the nitrogen rule because its nominal mass is not 45, as stated, but 46 (p. 7); and in eqns (5.4) and (5.8) where the ethyl and phenyl cations are not generated directly from the molecular ions but by CO loss as a secondary fragmentation from the primarily generated (by α-cleavage) acylium ions $C_2H_5CO^+$ and $C_6H_5CO^+$ respectively (p. 88). Similarly, the ion *m*/*z* 51 in eqn (5.18) is generated from the phenyl cation by loss of acetylene following the hydrogen atom loss from ionized benzene (p. 92), while the loss of water from the ions in eqns (5.21) and (5.22) proceeds through an initial hydrogen atom migration and not through hydride migration to the hydroxyl group (p. 93). Finally the loss of ·OD in eqn (5.38) occurs from a benzoic acid molecular ion, deuterated in the acid group following an intramolecular H/D exchange, to give the benzoyl cation and not the given carbene type ion with *m*/*z* 105 (p. 99).

Notwithstanding the critical comments made above, in particular about some parts of chapter 5, overall this book is very useful and can be recommended as an introduction for students into the presently wide applicability of mass spectrometry to a variety of disciplines.

**Nico Nibbering is Emeritus Professor of Chemical Mass Spectrometry at the Vrije Universiteit Amsterdam, and has undertaken research in mass spectrometry, including gas-phase ion chemistry and instrumental development and their applications to chemistry, physics, biochemistry, pharmacy, and medicine, since 1963. He is coeditor of Elsevier's forthcoming* Encyclopedia of Mass Spectrometry*, vol. 4.*

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