



Book review

[1] J. Sabine Becker, *Inorganic Mass Spectrometry—Principles and Applications*. John Wiley & Sons, Ltd., Chichester, West Sussex, England. ISBN: 978-0-470-01200-0 Hardcover, 514 pages, February 2008, US \$200.00.

A brief glance at the Tables of Contents of most journals that deal with mass spectrometry, or at the list of presentations at major conferences in the same field, would lead one to believe that the principal (or perhaps only) application of mass spectrometry is to biological systems and, in particular, to proteomics. In contrast, a great deal of effort in the field is being dedicated to the development of new instrumentation, to the understanding of gas-phase interactions involving charged species and to the qualitative and quantitative analysis of inorganic species. It is to the last of these areas that this useful new book has been directed. Armed with over thirty years of fundamental and practical experience, J. Sabine Becker has prepared a text that should serve to educate those relatively new to the field of inorganic mass spectrometry or to serve as a useful desk reference for others. Indeed, it could serve nicely as the textbook for a graduate-level course on the subject of its title.

The book is divided into two principal sections, the first dealing with the fundamentals of inorganic mass spectrometry and instrumental developments, and the second with applications of the technique. An overview of those chapters provides insight concerning the book's usefulness.

Chapter one begins with an interesting summary of the development of mass spectrometric instrumentation and methods and highlights in particular seminal advancements in several areas and the Nobel prizes that resulted from them. Following are four chapters that deal mainly with instrumentation and components, one that covers analytical and practical considerations, and the rest that cover applications.

The instrumentation chapter details the components found in a modern mass spectrometer. Specifically, chapter two deals with ion sources, with the inductively coupled plasma (ICP) receiving most attention but with additional details involving spark sources, lasers, glow discharges, thermal ionization, secondary-ion mass spectrometry, sputtered neutral mass spectrometry, electron ionization (especially for isotope-ratio determination), matrix assisted laser desorption/ionization (MALDI) and electrospray ionization.

Methods for ion separation and mass analysis are described in chapter three and feature sector-field systems, quadrupole mass filters, ion traps, time-of-flight mass spectrometers (TOFMS), and Fourier transform systems.

Devices for ion detection are described in chapter four and include the traditional Faraday-cup system, secondary-electron and channel electron multipliers, microchannel plates, the Daly detector, multi-channel detection, and detector arrays for mass spectrometry.

In chapter five can be found descriptions of complete instruments, with an emphasis on currently available commercial devices. Again, ICPMS receives heaviest emphasis, although mass spectrometers featuring other sources are reviewed as well. The relative utility of high resolution and either collision or dynamic reaction cells for overcoming isobaric interferences in ICPMS are also examined. A bit is included also about methods for introducing samples into inductively coupled plasma mass spectrometers, including nebulizers, hydride generators, flow injection, and laser ablation.

Chapter six, entitled generically "Analytical and Practical Considerations", provides a bridge between the treatment of instrumentation and the later coverage of applications. In it are described the considerations for qualitative and quantitative analysis by means of inorganic mass spectrometry. Among the aspects of qualitative analysis are included the determination of exact mass, the use of isotopic patterns, and methods for dealing with interferences. Practical aspects of quantitative analysis are the use of semi-quantitative procedures, development and proper use of calibration curves, standard additions, and the use of internal standards, selection and proper application of standard materials, and the benefits of isotope dilution. Methods for sample preparation are featured prominently in this chapter but in a necessarily general fashion. Detailed procedures for sample preparation are often so specific to a particular application that they cannot realistically be treated in a coverage as general as the present one.

The balance of the chapters in this book deal with applications. In chapter seven is examined the analysis of vapors and gaseous samples, while chapter eight is devoted to the measurement and use of isotope ratios in mass spectrometry. Chapter nine, which alone comprises roughly forty percent of the book length, details specific applications in a host of fields, including biology, bioengineering, medicine, food, geology, geochemistry, cosmochemistry, space science, the measurement of long-lived radionuclides, forensic science, and the formation of cluster and polyatomic ions. Ambitious in its scope, this chapter is rich with examples and includes a large number of figures (67) and tables (46).

The book ends with chapter ten, which purports to cover future developments and trends. Although this chapter was interesting, I found it somewhat disappointing in length and scope, given the author's extensive background, experience, and perspective.

Several other points serve to underscore the attractiveness of this text. Because it has only a single author, it is far more coherent and cohesive than most other volumes that are merely edited collections of individually written chapters. There is an extensive, up-to-date reference list comprising more than 1800 citations. Somewhat regrettably, but perhaps understandably, the author's own publications are most heavily cited, although work by others

is certainly not neglected. The book is well written, clearly intended for either teaching or reference use. Although it contains a few errors and inaccuracies, these deficiencies are minor. One example, admittedly picky, is that the terms “mass spectroscopy” and “mass spectrometry” are used interchangeably. The volume contains many figures, diagrams, photographs, spectra, illustrations, and tables that are attractively done and add to its utility. Color is used effectively throughout.

On balance, “*Inorganic Mass Spectrometry—Principles and Applications*” by J.S. Becker is a volume that belongs on the shelf of every practicing mass spectrometrists and worthy of consideration for any graduate-level course dealing with the subject.

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