

Book Review of Practical Aspects of Trapped Ion Mass Spectrometry, Volume IV: Theory and Instrumentation

Practical Aspects of Trapped Ion Mass Spectrometry, Volume IV: Theory and Instrumentation. Edited by Raymond E. March (Trent University, Ontario, Canada) and John F. J. Todd (University of Kent, Canterbury, U.K.). CRC Press (an imprint of Taylor & Francis Group): Boca Raton, FL. 2010. x + 922 pp. \$179.95. ISBN 978-1-4200-8371-2.

Because of the rapid development of new trapped-ion mass spectrometers over the past 10 years, the publication of Volume IV of this respected series is most welcome. The editors' decision to focus on theory and instrumentation was a good one, as there has been much progress in these areas in the 15 years since the publication of the previous volume. In that span, many groups have pushed the boundaries of trapped-ion technology and instrument development. The editors have assembled these advances here into a single volume so that both the seasoned researcher and budding spectrometrists can better understand the theory applied to these technologies.

The text is organized into six sections: Fundamentals; New Ion Trapping Techniques; Fourier Transform Mass Spectrometry; Quadrupole Rod Sets; 3D-Quadrupole Ion Trap Mass Spectrometry; and Photochemistry of Trapped Ions, comprising 21 chapters. The editors are to be applauded for assembling the cast of authors for these chapters—all have made considerable contributions to the field of trapped ions and add much credibility to the accuracy of the text. Repetition among chapters is avoided, making this book a good cover-to-cover read as well as a great reference text.

The extensive introductory chapter, "An Appreciation and Historical Survey of Mass Spectrometry", written by the editors is wonderfully done. It reintroduces the basic theory of trapped ions from Volumes I and II and lays out a comprehensive historical survey of mass spectrometry and trapped ions. This is a great section to serve as a source of references and introduce new readers to the field. The second chapter in this section moves beyond the standard ion trap configurations introduced in the first three volumes and introduces the emerging areas of miniaturization, preparative mass spectrometry, and multiplexing.

Section II on new ion-trapping techniques focuses on the Orbitrap mass analyzer, digital ion traps, traps with novel geometries, and high-field asymmetric waveform ion mobility (FAIMS). The latter seems a bit out of place. In the Preface, the editors define "trapped ions" as follows: "an ion is 'trapped' when its residence time within a defined spatial region exceeds that had the motion of the ion not been impeded in some way." FAIMS is a complementary and often orthogonal technique to mass spectrometry and is currently making an incredible impact in the field. I argue that even though it falls under the heading of "New Ion Trapping Techniques" it misses the standard m/z designation of mass spectrometry. This chapter is well done and worth reading, but may be misplaced.

Sections III–V cover new advances in familiar ion traps, Fourier transform mass spectrometry, quadrupole rods, and

3D-quadrupole traps. All three of these sections, comprising 13 chapters, thoroughly cover the theory of the techniques. The references within the chapters easily allow the reader to gain a full understanding of the development and implementation of these ion traps. The penultimate chapter in the final section is on photodissociation and is a great primer for all those interested using ion traps for structural information. Owing to the current broad use of lasers in the field, combining this technique with ion traps allows for an incredible amount of tuning capabilities for controlled ion dissociation.

In his 1952 text, "An Introduction to Scientific Research" (p 127), E. Bright Wilson warned that "With the present trend toward commercial instruments, tightly sealed in closed boxes, there is a dangerous tendency to develop mere 'knob twirlers' with only a vague understanding of the insides of instruments and the theories on which they are based." The wonderful contributions of the authors in this volume can help stave off the warning and give the reader a thorough foundation of trapped-ion mass spectrometry. Although the technology continues to advance at an incredible pace, and there are many other groups developing novel trapped-ion techniques, the timing for releasing this volume was apt. I will most certainly recommend this text to all in the field and those joining.

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