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BOOK REVIEWS

Differential Ion Mobility Spectrometry: Nonlinear Ion Transport and Fundamentals of FAIMS. By Alexandre A. Shvartsburg (Pacific Northwest National Laboratory, Richland, WA). CRC Press (an imprint of the Taylor & Francis group): Boca Raton, FL. 2008. xxx + 300 pp. $159.95. ISBN 978-1-4200-5106-3.

Differential ion mobility spectrometry (DMS) is a relatively new method of chemical measurement, and this monograph is an excellent reference on the topics of both linear and nonlinear modes of ion mobility measurements. It contains in-depth discussions of the theory and historical references to many seminal papers and books that are out of print or difficult to obtain. For example, some early publications are only available in Russian, and some published equations are corrected or enhanced. The perspective is from that of a physical chemist, so this book is not recommended for those who have an aversion to mathematics or find physical chemistry unpalatable.

Low-field ion mobility spectrometry is an existing technology that has been used for years for the detection of chemical weapons by the military, drugs by customs and law enforcement, and explosives for security. Ion mobility spectrometry (IMS) in the analytical chemistry community has in the past undeservingly suffered a poor reputation. On one occasion, I heard IMS speciously referred to as a low-resolution mass spectrometric method. The author of this book does an excellent job differentiating IMS from mass spectrometry and adeptly points out the theoretical limitations and advantages of IMS and DMS.

When the electric field strength is increased, nonlinear effects on mobility can be detected. Differential mobility measurements exploit these effects to provide a means of filtering ions under ambient conditions based on the difference between an ion's low-field and high-field mobility. The real strength of this monograph is the theoretical and deep presentation of this topic. I know of no other textbook in which this new mode of ion measurement is described in such depth and breadth.

The subject is divided into independent chapters that also have a comprehensive set of references at the end of each one. This organizational structure makes it very easy to read the chapters out of sequence. The first chapter presents the fundamentals of gas phase transport of ions under low field strengths. In the second, ion mobility under high field strengths is examined. The following chapter is on the process of measuring differential mobility by using asymmetric electric field waveforms. Chapter 4 covers separation performance and control, whereas the last chapter addresses new research areas originating from the author. The book comprises 300 pages and five chapters, so each chapter covers quite a bit of material, especially the first two chapters on principles.

The writing style is very personal: you can almost hear the author speak to you as you read the text. There is a list of standard symbols that are used throughout the book, and the notation is consistent throughout the chapters. Unfortunately, the writing style relies too much on symbols and some mathematical expressions appear embedded in the sentence structure. Consequently, you may find yourself frequently referring to the 11 pages of symbol and constant definitions at the beginning of the book. The practice of relying on mathematical notation instead of words is too common among the physical sciences, so I would like to encourage all scientists to strive to the higher literary standard of keeping mathematical notation to equations that appear offset from the text and using words as opposed to mathematics to describe the concepts represented by the equations in the text.

As noted above, some interesting research ideas originating from the author are the basis of the last chapter of the monograph. Among them are that ion separations can exploit higher order terms that can be achieved by altering the asymmetric waveform that is used in DMS, and that conventional IMS can be implemented with a strong transverse field to fix the ion dipoles and improve the precision of the ion cross section measurement. At the end of the book, you will feel that the story of nonlinear ion mobility measurements is just unfolding and it should have many interesting new applications and discoveries.

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