

BOOK REVIEW

Mass Spectrometry of Polymers

Giorgio Montaudo and Robert P. Lattimer, Eds.
CRC Press, Inc.

Boca Raton, FL 33431, USA

ISBN 0-8493-3127-7

2002, Hardcover \$149.95, 584 pp.

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¹As stated by the editors in the Preface, *Mass Spectrometry of Polymers* is meant as "an effort to summarize the current status of the use of mass spectrometry in polymer characterization." This work admirably achieves the stated goal, with a strong emphasis on the most recent literature describing technique developments and applications in the field of polymer mass spectrometry. The editors have gathered a strong team of contributing authors who are experts in the field of polymer mass spectrometry to contribute individual chapters to this book.

The book is divided into eleven chapters and contains a useful index. The first two chapters are introductory in nature, while the subsequent nine chapters are devoted to specific mass spectrometry techniques used in the analysis of polymers. Chapter 1 by Polce and Wesdemiotis provides an introduction to the technique of mass spectrometry; as stated in the Preface, the purpose of this chapter is to provide the polymer scientist an overview of mass spectrometry in polymer analysis. Polymer scientists will find this chapter a convenient and easily readable reference tool on mass spectrometry. Chapter 2 by Montaudo and Montaudo provides an introduction to methods of polymer characterization, including mass spectrometry. The practicing mass spectrometrists with any interest in polymer characterization will find this chapter extremely well-written and will value the discussion of the features of other polymer characterization techniques, such as osmometry, light scattering, size exclusion chromatography, and nuclear magnetic resonance. The section on "Copolymer Composition and Sequence" is particularly noteworthy due to the clarity of the examples rendered by the authors, showing both theoretical and experimental mass spectra of various copolymers.

Beginning with Chapter 3, each chapter is devoted to specific techniques used in characterization of polymers by mass spectrometry. Chapter 3 covers pyrolysis gas chromatography coupled to mass spectrometry. Authors Tsuge and Ohtani provide an excellent overview of this technique, especially with regard to its utility in

the analysis of the stereoregularity of polystyrene samples, and in the discussion of thermal degradation mechanisms of polystyrene and polyesters. Chapter 4 by Prokai provides an overview of electrospray ionization (ESI) mass spectrometry used in polymer analysis; the chapter provides a good discussion of the most useful aspect of ESI-MS of polymers, namely when it is coupled to liquid chromatography techniques. However, it is not clear why ESI-MS is discussed before Chapter 5, which deals with the direct pyrolysis of polymers in the ion source. Chapter 5 by Montaudo and Puglisi is well referenced, and provides many excellent examples from the literature on pyrolysis mass spectrometry of polymers.

Field ionization (FI) and field desorption (FD) of polymers is covered by Lattimer in Chapter 6. This account provides excellent discussion on the merits and disadvantages of FI and FD as applied to polymer analysis, and the section on "Recommendation to New Users" is particularly helpful and is highly recommended. An outstanding account by Montaudo and Samperi detailing the contributions of fast atom bombardment (FAB) to polymer analysis is given in Chapter 7. The discussion on the contributions of FAB in characterization of cyclic oligomers is especially engaging. In addition, the authors provide many excellent examples of copolymer sequence analysis by FAB that add significantly to the material introduced in Chapter 2. Hercules covers in detail time-of-flight secondary ion mass spectrometry (TOF-SIMS) in Chapter 8. This chapter is rich in its examples, particularly with regard to the discussion of ion fragmentation pathways of polymers observed in TOF-SIMS. Laser desorption Fourier transform mass spectrometry (LD-FTMS), a technique that is a predecessor to matrix-assisted laser desorption and ionization (MALDI) is logically presented next in Chapter 9. Authored by Pastor and Wilkins, this chapter provides a nice explanation of the distinction between LD, laser ablation, and MALDI, and provides an easy-to-follow historical account of LD-FTMS in synthetic polymer analysis.

Chapter 10 by Montaudo, Montaudo, and Samperi discusses the most widely used mass spectrometry technique for polymer analysis today, namely MALDI. Chapter 10 is very highly detailed and provides a wealth of references (over 300) to MALDI of polymers. The fundamentals of MALDI for polymer analysis are covered in depth, including sample preparation issues. Encyclopedic coverage of mass discrimination phenomena in MALDI of polymers is presented. Coverage of MALDI applied to structural analysis of homopolymers and copolymers is extensive. As one might expect, this is the longest chapter in the book, and it is warranted because of the importance MALDI plays in synthetic polymer analysis. The chapter also makes frequent reference to some of the earlier chapters, providing some cohesiveness to the text. Chapter 11 by de Vries and Hunziker discusses the combined

Published online September 5, 2002

approach of laser desorption followed by laser ionization. Though interesting, the chapter seems somewhat out of place considering the sparse number of reports of the technique being used in industrial settings.

There are a few typographical errors in the book, particularly in the references sections at the end of some chapters. There are also a few instances of incorrect terminology being used (e.g., on page 539 “electron spray ionization” is used where “electrospray ionization” is clearly intended). On the whole, however, the editors have clearly made considerable effort to keep the terminology consistent throughout the chapters.

Overall, *Mass Spectrometry of Polymers* is an extremely practical book covering the state-of-the-art in polymer mass spectrometry. The contributors and editors are to be commended for producing what is truly a tutorial possessing excellent examples and abundant references. In the Preface, the editors note that they “trust that the book will be useful to both novices and experienced practitioners in polymer MS.” Unquestionably, they have achieved this objective. *Mass Spectrometry of Polymers* is highly recommended to anyone engaged in polymer science or in mass spectrometry of polymeric materials.