

Book review

Principles and Applications of Ion Scattering Spectrometry: Surface Chemical and Structural Analysis

J. Wayne Rabalais, Wiley-Interscience, New York, 2003, 301 pp., ISBN 0-471-20277-0

This book is the fourth in a series written by experts in the various disciplines of mass spectrometry. The author is an acknowledged expert in the field of ion scattering and recoiling spectrometry who has made substantial contributions to the science over much of its 30-year history. The discussion is limited to low energy ion scattering (0.5–10 keV), with a brief excursion into hyperthermal (1–500 eV) reactive ion-surface interactions in one of the final chapters. Ion-surface interactions in the low energy range arise primarily from coulomb repulsion between colliding atomic cores, and the dominant physical phenomenon is elastic scattering.

Chapters 1 through 5 are foundational (introduction, theory, experiment, spectral features, and structural analysis), written to introduce the more detailed discussion that follows. The material could serve either as a review of ion-surface interactions for the surface analysis researcher or as a primer in ion scattering for students in chemical physics.

Chapters 6 through 9 comprise material at the forefront of current research in ion-surface interactions. The section begins with a discussion of scattering and recoiling imaging spectrometry (SARIS), with its potential for measuring real-space surface crystallography, and continues with a treatment of theory and applications of time-of-flight scattering and recoiling spectrometry (TOF-SARS), ion-surface charge exchange phenomena, and hyperthermal reactive ion scattering (RIS). There is an emphasis in the text on structural characterization of surfaces, which this reviewer found

to be helpful for visualizing the ion-surface interaction. The author effectively interweaves an abundance of experimental data into the narrative, giving the reader supporting evidence for verifying and understanding the concepts being presented. References are listed at the end of each chapter.

A final chapter (chapter 10) contains an extensive bibliography of ion scattering literature (over 800 references) for the reader who desires further information. References are fairly complete through 2001, with a few from 2002.

This reviewer was particularly drawn to chapter 9, which covers the topic of hyperthermal RIS. RIS adds the further dimension of chemical reactivity of the projectile ion to the ion-surface interaction, opening the possibility of molecular dissociation, abstraction reactions, and various charge exchange phenomena. After an opening discussion of non-reactive scattering and sputtering at hyperthermal energies, the author addresses Cs⁺ RIS, covering both theoretical aspects and applications. Selected studies illustrate how the technique has answered important questions or added unique information to several well-known and long-standing surface investigations. With its potential for surface molecular analysis, the RIS technique will be of interest to scientists working with functionalized surfaces or self-assembled monolayers.

In summary, this book is an authoritative, up-to-date reference covering both the history and current research in ion scattering, with an abundance of supporting references and aids for further study.

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