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BOOK REVIEWS

Advances in Quantitative Structure−Property Relationships, Volume 3. Edited by Marvin Charton (Pratt Institute) and Barbara I. Charton (New York University Library). JAI Press (an Imprint of Elsevier Science B.V.): Amsterdam. 2002. xi + 228 pp. $160.00. ISBN 0-444-51112-1.

As M. Charton writes in the preface, "Over the last 40 years Quantitative Structure Property Relationships (QSPR) have developed into a major method of chemical research." He states that the object of the series is "to provide interesting timely reviews covering all aspects" which he hopes "will provide the cross fertilization" that is sorely needed. This is indeed a worthy aim.

The increasing power of synthesis and the growing number of structures that can feasibly be prepared, together with the escalating cost of preparing them, means that it is more important than ever to understand the relationship between chemical structure and physical, chemical, biological, and technological properties. QSPR can immensely aid both our understanding and our efficiency in research and development.

The five chapters in this book are certainly relevant. They cover a range of distinct and diverse topics, including correlations of density and of "phase-change" properties (i.e., melting point, boiling point, and critical temperature). Subsequent chapters cover relationships in molecular geometry and consider the special place of halogens as well as the electronic effects on oxidation rates and mechanisms.

Unfortunately, the book has a major shortcoming: all of the chapters are already out of date. QSPR is a very rapidly moving field, and it is a real pity to publish a book in 2002 in which there are essentially no references later than 1999 and indeed very few to publications in 1998 and 1999.

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Surface and Thin Film Analysis. A Compendium of Principles, Instrumentation, and Applications. Edited by Henning Bubert and Holger Jenett (Institute of Spectrochemistry and Applied Spectroscopy, Dortmund, Germany). Wiley-VCH: Weinheim, Germany. 2002. xviii + 336 pp. $84.95. ISBN 3-527-30458-4.

The title and subtitle of this book accurately reflect its focus on experimental techniques that are used for the practical analysis of surfaces and thin films. The editors have chosen to cover techniques, and examples of their use, that heavily favor applications. Only methods that use commercially available equipment are considered. Given the applied focus of the coverage, the book is impressive in the number of different methods that are described. The sections on each technique are written by experts according to a format that is fairly uniform among the different authors. This makes it relatively easy to compare and contrast different methods and their capabilities. Although some of the same topics are covered by other books, this one is unique in the comprehensive nature of its coverage, and it provides a handy reference to researchers needing information on techniques outside their own areas of expertise. Each topic has extensive references to more specialized literature.

The intended audience for the book can be deduced not only by the topics covered but also by what aspects of surface analysis the editors have chosen not to include. Although studies of the physical phenomena underlying the structure and properties of solid surfaces depend on the use of surface sensitive techniques, the extent to which a technique is covered in this book does not necessarily reflect its importance in advancing our understanding of the physics and chemistry of surfaces. Techniques that have given us the most insight into the structure of solid surfaces, such as low-energy electron diffraction and scanning tunneling microscopy (STM), receive relatively little coverage. Likewise, techniques that have given us detailed fundamental information on chemical reactions on surfaces, such as thermal desorption spectroscopy and reflection absorption infrared spectroscopy, are treated only briefly, while other important but rather specialized techniques, such as high-resolution electron-energy-loss spectroscopy as a method for studying surface vibrations, are not treated at all. Advances in our understanding of the dynamics of molecule−surface interactions have greatly benefited from experiments involving scattering of molecular beams, yet these are not included. This is not only because these experiments rely on user-designed and -built equipment, but also because they are of limited practical use. There is, of course, essentially no treatment of various theoretical methods that are used to understand surface structure, surface chemistry, and thin film growth mechanisms. Thus, the book is mainly for those interested in identifying which techniques are most suitable for the practical analysis of a given surface, rather than for scientists interested in how surface phenomena are studied and analyzed.

The book starts with a brief introductory chapter by the two editors that includes a table listing techniques according to whether the excitation and detection are based on electrons, ions, or photons. A second table lists the relatively few techniques that cannot be classified in this way. These tables are the basis for the way the rest of the book is organized, with Chapters 2−4 describing techniques in which electrons, ions, or photons are detected, respectively. The final and shortest chapter covers atomic force microscopy (AFM) and STM. The book concludes with a table that summarizes and compares the techniques and with a current list of equipment suppliers. It is safe to predict that the latter will be obsolete much sooner than the contents of the rest of the book.

The section on each technique typically covers the basic principles of operation, the instrumentation, the spectral information provided, quantification, and applications. The explicit and detailed examination of how to obtain quantitative information from a given technique is one of the main strengths of the book. In most cases, equations for the absolute signal measured

are given, as well as information on how to calibrate the measurements using appropriate standards. The various authors point out which methods are good for obtaining absolute elemental concentrations and which are mainly useful for relative concentrations. Depth profiling and imaging are considered in detail for the many methods used for these purposes.

Another strong point of the book is the presentation of a wide variety of illustrative applications. These include, for example, changes in the chemical state of Mo in a cobalt−molybdenum−alumina catalyst as a function of reduction treatment as observed with X-ray photoelectron spectroscopy; elemental mapping with submicron spatial resolution of B, Na, K, and O in a SiC sample obtained with scanning Auger microscopy; analysis of a defect in car paint obtained with a combination of secondary ion mass spectrometry and imaging with ion-induced secondary electron emission; Rutherford backscattering analysis of a $Si_{1-x}Ge_x$/Si strained layer superlattice; grazing incidence X-ray scattering analysis of oxide layers on a yttrium-implanted NiCr sample; depth profiles of TiN-coated steel using glow discharge optical emission spectroscopy; and an AFM image of a photoresist layer on silicon structured by ion lithography. As indicated by these examples, many of the applications are from the semiconductor industry.

The quality of the book is somewhat variable, as would be expected from the fact that it contains contributions from 15 different authors. There are quite a few typographical and grammatical errors, and some of the figures are of poor quality. However, most of the sections provide an excellent overview of important experimental techniques. Although expertise in the subject matter is well distributed throughout the international scientific community, all of the contributing authors to this book are from Europe, with most from Germany. The book would be a useful resource for researchers seeking the best methods to analyze a particular surface or thin film as well as for students seeking a concise overview of the relative merits of various experimental surface and thin-film analysis techniques.

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