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Book Review

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Book Review

(Received January 21, 2001)

“Properties of Materials” by Mary Anne White. Oxford University Press, New York, Oxford, 1999; ISBN 0-19-511331-4(paperback); xv + 334 pages; \$36.00

From the author's preface, this book has been used as the basis of a one semester course in materials science, offered in a chemistry department, and taken by a cross section of science and engineering students. The book assumes a basic knowledge of the physical sciences and presents topics with introductory mathematical and theoretical rigor to avoid the use of tensors. While not stated, the book largely avoids terms like “quantum mechanics” while attempting to cover topics such as band theory and optical properties. One exception is noted below.

The book consists of 5 parts and a total of 14 chapters, along with 5 one page appendices. The Parts are: Part I, Introduction; Part II Color and Other Optical Properties of Matter; Part III Thermal Properties of Materials; Part IV Electrical and Magnetic Properties of Matter; Part V Mechanical Properties of Materials. With the exception of the Introduction, each chapter is followed by a problem set, numerous references for further reading, and tutorials on selected topics. Indeed, the extensive lists of references are a major strength of the book. Many topics are introduced in chapters as “Comments”. An Instructors' Supplement is available through the publisher to instructors who have chosen the book for class use.

Part II treats color and optical properties in a largely nonmathematical manner. In addition to the common absorption processes, it also deals with topics such as refraction, interference, light scattering, diffraction grating, and nonlinear optical effects. Part III is a largely traditional treatment of the thermal properties of matter. Part IV is a brief introduction to the electrical and magnetic properties of matter, including brief discussions of molecular metals and high T_c ceramic superconductors. Part V is a one chapter treatment of mechanical properties.

The level of the book is not specified by the author, although it may be reasonably assumed that it would be for advanced undergraduate students given the expectation of a background in the physical sciences. The lack of mathematics in

most of the book probably makes it unsuitable for most graduate courses. The book can probably be used successfully with advanced undergraduates or as a supplement to introductory physical chemistry courses.

While students can learn much from the material introduced as Comments or Tutorials, they will have to spend considerable time in either the review or original literature. For example, in the Comment on "New Directions in Light-Emitting Diodes" (p. 42), the reader is told that the color of CdSe nanocrystals can be changed from red to yellow by controlling the size of the nanocrystal and that this is a consequence of "quantum effects". However, the term Wannier exciton is not used and the nature of the relationship between nanocrystal size and color is not specified. In the Comment on "One Dimensional Conductors", a student might wonder how and why electron transfer occurs between TTF and TCNQ, why they form segregated stacks when other complexes form mixed stacks, and what are the consequences of the 0.59 electron transfer process.

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