Introduction to the Electronic Properties of Materials
David Jiles
(Chapman & Hall, 1994)
ISBN: 0-412-49580-5

The field of electronic materials is multidisciplinary in nature. Solid state physics provides the fundamentals while the understanding of the properties of the different materials are in the realm of materials science. The use and performance of the devices fabricated with these materials are related to electrical engineering. The aim of the book written by David Jiles, *Introduction to the Electronic Properties of Materials*, is to present these three aspects in a useful way for students in all of the corresponding disciplines. Bearing this idea, the book has been divided into three parts: "Fundamentals of Electrons in Materials," "Properties of Materials," and "Applications of Electronic Materials." The summary that precedes each chapter provides a concise overview of the chapter. Every section, in turn, is preceded by the main question that the section seeks to answer. The questions are relatively useful, though at times they are equivalent to a subtitle. I found that after reading a number of sections, I tended to skip them.

The first part dealing with fundamentals of electrons in materials is a well-balanced overview of the basic elements required to understand properties of these materials. The conclusions that end the chapters of this first part summarize well the properties that can be predicted with the models developed in the chapter. They also provide the driving force to go on to the next level of modeling complexity. The problems at the end of the chapters are mostly analytical and can help the student to become more familiar with the various concepts presented.

The electronic, electrical, thermal, optical, and magnetic properties of materials are developed in the second part of the book. The optical and magnetic properties of materials are particularly well-developed chapters. There are some weak points in the chapter on electronic properties of semiconductors, e.g., the definitions of intrinsic and extrinsic semiconductors. These are not the definitions commonly found in standard sophomore books on introduction to materials, and could lead to some confusion.

The third part of the book provides a comprehensive list of applications of electronic devices. The materials described in this third part include typical semiconductors, III-V and II-VI semiconducting compounds, conventional and high-temperature superconductors, material for magnetic recording, and materials for transducers and for radiation detection. There is also a good description of a variety of devices that includes light-emitting diodes, semiconductors lasers, liquid crystal displays, SQUIDs, and magnetic recording systems. The references for each of the subjects are fairly recent, the most recently referenced papers date back to 1992.

There is some amount of repetition of formulas and concepts, especially in the overlapping portions between the different parts of the book. For instance, Ohm's law is formulated in Chapters 1 and 8, and p-n junctions are discussed in Chapters 7

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and 11. Overall, this is a very good textbook for an undergraduate introductory course on electronic properties of materials. It can also be considered as a good starting point for more advanced texts.

Reviewer: Anthony J. Pedraza is a professor of materials science and engineering at the University of Tennessee. His current research interests include electronic packaging materials science, laser processing of materials, sputter deposition, phase transformations and solidification, radiation damage, amorphous metals, residual micro- and macrostresses, electrolytic and electroless metallic films, and x-ray diffraction.

Mathematical Techniques in Crystallography and Materials Science

E. Prince
(Springer-Verlag, 1994)
ISBN: 0387-5811-54

Mathematical Techniques in Crystallography and Materials Science treats the mathematical basis of crystallographic analysis, including linear algebra, point and space groups, vectors and tensors, data fitting, statistical analysis, crystal structure refinement, and fast Fourier transforms. The title notwithstanding, this book provides a fairly complete grounding in the mathematics of crystallography and little if any coverage of unrelated areas of materials science. This bias is foreshadowed by the misspelling of "materials" on the first page. While this book would be useful to a materials scientist seeking a better understanding of crystallography, it would not be of interest to a materials scientist working outside of crystallography. While the book assumes no mathematical knowledge beyond calculus (it begins by defining a matrix), the level of sophistication is appropriate to a graduate or post-graduate level. The notation is clear, and the derivations are easy to follow.

This is a small book covering a large subject. It is no replacement for more comprehensive references in numerical analysis and group theory. It may be useful for those who wish to understand some crystallographic techniques without knowing all the details, such as scientists who will use crystallographic software but do not need to write it, or those who need to understand the uncertainties quoted in another's crystallographic analysis. While it includes some valuable reference material such as character tables, those most likely to make use of this material would need a more comprehensive reference.

The coverage reflects some idiosyncracies of the author. It includes a detailed discussion of fast Fourier transforms, but entirely omits discussion of the mathematics of modern crystallographic techniques such as direct methods, anomalous scattering, and isomorphous replacement.

An appendix provides the listing of a number of Fortran programs. This strikes me as outdated. Some form of electronic distribution would eliminate the errors inherent in typing in the code.

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