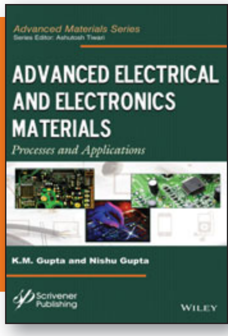


Advanced Electrical and Electronics Materials: Processes and Applications

K.M. Gupta and Nishu Gupta

Wiley-Scrivener, 2015
760 pages, $175.00 (e-book $140.99)
ISBN 978-1-118-99835-9

This book provides brief introductory overviews of electrical and electronic materials, with an intended audience of upper undergraduate and graduate students. It could serve either as a textbook or reference handbook. It is divided into 19 chapters, each with an average of 15 sections, and many more subsections. Many of the subsections are two pages or less, thus none of the topics are covered in depth. Consequently, some of the explanations can be incomplete and confusing. Much of the text is in the form of outlines, lists, and tables identifying the main characteristics of several materials, their functional dependencies (such as changes with temperature), and their virtues for specific applications.

The book includes many example problems and end of the chapter problems that could be assigned as homework in an introductory materials science course. These problems are divided among basic definitions, concepts, and short, simple numerical calculations such as calculating the wavelength produced by a semiconductor with a given energy bandgap.

There are figures on almost every page illustrating basic concepts. Most of the figures are of good quality and illustrate a significant concept, but some are dated (e.g., a desktop computer from circa 1995), some are not particularly informative (a photograph of the exterior of 11 DVD and television remote controls), and some are of poor quality.

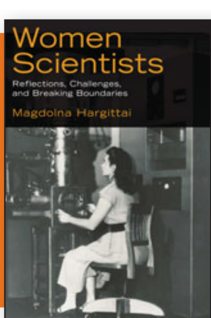
The authors frequently use vague, qualitative terms that are not defined in describing properties. For example, a favorable property of semiconductors is "they are much smaller in size." Presumably the authors are describing semiconductor devices, not the semiconductors themselves, but what they are being compared to is not clear. No context is given. As another example, the virtue of palladium as a contact metal, is that "it is cheap." The division between cheap and expensive is not defined. Perhaps it is less expensive than gold or platinum, but it is much more expensive than some of the other contact metals listed such as tungsten, molybdenum, and silver.

In other cases, the text is oddly specific. The coefficient of resistance for semiconductors is given as -4×10^{-6}/°C to 6×10^{-6}/°C without any clarification whether this is strictly for silicon or all semiconductors. There is some repetition as well (e.g., the Fermi–Dirac probability function is introduced in two places in the text, just three pages apart).

The section on Semiconductors is not up to date, as it focuses almost exclusively on silicon and gallium arsenide. Furthermore, the properties are presented without any context explaining that one type of material might be better or more favored than another. Specifically, in the past 20 years, silicon carbide and gallium nitride have become the dominant semiconductors for displays, lighting, and power devices, while progress on zinc selenide has waned.

In summary, even though this is a new book, several older textbooks cover the same topics more completely and provide better, more easily understood explanations of physics and chemistry. A good example is *Principles of Electronic Materials and Devices*, 2nd ed., by S.O. Kasap (McGraw-Hill, 2002).

Reviewer: J. H. Edgar *of the Department of Chemical Engineering, Kansas State University, USA.*



Women Scientists: Reflections, Challenges, and Breaking Boundaries

Magdolna Hargittai

Oxford University Press, 2015
384 pages, $29.95
ISBN 978-0-19-935998-1

The term "women in science" has long been associated with nonconformist women who use their unique and special qualities to surmount the mountains of science and then retain their footing in the largely male-dominated fields. But who are these women, and how do they actually see their careers? This question is asked and mostly answered in this book by Magdolna Hargittai, research professor of structural chemistry at the Budapest University of Technology and Economics. The book captures 60 of her approximately 100 interviews with female scientists who hold or have held high positions in science and administration, but also includes some with more ordinary scientific careers. Hargittai has been dedicated to interviewing both male and female scientists for years, and this book is the compilation of her research and visits with women in the United States and Europe, plus Russia, Turkey, and India—countries whose women of science she felt are underrepresented.

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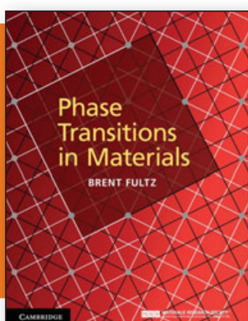
Some of the women are famous scientists in their own right; others contributed to partnerships with their husbands; and others hold or have held administrative positions leading major universities, hospitals, or scientific organizations. Unsurprisingly, most of the women tell similar stories of having strong mentors, a passion for science, and a willingness to work very hard.

Each interview is short, on average about four pages, and includes a brief description of the scientist's technical work and achievements. In Hargittai's interviews, she asks the scientists, "How did you balance having a family and children with your demanding job?"—a question rarely asked of men, and cautiously asked of women. The interviews left me satisfied that there is no inherent conflict with women being scientists while also having rich family lives.

The text is straightforward and analytical, as might be expected from a work authored by a research scientist. As a result, the book reads as a history book with its factual information and life details. The women, therefore, come across as veterans rather than role models. The stories are upbeat and inspirational, with no complaints about the Nobel prizes they should have won or workplace hazards, such as sexual harassment. The only shortcoming of the book is that Hargittai draws no strong conclusions from the summary of the interviews, leaving the reader craving her perspective on how these women fit into a broader picture of history and science. This book will be of interest to both upcoming and established women in science, their children and families, as well as historians.

Reviewer: Karen Swider Lyons *researches fuel-cell and battery materials and their integration into naval systems in Alexandria, Va., USA.*



Phase Transitions in Materials
Brent Fultz

Materials Research Society and Cambridge University Press, 2014
583 pages, $105.00 (e-book $84.00)
ISBN 9781107067240

This book is clear and well written. It covers most of the topics in phase transitions, and explains thermal dynamics and kinetics in materials science and condensed-matter physics. Readers will be exposed to many topics ranging from classical metallurgy to quantum phase transitions. The scope of the book may be a little too broad for some readers, although there is enough depth for advanced researchers. Readers will fully appreciate the typical treatise in phase transitions and the critical phenomena.

At the beginning of each section/chapter, there is a brief recap of each topic. These reviews are easy to understand without any formulas or equations. This will help readers to get an overall picture of the topics without being lost in the mathematics, which are discussed in more detail later in the chapter. For experimentalists who are interested in phase transitions and their atomic-scale origins, parts I and II, and some topics in part III, should be sufficient. Theorists may be more interested in the advanced topics such as scaling and renormalization group theory. Many of the figures in the book are taken from state-of-the-art equipment, such as atom probe tomography and high-resolution electron microscopy, which directly link theories to experiments. This provides a lucid picture to help readers understand and apply the theory in their research.

Considering the range of topics covered in this book, step-by-step mathematical derivations are not necessary. Critical steps in the derivations are given with the meanings and limits of the formulae delineated. Brief explanations and derivations are provided for key equations from statistical physics and solid-state physics. In order to derive the spinodal decomposition model from the Taylor expansion of free energy, the author presents a detailed explanation of the decomposition process and its requirement on the mathematical form of the model. In particular, it is clearly explained why the square of the composition gradient is necessary in the final form of the model. These preparations make it easy to understand the mathematical derivations of the model and the Cahn–Hilliard equation.

An introduction to magnetism is included before the discussion of magnetic phase transition, covering most of the major topics in ferromagnetism. These introductions are brief, which is understandable considering the number of topics covered in this book. As a textbook, it is more suitable for upper-level undergraduate or graduate students in physics and materials science given the extent of the prerequisite knowledge in physics and materials science. A selection of problems is posed at the end of each chapter.

For graduate students, this can be used as a two-semester textbook, with the first semester covering parts I and II, and the second semester covering some selected topics in parts III and IV. Although the author uses this in a one-quarter graduate-level course at the California Institute of Technology, he indicates that only parts I and II are covered in detail, with selections from parts III and IV. Squeezing most of the topics into one semester would likely be too much of a stretch for most students.

Reviewer: Wanfeng Li *is a research engineer of Research & Advanced Engineering, Ford Motor Co., USA.*

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