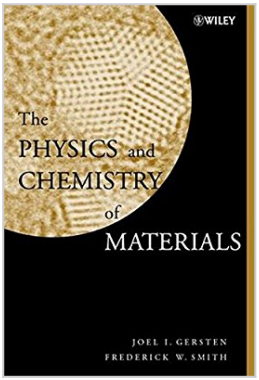

The Physics and Chemistry of Materials

By Joel I. Gersten, Frederick W. Smith

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A comprehensive introduction to the structure, properties, and applications of materials
This title provides the first unified treatment for the broad subject of materials. Authors Gersten and Smith use a fundamental approach to define the structure and properties of a wide range of solids on the basis of the local chemical bonding and atomic order present in the material. Emphasizing the physical and chemical origins of material properties, the book focuses on the most technologically important materials being utilized and developed by scientists and engineers.
Appropriate for use in advanced materials courses, The Physics and Chemistry of Materials provides the background information necessary to assimilate the current academic and patent literature on materials and their applications. Problem sets, illustrations, and helpful tables complete this well-rounded new treatment.
Five sections cover these important topics:
* Structure of materials, including crystal structure, bonding in solids, diffraction and the reciprocal lattice, and order and disorder in solids
* Physical properties of materials, including electrical, thermal, optical, magnetic, and mechanical properties
* Classes of materials, including semiconductors, superconductors, magnetic materials, and optical materials in addition to metals, ceramics, polymers, dielectrics, and ferroelectrics
* A section on surfaces, thin films, interfaces, and multilayers discusses the effects of spatial discontinuities in the physical and chemical structure of materials
* A section on synthesis and processing examines the effects of synthesis on the structure and properties of various materials

The Physics and Chemistry of Materials is a complete introduction to the structure and properties of materials for students and an excellent reference for scientists and engineers.

*An Instructor's Manual presenting detailed solutions to all the problems in the book is available from the Wiley editorial department.

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Editorial Review

Review
"This text...defines the structure and properties of a range of solids on the basis of the local chemical bonding and atomic order present in the material." (*SciTech Book News*, Vol. 25, No. 4, December 2001)

"To capture the essence of this vast subject in any detail is a difficult undertaking in one single book, but on the whole I believe that the authors have succeeded." (*Chemistry in Britain*, February 2002)

"...a fine addition to the library of material science.... Highly recommended..." (*Choice*, Vol. 39, No. 8, April 2002)

"...we clearly need a textbook that combines an authoritative treatment of the issues with broad scope, appropriate journal coverage, clarity, integrated notation, and continuity. Joel I. Gersten and Frederick W. Smith have worked hard on this problem and have solved it in an exemplary and remarkably efficient fashion; their The Physics and Chemistry of Materials is...a wonderful book." (*Physics Today*, July 2002)

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In their preface, the authors discuss the need for a textbook that ?emphasizes the physical and chemical origins of the properties of solids while . . . focusing on the technologically important materials that are being developed and used by scientists and engineers.? They declare their intent to ?bring the science of materials closer to technology than is done in most traditional books on solid-state physics . . . [stressing] properties and their interpretation and [avoiding] the development of formalism for its own sake.? And they designed their book so that, "the range of topics covered is comprehensive but not exhaustive . . . much more material is presented than can be covered in a one semester course." All of these statements of intent are borne out by the text. In its 826 pages, the book does a remarkable job of covering five major topics: structure, physical properties, classes, synthesis, and processing of materials; surfaces; thin films; interfaces; and multilayers. The text is divided into 22 chapters that present clearly and authoritatively the appropriate qualitative descriptions, mathematical developments, conceptual notions, notations, and formulas.
The book contains all the resources that an excellent textbook should have but many modern ones do not. These resources include extensive tables and data, two excellent indices that make the book useful as a reference as well as a text, clear illustrations, and a set of problems that focus on fundamentals rather than simple mathematics or plug-in exercises.
A Web site associated with the book contains further extended discussions of some major points, including the description of additional materials properties and examples of current applications. The Web site also offers experimental techniques and appendices on thermodynamics, statistical mechanics, and quantum mechanics.
Although The Physics and Chemistry of Materials is intended as a textbook, it is one of the few books that I will actually make space for on my desk, because of its very broad coverage and remarkably focused discussion of so many topics. The next time I need to be reminded of what the Poole?Frenkel effect is, or what the fundamental microscopic basis for plasticity is, or which polymers are piezoelectric, this book is the place to find the description at the right level, along with some physical examples and leading references.

There are a few things missing even in this exemplary treatment. As the authors themselves point out, the treatment of biomaterials and composites is quite short. Indeed, of the classical aspects of materials science, ceramics clearly gets less emphasis here than do metals and polymers. Some modern topics that one might have expected to find, such as organic light-emitting diodes and conductive polymers, are absent. The book does not point to answers to the problems.
These, though, are minor quibbles. I find this book a delight: its clarity is matched only by its broad scope and remarkable utility. While the cost is high, elementary text-books for first-year students are roughly in the same cost range. And this book (unlike many classroom texts) will remain very useful long after the course ends. (*PHYSICS TODAY*)
Authors note: The topics of electrical conductivity of polymers and organic light emitting diodes are covered in the web supplement to the text in sections W14.7 and W20.7 respectively.

"...an excellent text for advanced students and an excellent reference for more experienced chemists.... Its range of coverage...is certainly unmatched." (*Journal of Chemical Education*, Vol. 80, No. 4, April 2003)

"...a wonderful text...strongly recommended..." (*Materials & Manufacturing Processes*, Vol. 17, No. 1, 2002)

From the Back Cover
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This book is enhanced by a Web-based supplement that offers advanced material together with an entire electronic chapter on the characterization of materials. The Physics and Chemistry of Materials is a complete introduction to the structure and properties of materials for students and an excellent reference for scientists and engineers.

About the Author
JOEL I. GERSTEN, PhD, and FREDERICK W. SMITH, PhD, are professors in the Department of Physics

at The City College of the City University of New York.

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