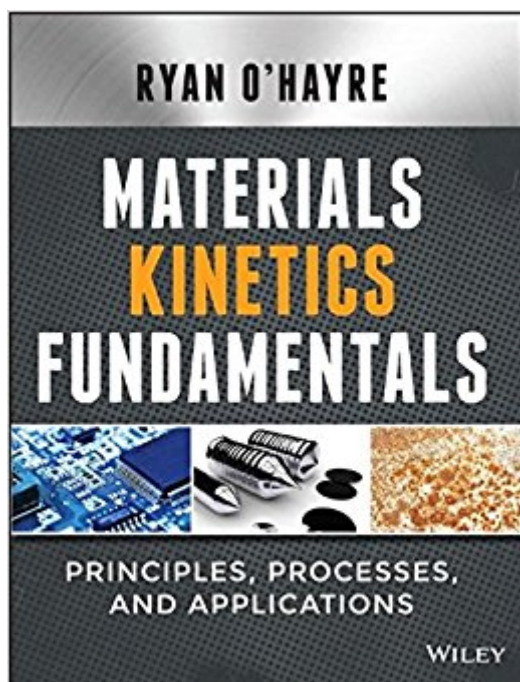


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# Materials Kinetics Fundamentals



## Synopsis

Introductory kinetics for the undergrad materials scientist *Materials Kinetics Fundamentals* is an accessible and interesting introduction to kinetics processes, with a focus on materials systems. Designed for the undergraduate student, this book avoids intense mathematics to present the theory and application of kinetics in a clear, reader-friendly way. Students are first introduced to the fundamental concepts of kinetics, with illustrated diagrams, examples, text boxes, and homework questions that impart a unified, intuitive understanding. Further chapters cover the application of these concepts in the context of materials science, with real-world examples including silicon processing and integrated circuit fabrication, thin-film deposition, carbon-14 dating, steel degassing, energy conversion, and more. Instructor materials including PowerPoint presentations, a test bank, and more are available through the companion website, providing a complete resource for the undergraduate materials science student. At its core, kinetics deals with rates, telling us how fast something will take place – for example, how fast water will evaporate, or how fast molten silicon will solidify. This book is designed to provide students with an introduction to kinetics' underlying principles, without rigorous math to distract from understanding. Understand universally important kinetic concepts like diffusion and reaction rate Model common kinetic processes both quantitatively and qualitatively Learn the mechanisms behind important and interesting materials systems Examine the behaviors, properties, and interactions of relevant solid materials There are a large number of books on chemical kinetics, but there are far fewer that focus on materials kinetics, and virtually none that provide an accessible, introductory-level treatment of the subject. *Materials Kinetics Fundamentals* fills that need, with clear, detailed explanations of these universal concepts.

## Book Information

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## Customer Reviews

THE FIRST ACCESSIBLE TEXTBOOK ON THE KINETICS OF MATERIALS Until now, a straightforward introduction to the fundamental concepts and principles underlying kinetic processes in materials systems has been missing from available literature. This textbook explores the essential kinetics concepts and applications necessary for more advanced studies in engineering and materials science. Part I is devoted to a basic treatment of critical kinetic concepts such as diffusion and reaction rate theory, essential thermodynamics, and chemical reaction kinetics. Illustrated diagrams, examples, textboxes, and homework questions impart a unified, intuitive understanding of these essentials, creating the groundwork for application. Part II builds upon this foundation, showing how to apply the basic tool developed in Part I to qualitatively and quantitatively model common kinetic processes relevant to materials science and engineering. Topics explored include gas-solid kinetic processes, liquid-solid and solid-solid phase transformations, and microstructural evolution. Throughout the book, real-world examples illustrate the application of kinetic principles to important materials systems. These include silicon processing and integrated circuit fabrication, gas transport through membranes, thin-film deposition, sintering, oxidation, carbon-14 dating, nucleation and growth, steel degassing, and kinetic aspects of energy conversion devices like fuel cells and batteries. Each chapter features exercises designed to further illustrate the concepts for greater understanding.

RYAN O'HAYRE, Ph.D., is Professor of Metallurgical and Materials Engineering at the Colorado School of Mines, where he directs the Advanced Energy Materials Laboratory, a developer of new materials and devices to enable alternative energy technologies including fuel cells and solar cells. He received his Ph.D. in materials science and engineering from Stanford University.

Dr. O'Hayre's textbook is the best textbook I have used in my coursework thus far. Reading the textbook before tests helped me learn more than any other textbook i have read. Wording was concise and clear on all accounts. Pictures were well drawn and added to my understanding greatly. the worked problems are absolutely clear and the presentation of new and difficult subjects is clean and well thought out. I would highly recommend this textbook to any students studying materials science/engineering or any students enrolled in a materials kinetics course. the explanations afforded by this textbook were incredibly valuable to my learning. This textbook blurs the line of

reading for academic purposes and reading for pleasure, the short 250 page book includes all that is needed for undergraduate kinetics courses and is incredibly easy to read and use.

This book breaks everything down nicely. I read the whole thing and it really helped me to be successful in the class

I was the instructor for a Kinetics of Materials course, and used this book as my required text. I found it to be a great book for use at the undergraduate level, with clear, adequate explanations. As a faculty member interested in pedagogy, it was refreshing to see the learning objectives clearly stated at the beginning of the book and the review questions included in the problem section. When it came time for my students to study for their exam, I was able to point them to these sections to highlight the key points. The problems at the end of each chapter include conceptual questions as well as mathematical, problem-based questions. Furthermore, there were very few typos or errors, even though it was the first print edition. I plan to use it again next year.

Absolutely great textbook that I used for my materials kinetics class. Very easy and clear reading posed in an organized manner, it did a fantastic job to complement the material that was taught in class. I really like the quick review of thermodynamics and all of the applications of materials kinetics found throughout the textbook as well. I very rarely read textbooks, but I actually enjoyed reading this one from cover to cover. I will be keeping this book as a reference in the future!

Having this book was a really great tool for learning materials kinetics. The reading was very understandable and helpful and allowed me to learn the material with ease, especially with all of the practice problems available to help ensuring understanding of the concepts. This book also has a lot of real world examples available to help explain the concepts being taught and are very interesting to read about especially when you are learning what drives these processes.

Dr. O'Hayre's textbook was an invaluable resource for understanding how things happen. From simple thermodynamics to complex transient spherical diffusion, the topics are well explained in a concise manner.

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