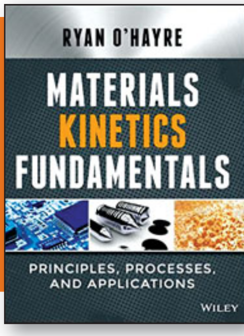



## Materials Kinetics Fundamentals: Principles, Processes, and Applications

Ryan O'Hayre

Wiley, 2015
312 pages, $115.00 (e-book $92.99)
ISBN 978-1-118-97289-2

O'Hayre's textbook on materials kinetics serves as a concise introduction to the topic. The book is intended for use in a third- or fourth-year undergraduate class, and is well suited both in terms of the depth of topical coverage as well as writing style that maintains student interest. The writing style is somewhat less formal than in other textbooks on this topic, and more complicated math is often skipped in the interest of moving more quickly to practical outcomes. In addition, the book continually ties fundamental concepts to a range of applications. At the end of each chapter are a brief summary and a short list of questions that could be assigned as homework.

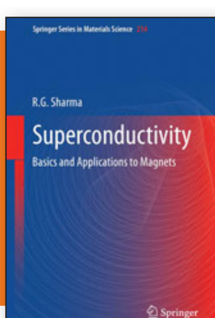
The book is split roughly in half. The first half, "Kinetic Principles," begins with two chapters that introduce the topic of materials kinetics and then review the foundational thermodynamics. The principles that are reviewed include thermodynamic potentials, reaction equilibrium constants, and calculations of various units of concentration. This review might be unnecessary in a curriculum that offers thermodynamics and kinetics in a well-integrated sequence.

The heart of the first half comes in the next two chapters. Chapter 3 discusses chemical kinetics, starting with zero-, first-, and second-order homogeneous reactions and then moving to heterogeneous reactions. Chapter 4 discusses transport kinetics. Continuum approaches are given first, with content centered on Fick's first and second laws. Next, atomistic approaches are summarized, largely to show how diffusivities can be derived from first principles in ideal gases and solids.

The book's second half is entitled "Applications of Materials Kinetics," and consists of three chapters. Chapter 5 deals with kinetics at the gas–solid interface, including adsorption, gaseous corrosion, and various thin-film deposition methods. Chapter 6 discusses phase transformations, solidification, nucleation, and growth. Finally, a brief chapter 7 considers microstructural evolution. Of the book's little more than 100 figures, there is a much greater density of them in this second half.

The writing style, figures, and worked examples are consistently good and will appeal to undergraduates. There are numerous asides that add depth and interest to the topics. For example, snowpack evolution and avalanches are used to highlight the effects of gas–solid kinetics. If the book has a fault, it is that it can be a bit too brief. The microstructural evolution chapter, in particular, could have more extended discussion. The book seems about the right length for a one-semester undergraduate course if the instructor chooses to focus on only the topics given here. Instructors who may wish to branch out to other topics or take some of the included topics to more depth may find some aspects lacking. This textbook is non-intimidating and focuses on the many aspects of materials (and not just chemical or physical) kinetics. I would recommend a graduate student in materials science to start with a more rigorous text, provided that their undergraduate background was in chemistry, physics, or other aligned field.

***Reviewer: Joshua Hertz** is an assistant teaching professor in the College of Engineering, Northeastern University, USA.*




## Superconductivity: Basics and Applications to Magnets

R.G. Sharma

Springer, 2015
414 pages, $179.00 (e-book $139.00)
ISBN 978-3-319-13712-4

This is an excellent book for young researchers who want to get a clear knowledge about low-temperature measurements and experimental techniques, magnetic applications, and superconductivity. The most attractive aspect of this book is that it covers the basic phenomenon of low-temperature physics, magnetism, and superconductivity with the help of a combined experimental and theoretical approach with very clear illustrations in 10 chapters.

The first chapter gives a brief introduction about how to liquefy gases and achieve low temperatures to pK with pictorial representation of experimental setups and different processes (Linde–Hampson liquefaction cycle to the recent developments in achieving low temperatures with Kamerlingh Onnes's success story of liquefying helium and the discovery of superconductivity). Phenomena and the physical properties of superconducting materials, as well as the utilization of such phenomena to make superconducting devices, are discussed clearly in chapter 2. Basic concepts such as the Meissner effect, energy gap, and flux quantization are also covered. The occurrence of Type II superconductivity in alloys and compounds is explained, starting with Abrikosov's concept in chapter 3. Chapter 4 gives an overview of cuprate superconductors starting with the very first superconductor Y-Ba-Cu-O and different families of