

1. Record Nr.	UNINA9911018829503321
Autore	Balluffi R. W
Titolo	Kinetics of materials // Robert W. Balluffi, Samuel M. Allen, W. Craig Carter ; with editorial assistance from Rachel A. Kemper
Pubbl/distr/stampa	Hoboken, N.J., : J. Wiley & Sons, 2005
ISBN	9786610288137 9781280288135 1280288132 9780470302163 047030216X 9780471749318 0471749311 9780471749301 0471749303
Descrizione fisica	1 online resource (673 pages)
Altri autori (Persone)	AllenSamuel M CarterW. Craig KemperRachel A
Disciplina	620.1/1292
Soggetti	Materials - Mechanical properties Materials science
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	"Wiley-Interscience."
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	CONTENTS; Preface; Acknowledgments; Notation; Symbols-Roman; Symbols-Greek; 1 Introduction; 1.1 Thermodynamics and Kinetics; 1.1.1 Classical Thermodynamics and Constructions of Kinetic Theories; 1.1.2 Averaging; 1.2 Irreversible Thermodynamics and Kinetics; 1.3 Mathematical Background; 1.3.1 Fields; 1.3.2 Variations; 1.3.3 Continuum Limits and Coarse Graining; 1.3.4 Fluxes; 1.3.5 Accumulation; 1.3.6 Conserved and Nonconserved Quantities; 1.3.7 Matrices, Tensors, and the Eigensystem; Bibliography; Exercises; PART I MOTION OF ATOMS AND MOLECULES BY DIFFUSION 2 Irreversible Thermodynamics: Coupled Forces and Fluxes 2.1 Entropy and Entropy Production; 2.1.1 Entropy Production; 2.1.2 Conjugate

Forces and Fluxes; 2.1.3 Basic Postulate of Irreversible Thermodynamics; 2.2 Linear Irreversible Thermodynamics; 2.2.1 General Coupling between Forces and Fluxes; 2.2.2 Force-Flux Relations when Extensive Quantities are Constrained; 2.2.3 Introduction of the Diffusion Potential; 2.2.4 Onsager's Symmetry Principle; Bibliography; Exercises; 3 Driving Forces and Fluxes for Diffusion; 3.1 Concentration Gradients and Diffusion  
 3.1.1 Self-Diffusion: Diffusion in the Absence of Chemical Effects  
 3.1.2 Self-Diffusion of Component  $i$  in a Chemically Homogeneous Binary Solution; 3.1.3 Diffusion of Substitutional Particles in a Chemical Concentration Gradient; 3.1.4 Diffusion of Interstitial Particles in a Chemical Concentration Gradient; 3.1.5 On the Algebraic Signs of Diffusivities; 3.1.6 Summary of Diffusivities; 3.2 Electrical Potential Gradients and Diffusion; 3.2.1 Charged Ions in Ionic Conductors; 3.2.2 Electromigration in Metals; 3.3 Thermal Gradients and Diffusion; 3.4 Capillarity and Diffusion  
 3.4.1 The Flux Equation and Diffusion Equation  
 3.4.2 Boundary Conditions; 3.5 Stress and Diffusion; 3.5.1 Effect of Stress on Mobilities; 3.5.2 Stress as a Driving Force for Diffusion: Formation of Solute-Atom Atmosphere around Dislocations; 3.5.3 Influence of Stress on the Boundary Conditions for Diffusion: Diffusional Creep; 3.5.4 Summary of Diffusion Potentials; Bibliography; Exercises; 4 The Diffusion Equation; 4.1 Fick's Second Law; 4.1.1 Linearization of the Diffusion Equation; 4.1.2 Relation of Fick's Second Law to the Heat Equation  
 4.1.3 Variational Interpretation of the Diffusion Equation  
 4.2 Constant Diffusivity; 4.2.1 Geometrical Interpretation of the Diffusion Equation when Diffusivity is Constant; 4.2.2 Scaling of the Diffusion Equation; 4.2.3 Superposition; 4.3 Diffusivity as a Function of Concentration; 4.4 Diffusivity as a Function of Time; 4.5 Diffusivity as a Function of Direction; Bibliography; Exercises; 5 Solutions to the Diffusion Equation; 5.1 Steady-State Solutions; 5.1.1 One Dimension; 5.1.2 Cylindrical Shell; 5.1.3 Spherical Shell; 5.1.4 Variable Diffusivity; 5.2 Non-Steady-State Diffusion  
 5.2.1 Instantaneous Localized Sources in Infinite Media

---

## Sommario/riassunto

A classroom-tested textbook providing a fundamental understanding of basic kinetic processes in materials. This textbook, reflecting the hands-on teaching experience of its three authors, evolved from Massachusetts Institute of Technology's first-year graduate curriculum in the Department of Materials Science and Engineering. It discusses key topics collectively representing the basic kinetic processes that cause changes in the size, shape, composition, and atomistic structure of materials. Readers gain a deeper understanding of these kinetic processes and of the properties and applicati

---