Kinetics, Transport, and Structure in Hard and Soft Materials

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Kinetics, Transport, and Structure in Hard and Soft Materials is the only single reference that discusses the connection between structure and mechanisms of atomic or molecular transport in different classes of materials, from metals and semiconductors to network glasses, polymers and supercooled liquids.

Divided into four parts, **Part I** begins with a discussion the fundamentals of transport, wherein transport properties of a system of non-interacting particles are calculated and the phenomenon of Brownian motion introduced. The phenomenology of diffusion is also discussed wherein Fick's laws are introduced and solved for a range of practical cases involving mass transport. Elementary Statistical mechanics, involving Partition functions, probability distribution functions and correlation functions, is discussed to lay the foundation for the subsequent discussion of mechanisms of transport in different materials. **Parts II and III** focus on mechanisms of transport in crystalline materials and in structurally disordered materials. Chapters explain how the mechanism of diffusional transport of an atom or molecule is intimately connected to the spatial organization of neighboring structural elements and to its interactions with them. The book reviews factors that control temperature dependent long-range dynamics of glass-forming systems. Diffusion and viscoelasticity of polymer melts, transport (viscous flow and ionic diffusion) in inorganic network glasses, and dynamic heterogeneity in super cooled liquids are described. **Part IV** analyzes the development of instabilities, such as spinodal decomposition and Mullins-Sekerka instabilities, which lead to the morphological evolution of materials.

Kinetics, Transport, and Structure in Hard and Soft Materials emphasizes interdisciplinary nature of transport in materials, presenting its material in a user-friendly format for students from any discipline with a foundation in elementary differential equations and thermodynamics or physical chemistry. This book shows how transport processes in materials are fundamentally connected a wide range of innovative applications of materials across several industries.

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