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Parts II and III are concerned with applications of the fundamentals in transport phenomena occurring in manufacturing and materials processing, respectively. Emphasis has been placed on common aspects of both disciplines, such as forming, machining, welding, casting, injection molding, surface processes, heating and cooling, solidification, crystal growth and diffusion.

This text provides a teachable and readable approach to transport phenomena (momentum, heat, and mass transport) by providing numerous examples and applications, which are particularly important to metallurgical, ceramic, and materials engineers. Because the authors feel that it is important for students and practicing engineers to visualize the physical situations, they have attempted to lead the reader through the development and solution of the relevant differential equations by applying the familiar principles of conservation to numerous situations and by including many worked examples in each chapter. The book is organized in a manner characteristic of other texts in transport phenomena. Section I deals with the properties and mechanics of fluid motion; Section II with thermal properties and heat transfer; and Section III with diffusion and mass transfer. The authors depart from tradition by building on a presumed understanding of the relationships between the structure and properties of matter, particularly in the chapters devoted to the transport properties (viscosity, thermal conductivity, and the diffusion coefficients). In addition, generous portions of the text, numerous examples, and many problems at the ends of the chapters apply transport phenomena to materials processing.

An extremely useful guide to the theory and applications of transport phenomena in materials processing This book defines the unique role that transport phenomena play in materials processing and offers a graphic, comprehensive treatment unlike any other book on the subject. The two parts of the text are, in fact, two useful books. Part I is a very readable introduction to fluid flow, heat transfer, and mass transfer for materials engineers and anyone not yet thoroughly familiar with the subject. It includes governing equations and boundary conditions particularly useful for studying materials processing. For mechanical and chemical engineers, and anyone already familiar with transport phenomena, Part II covers the many specific applications to materials processing, including a brief description of various materials processing technologies. Readable and unencumbered by mathematical manipulations (most of which are allocated to the appendixes), this book is also a useful text for upper-level undergraduate and graduate-level courses in materials, mechanical, and chemical engineering. It includes hundreds of photographs of materials processing in action, single and composite figures of computer simulation, handy charts for problem solving, and more. Transport Phenomena and Materials Processing: Describes eight key materials processing technologies, including crystal growth, casting, welding, powder and fiber processing, bulk and surface heat treating, and semiconductor device fabrication Covers the latest advances in the field, including recent results of computer simulation and flow visualization Presents special boundary conditions for transport phenomena in materials processing Includes charts that summarize commonly encountered boundary conditions and step-by-step procedures for problem solving Offers a unique derivation of governing equations that leads to both overall and differential balance equations Provides a list of publicly available computer programs and publications relevant to transport phenomena in materials processing

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Motivated by international competition and an easy access to high-speed computers the manufacturing and materials processing industry has seen many changes in recent times. New techniques are constantly being developed based on a broad range of basic sciences including physics, chemistry and particularly thermal-fluids sciences and kinetics. In order to produce and treat massive products, the industry is also in need of a very wide range of engineering knowledge and skill for integrating metallurgy, mechanics, electricity, transport phenomena, instrumentation and computer control. This monograph covers a part of these demands, namely by presenting the available knowledge on transport phenomena in manufacturing and materials processing. It is divided into four parts. Part I deals with the fundamentals of transport phenomena, including the transfer of momentum, energy, mass, electric and magnetic properties. Parts II and III are concerned with applications of the fundamentals in transport phenomena occurring in manufacturing and materials processing, respectively. Emphasis has been placed on common aspects of both disciplines, such as forming, machining, welding, casting, injection molding, surface processes, heating and cooling, solidification, crystal growth and diffusion. Part IV deals with beam technology and microgravity, two topics of current importance.

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This book presents the basic theory and experimental techniques of transport phenomena in materials processing operations. Such fundamental knowledge is highly useful for researchers and engineers in the field to improve the efficiency of conventional processes or develop novel technology. Divided into four parts, the book comprises 11 chapters describing the principles of momentum transfer, heat transfer, and mass transfer in single phase and multiphase systems. Each chapter includes examples with solutions and exercises to facilitate students' learning. Diagnostic problems are also provided at the end of each part to assess students' comprehension of the material. The book is aimed primarily at students in materials science and engineering. However, it can also serve as a useful reference text in chemical engineering as well as an introductory transport phenomena text in mechanical engineering. In addition, researchers and engineers engaged in materials processing operations will find the material useful for the design of experiments and mathematical models in transport phenomena. This volume contains unique features not usually found in traditional transport phenomena texts. It integrates experimental techniques and theory, both of which are required to adequately solve the inherently complex problems in materials processing operations. It takes a holistic approach by considering both single and multiphase systems, augmented with specific practical examples. There is a discussion of flow and heat transfer in microscale systems, which is relevant to the design of modern processes such as fuel cells and compact heat exchangers. Also described are auxiliary relationships including turbulence modeling, interfacial phenomena, rheology, and particulate systems, which are critical to many materials processing operations.

Proceedings of the November 1996 symposium which included sessions on thermal transport in laser-materials interactions, laser-materials processing, transport phenomena in crystal growth, solidification, and melting, transport phenomena in manufacturing and materials processing, and multiphase flow

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