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Fundamentals of Solidification Fundamentals of Solidification Solutions Manual to Accompany Fundamentals of Solidification Fundamentals of Solidification 5th Edition Fundamentals of Solidification Solutions Manual Symposium on Fundamentals of Solidification Symposium on Fundamentals of Solidification Fundamentals of Solidification and Crystal Growth Fundamentals of Solidification Shrinkage Void Formation Several Papers from the Symposium on the Fundamentals of Solidification and Crystal Growth Held at the University of Pittsburgh on 22-24 February 1987 Fundamentals of Alloy Solidification Applied to Industrial Processes Fundamentals of Rapid Solidification Processes Solidification and Crystallization Processing in Metals and Alloys Elements of Rapid Solidification Fundamentals of Alloy Solidification Applied to Industrial Processes Fundamentals of Alloy Solidification Applied to Industrial Processes The Fundamentals of Molten Microdrop Deposition and Solidification Solidification Rapidly Solidified Alloys Science and Engineering of Casting Solidification Fundamentals of Alloy Solidification Applied to Industrial Processes Principles of Solidification Solidification and Solid-State Transformations of Metals and Alloys Solidification Processing Solidification Theory of Solidification Science and Engineering of Casting Solidification, Second Edition Phase Transformation in Metals Physical Metallurgy of Direct Chill Casting of Aluminum Alloys Fundamentals of Aluminium Metallurgy Phase Diagrams Fundamentals of Phase Change Micromechanical study on the deformation behaviour of directionally solidified NiAl-Cr eutectic composites Physical Metallurgy Perspectives in Fluid Dynamics Shape Casting Modeling for Casting and Solidification Processing Materials Processing Fundamentals 2020 Fundamentals of Metal Casting

Solidification and Solid-State Transformations of Metals and Alloys describes solidification and the industrial problems presented when manufacturing structural parts by casting, or semi-products for forging, in order to obtain large, flat or specifically shaped parts. Solidification follows the nucleation and growth model, which will also be applied in solid-state transformations, such as those taking place because of changes in solubility and allotropy or changes produced by recrystallization. It also explains the heat treatments that, through controlled heating, holding and cooling, allow the metals to have specific structures and properties. It also describes the correct interpretation of phase diagrams so the reader can comprehend the behaviour of iron, aluminium, copper, lead, tin, nickel, titanium, etc. and the alloys between them or with other metallic or metalloid elements. This book can be used by graduate and undergraduate students, as well as physicists, chemists and engineers who wish to study the subject of Metallic Materials and Physical Metallurgy, specifically industrial applications where casting of metals and alloys, as well as heat treatments are relevant to the quality assurance of manufacturing processes. It will be especially useful for readers with little to no knowledge on the subject, and who are looking for a book that addresses the fundamentals of manufacturing, treatment and properties of metals and alloys. Uses theoretical formulas to obtain realistic data from industrial operations Includes detailed explanations of chemical, physical and thermodynamic phenomena to allow for a more accessible approach that will appeal to a wider audience Utilizes micrographs to illustrate and demonstrate different solidification and transformation processes Since the 4th 1998 edition, there have been numerous crucial advances to the modelling and the basic understanding of solidification phenomena, and with its linking to experimental results. These topics have been incorporated into this 5th Fully Revised Edition, as well as a new final chapter on microstructure selection which explains how to combine the concepts of the preceding chapters for modelling real microstructures, in complex processes such as additive manufacturing. With its numerous new topics - also borne out by the new

authorship - students and teachers, scientists and engineers will greatly benefit from this new book. The topics are presented in the same praised manner as in previous editions, readable at three levels: - an initial feel for the subject is obtained by consulting the figures and their detailed captions; - a deeper understanding of the underlying physics is found by working through the main text; - 15 appendices offer a detailed analysis of the various theories, by providing detailed derivations of the relevant equations. Particularly Novel: the final chapter 8 on microstructure-selection explains how to combine the concepts of the preceding chapters to model the real microstructures formed during complex processes such as additive manufacturing, and the new detailed phase-field appendix which opens the door to the accurate computer-modelling of growth-forms. This new 5th edition is of high interest to undergraduate and graduate levels and professionals. For orders you are welcome to download the Order Form. Solidification and Crystallization Processing in Metals and Alloys Hasse Fredriksson KTH, Royal Institute of Technology, Stockholm, Sweden Ulla Åkerlind University of Stockholm, Sweden Solidification or crystallization occurs when atoms are transformed from the disordered liquid state to the more ordered solid state, and is fundamental to metals processing. Conceived as a companion volume to the earlier works, Materials Processing during Casting (2006) and Physics of Functional Materials (2008), this book analyzes solidification and crystallization processes in depth. Starting from the thermodynamic point of view, it gives a complete description, taking into account kinetics and mass transfer, down to the final structure. Importantly, the book shows the relationship between the theory and the experimental results. Topics covered include: Fundamentals of thermodynamics Properties of interfaces Nucleation Crystal growth - in vapours, liquids and melts Heat transport during solidification processes Solidification structures - faceted, dendritic, eutectic and peritectic Metallic glasses and amorphous alloy melts Solidification and Crystallization Processing in Metals and Alloys features many solved examples in the text, and exercises (with answers) for students. Intended for Masters and PhD students as well as researchers in Materials Science, Engineering, Chemistry and Metallurgy, it is also a valuable resource for engineers in industry. Elements of Rapid Solidification: Fundamentals and Applications is the product of many years of concentrated work in the field of rapid solidification and processing. This quasi-monograph is unique in two ways. It brings together the talent of many international scientists in an effort to focus attention on all aspects of a new scientific field and it concentrates on fundamentals and practical applications. Simply stated, this book has been written by the senior students in the field of rapid solidification technology for the new generation of solid-state physicists, materials scientists, materials engineers, metallurgists and ceramicists. Now available in paperback, this wide-ranging text on modern fluid mechanics research includes sections on modelling the environment, physiology and magnetohydrodynamics. At the same time, the book discusses basic physical phenomena such as turbulence that still present fundamental challenges. Conventional textbooks cannot hope to give graduate students more than an inkling of what topics are currently being researched, or how to make a choice between them. This book aims to rectify matters, at least in part. It consists of eleven chapters that each introduces a different branch of the subject. Though not exhaustive, the coverage is broad: thin-film flows, Saffman-Taylor fingering, flows in arteries and veins, convective and absolute instabilities, turbulence, natural convection, magnetohydrodynamics, solidification, geological fluid mechanics, oceanography and atmospheric dynamics are all introduced and reviewed by established authorities. Thus the book will not only be suitable for graduate-level courses but also for specialists seeking introductions to other areas. For students ready to advance in their study of metals, Physical Metallurgy, Second Edition uses engaging historical and contemporary examples that relate to the applications of concepts in each chapter.This book combines theoretical concepts, real alloy systems, processing procedures, and examples of real-world applications. The author uses his ex Fundamentals of Aluminium Metallurgy: Recent Advances updates the very successful book Fundamentals of Aluminium Metallurgy. As the technologies related to casting and forming of aluminum components are rapidly improving, with new technologies generating alternative manufacturing methods that improve competitiveness, this book is a timely resource. Sections provide an overview of recent research

breakthroughs, methods and techniques of advanced manufacture, including additive manufacturing and 3D printing, a comprehensive discussion of the status of metalcasting technologies, including sand casting, permanent mold casting, pressure diecastings and investment casting, and recent information on advanced wrought alloy development, including automotive bodysheet materials, amorphous glassy materials, and more. Target readership for the book includes PhD students and academics, the casting industry, and those interested in new industrial opportunities and advanced products. Includes detailed and specific information on the processing of aluminum alloys, including additive manufacturing and advanced casting techniques Written for a broad ranging readership, from academics, to those in the industry who need to know about the latest techniques for working with aluminum Comprehensive, up-to-date coverage, with the most recent advances in the industry This text seeks to provide a comprehensive technical foundation and practical examples for casting process modelling technology. It highlights fundamental theory for solidification and useful applications for industrial production. It also details shape and ingot castings, semi-solid metalworking, and spray forming. This volume includes contributions on the physical and numerical modeling of materials processing, and covers a range of metals and minerals. Authors present models and results related to the basics of processing such as extraction, joining, separation, and casting. The corresponding fundamentals of mass and heat transport as well as physical and thermodynamics properties are addressed, allowing for a cross-disciplinary vision of the field. This textbook explains the physics of phase transformation and associated constraints from a metallurgical or materials science point of view, based on many topics including crystallography, mass transport by diffusion, thermodynamics, heat transfer and related temperature gradients, thermal deformation, and even fracture mechanics. The work presented emphasizes solidification and related analytical models based on heat transfer. This corresponds with the most fundamental physical event of continuous evolution of latent heat of fusion for directional or non-directional liquid-to-solid phase transformation at a specific interface with a certain geometrical shape, such as planar or curved front. Dr. Perez introduces mathematical and engineering approximation schemes for describing the phase transformation, mainly during solidification of pure metals and alloys. Giving clear definitions and explanations of theoretical concepts and full detail of derivation of formulae, this interdisciplinary volume is ideal for graduate and upper-level undergraduate students in applied science, and professionals in the metal making and surface reconstruction industries. “Principles of Solidification” offers comprehensive descriptions of liquid-to-solid transitions encountered in shaped casting, welding, and non-biological bulk crystal growth processes. The book logically develops through careful presentation of relevant thermodynamic and kinetic theories and models of solidification occurring in a variety of materials. Major topics encompass the liquid-state, liquid-solid transformations, chemical macro- and microsegregation, purification by fractional crystallization and zone refining, solid-liquid interfaces, polyphase freezing, and rapid solidification processing. Solid-liquid interfaces are discussed quantitatively both as sharp and diffuse entities, with supporting differential geometric descriptions. The book offers: • Detailed mathematical examples throughout to guide readers • Applications of solidification and crystal growth methodologies for preparation and purification of metals, ceramics, polymers and semiconductors • Appendices providing supporting information on special topics covered in the chapters. Readers in materials, metallurgical, chemical, and mechanical engineering will find this to be a useful source on the subjects of solidification and crystal growth. Chemists, physicists, and geologists concerned with melting/freezing phenomena will also find much of value in this book. This well-written text is for non-metallurgists and anyone seeking a quick refresher on an essential tool of modern metallurgy. The basic principles, construction, interpretation, and use of alloy phase diagrams are clearly described with ample illustrations for all important liquid and solid reactions. Gas-metal reactions, important in metals processing and in-service corrosion, also are discussed. Get the basics on how phase diagrams help predict and interpret the changes in the structure of alloys. The processes of freezing and melting were present at the beginnings of the Earth and continue to dominate the natural and industrial worlds. The solidification of a liquid or the melting of a solid involves a complex

interplay of many physical effects. This 2001 book presents in a systematic way the field of continuum solidification theory based on instability phenomena. An understanding of the physics is developed by using examples of increasing complexity with the object of creating a deep physical insight applicable to more complex problems. Applied mathematicians, engineers, physicists, and materials scientists will all find this volume of interest. The 3rd edition of this popular textbook covers current topics in all areas of casting solidification. Partial differential equations and numerical analysis are used extensively throughout the text, with numerous calculation examples, to help the reader in achieving a working knowledge of computational solidification modeling. The features of this new edition include: • new chapters on semi-solid and metal matrix composites solidification • a significantly extended treatment of multiscale modeling of solidification and its applications to commercial alloys • a survey of new topics such as solidification of multicomponent alloys and molecular dynamic modeling • new theories, including a theory on oxide bi-films in the treatment of shrinkage problems • an in-depth treatment of the theoretical aspects of the solidification of the most important commercial alloys including steel, cast iron, aluminum-silicon eutectics, and superalloys • updated tables of material constants. Solidification phenomena play an important role in many of the processes used in fields ranging from production engineering to solid-state physics. The broad range of applications of solidification models - from the large tonnages of continuously cast products, through superalloy precision castings, to high-purity single crystals - means that a book such as the present one must cater for the requirements of a very wide range of readers. Solidification processes and phenomena, segregation, porosity, gravity effects, fluid flow, undercooling, as well as processing of materials in the microgravity environment of space, now available on space shuttle flights were discussed. Solidification is one of the oldest processes for producing complex shapes for applications ranging from art to industry, and remains as one of the most important commercial processes for many materials. Since the 1980s, numerous fundamental developments in the understanding of solidification processes and microstructure formation have come from both analytical theories and the application of computational techniques using commonly available powerful computers. This book integrates these developments in a comprehensive volume that also presents and places them in the context of more classical theories. This second edition highlights the key concepts within each chapter to help guide the reader through the most important aspects of the topics. The figures are now in color, in order to improve the visualization of phenomena and concepts. Recent important developments in the field since the first edition was published have also been added. The three-part text is aimed at graduate and professional engineers. The first part, Fundamentals and Macroscale Phenomena, presents the thermodynamics of solutions and then builds on that subject to motivate and describe equilibrium phase diagrams. Transport phenomena are discussed next, focusing on the issues of most importance to liquid-solid phase transformations, then moving on to describing in detail both analytical and numerical approaches to solving such problems. The second part, Microstructure, employs these fundamental concepts for the treatment of nucleation, dendritic growth, microsegregation, eutectic and peritectic solidification, and microstructure competition. This part concludes with a chapter describing the coupling of macro- and microscopic phenomena in microstructure development. The third and final part describes various types of Defects that may occur, with emphasis on porosity, hot tearing and macrosegregation, presented using the modeling tools and microstructure descriptions developed earlier. This volume details the principles underlying rapid solidification processing, material structure and properties, and their applications. This practical resource presents a manifold approach to both amorphous and crystalline rapidly solidified metallic alloys.;Written by over 30 internationally acclaimed specialists in their respective fields, Rapidly Solidified Alloys: surveys nucleation and growth studies in undercooled melts; examines various processes for the production of rapidly solidified alloys; discusses the compaction of amorphous alloys; describes surface remelting treatments for the rapid solidification of surface layers and the resultant improved workpiece properties; covers the closely related topics of structural relaxation, atomic transport and other thermally induced processes; demonstrates microstructure-property relationships in rapidly

quenched crystalline alloy systems and their beneficial effects in applications; and elucidates the basic, engineeering, and applications-oriented magnetic properties of amorphous alloys.;Furnishing more than 2300 literature citations for further study of specific subjects, Rapidly Solidified Alloys is intended for materials, mechanical, product, and civil engineers; metallurgists; magneticians; physicists; physical chemists; and graduate students in these disciplines. This book contains a collection of papers on the science, engineering, and technology of shape casting, with contributions from researchers worldwide. Among the topics that are addressed are the structure-property-performance relationships, modeling of casting processes, and the effect of casting defects on the mechanical properties of cast alloys. Pulling together information previously scattered throughout numerous research articles into one detailed resource, Physical Metallurgy of Direct Chill Casting of Aluminum Alloys connects the fundamentals of structure formation during solidification with the practically observed structure and defect patterns in billets and ingots. The author examines the formation of a structure, properties, and defects in the as-cast material in tight correlation to the physical phenomena involved in the solidification and the process parameters. The book draws on the author’s advanced research to provide a unique application of physical metallurgy to direct chill (DC) casting technology. He examines structure and defect formation— including macrosegregation and hot tearing. Each technology-centered chapter provides historical background before reviewing current developments. The author supports his conclusions with computer simulation results that have been correlated with highly progressive experimental data. He presents a logical system of structure and defect formation based on the specific features of the DC casting process. He also demonstrates that the seemingly controversial results reported in literature are, in fact, caused by the different ratio of the same mechanisms. Compiling recent results and data, the book discusses the fundamentals of solidification together with metallurgical and technological aspects of DC casting. It gives new insight and perspective into DC casting research. Stefanescu here attempts to describe solidification theory through the complex mathematical apparatus required for a fundamental treatment of the problem. The mathematics is however restricted to the elements essential to attain a working knowledge in the field. This is in line with the main goal of the book, which is to educate the reader in the fast moving area of computational modeling of solidification of castings. A special effort has been made to introduce the reader to the latest developments in solidification theory including, in this second edition, a new chapter on semi-solid casting. Solidification is one of the oldest processes for producing useful implements and remains one of the most important modern commercial processes. This text describes the fundamentals of the technology in a coherent way, using consistent notation.

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