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Rather than simply starting with phase diagrams, and using them to describe the progress of metallurgical changes which occur, for example, in alloy solidification or heat treatment, the authors set out to explain the fundamental analytical steps which lead to these phase diagrams. This gives students a deeper understanding of phase change.

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There are myriad different types of phase transformations that occur in metals, some very complex, but they



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can be divided into two general groups, both of which are encountered in Nitinol: Diffusional transformations are those in which the new phase has a different chemical composition than the extant parent phase. Because it is compositionally different than its surroundings, the new phase can only be formed by transporting atoms over relatively long distances—for example, the ...

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Confluent Medical  
elemental metals, allotropic  
transformation, recrystallization, grain  
growth). 2. Diffusion-dependent  
transformation: transformation with  
alteration in phase composition and,  
often, with changes in number of  
phases present (e.g. eutectoid

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reaction). 3. Diffusionless transformation: e.g. rapid T quenching to “trap” metastable phases.

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At ambient conditions the great majority of the metallic elements have simple crystal structures, such as face-centred or body-centred cubic, or hexagonal close-packed. However,

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when subjected to very high pressures, many of the same elements undergo phase transitions to low-symmetry and surprisingly complex High Pressure Science

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High-pressure structures and phase transformations in ...

Mechanisms of Diffusional Phase Transformations in Metals and Alloys is devoted to solid-solid phase transformations in which elementary atomic processes are diffusional jumps, and these processes occur in a series of so-called nucleation and growth through interface migration. Instead of relying strictly on a pedagogical approach, it documents the evolution of phase transformation concepts.

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Revised to reflect recent developments in the field, Phase Transformation in Metals and Alloys, Fourth Edition, continues to be the most authoritative and approachable resource on the subject. It supplies a comprehensive overview of specific types of phase transformations, supplemented by practical case studies of engineering alloys. The book's unique presentation links a basic understanding of theory with application in a gradually progressive yet exciting manner. Based on the authors' teaching notes, the text takes a pedagogical approach and provides examples for applications and problems that can be readily used for exercises. NEW IN THE FOURTH EDITION 40% of the figures and 30%

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**Determining the dislocation content of grain boundaries and interfaces**  
**Updated treatment of coherency and interface structure including the important fcc–bcc interfaces**  
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structures in aluminum castings, Al–Cu–Li aerospace alloys, superelastic and shape memory alloys, quenched and partitioned steels, advanced high-strength steels and martensitic stainless steels Each chapter now concludes with a summary of the main points References to scientific publications and suggestions for further reading updated to reflect experimental and computational advances Aimed at students studying metallurgy and materials science and engineering, the Fourth Edition retains the previous editions' popular easy-to-follow style and excellent mix of basic and advanced information, making it ideal for those who are new to the field. A new solutions manual and PowerPoint figure slides are available to adopting professors.

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In the decade since the first edition of this popular text was published, the metallurgical field has undergone rapid developments in many sectors.

Nonetheless, the underlying principles governing these developments remain the same. A textbook that presents these advances within the context of the fundamentals is greatly needed by instructors in the field

Phase Transformations in Metals and Alloys, Second Edition maintains the simplicity that undergraduate instructors and students have come to appreciate while updating and expanding coverage of recently developed methods and materials.

The book is effectively divided into two parts. The beginning chapters contain the background material necessary for understanding phase transformations -

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thermodynamics, kinetics, diffusion theory and the structure and properties of interfaces. The following chapters deal with specific transformations - solidification, diffusional transformation in solids and diffusionless transformation. Case studies of engineering alloys are incorporated to provide a link between theory and practice. New additions include an extended list of further reading at the end of each chapter and a section containing complete solutions to all exercises in the book. Designed for final year undergraduate and postgraduate students of metallurgy, materials science, or engineering materials, this is an ideal textbook for both students and instructors.

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Developed by the late metallurgy professor and master experimentalist Hubert I. Aaronson, this collection of lecture notes details the fundamental principles of phase transformations in metals and alloys upon which steel and other metals industries are based. Mechanisms of Diffusional Phase Transformations in Metals and Alloys is devoted to solid-solid phase transformations in which elementary atomic processes are diffusional jumps, and these processes occur in a series of so-called nucleation and growth through interface migration. Instead of relying strictly on a pedagogical approach, it documents the evolution of phase transformation concepts. The authors present topics by describing a phenomenon and then following up with a corresponding hypothesis or alternative explanation.

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In this way, the book also shows how the field continues to evolve and meet new challenges. Integrated with information from a number of key papers and review articles, this volume reflects this revered and influential instructor's unique and passionate way of introducing well-established theories and knowledge in a systematic way, at the same time introducing, in great detail, how a new idea or interpretation of a phenomenon has emerged, evolved, and gained its current status. If the published version of a theory or a model was too condensed, Aaronson worked the problem out in painstaking detail so that graduate students could follow the derivations. This collection is full of such unique "Aaronsonian idiosyncrasies," which add immense value as a powerful tool for learning in

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this challenging materials field.

This work is a classic reference text for metallurgists, material scientists and crystallographers. The first edition was published in 1965. The first part of that edition was revised and re-published in 1975 and again in 1981. The present two-part set represents the eagerly awaited full revision by the author of his seminal work, now published as Parts I and II. Professor Christian was one of the founding fathers of materials science and highly respected worldwide. The new edition of his book deserves a place on the bookshelf of every materials science and engineering department. Suitable thermal and mechanical treatments will produce extensive rearrangements of the atoms in metals and alloys, and corresponding marked variations in

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physical and chemical properties. This book describes how such changes in the atomic configuration are effected, and discusses the associated kinetic and crystallographic features. It deals with areas such as lattice geometry, point defects, dislocations, stacking faults, grain and interphase boundaries, solid solutions, diffusion, etc. The first part covers the general theory while the second part is concerned with descriptions of specific types of transformations.

The processing-microstructure-property relationships in steels continue to present challenges to researchers because of the complexity of phase transformation reactions and the wide spectrum of microstructures and properties achievable. This major two-volume work summarises the

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Current state of research on phase transformations in steels and its implications for the emergence of new steels with enhanced engineering properties. Volume 1 reviews fundamentals and diffusion-controlled phase transformations. After a historical overview, chapters in part one discuss fundamental principles of thermodynamics, diffusion and kinetics as well as phase boundary interfaces. Chapters in part two go on to consider ferrite formation, proeutectoid ferrite and cementite transformations, pearlite formation and massive austenite-ferrite phase transformations. Part three discusses the mechanisms of bainite transformations, including carbide-containing and carbide-free bainite. The final part of the book considers additional driving forces for



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transformation including nucleation and growth during austenite-to-ferrite phase transformations, dynamic strain-induced ferrite transformations (DIST) as well as the effects of magnetic fields and heating rates. With its distinguished editors and distinguished international team of contributors, the two volumes of Phase transformations in steels is a standard reference for all those researching the properties of steel and developing new steels in such areas as automotive engineering, oil and gas and energy production. Discusses the fundamental principles of thermodynamics, diffusion and kinetics Considers various transformations, including ferrite formation, proeutectoid ferrite and cementite transformations Considers additional driving forces for transformation including nucleation

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and growth during austenite-to-ferrite phase transformations

Expanded and revised to cover developments in the field over the past 17 years, and now reprinted to correct errors in the prior printing, Phase Transformation in Metals and Alloys, Third Edition provides information and examples that better illustrate the engineering relevance of this topic. It supplies a comprehensive overview of specific types o

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

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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

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And Alloys undergraduate students in applied science, and professionals in the metal making and surface reconstruction industries.

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

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And Alloys 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

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And Alloys, 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

For all kinds of materials, phase transformations show common phenomena and mechanisms, and often turn a material, for example metals, multiphase alloys, ceramics or composites, into its technological useful form. The physics and thermodynamics of a transformation from the solid to liquid state or from

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one crystal form to another are therefore essential for creating high-performance materials. This handbook covers phase transformations, a general phenomenon central to understanding the behavior of materials and for creating high-performance materials. It will be an essential reference for all materials scientists, physicists and engineers involved in the research and development of new high performance materials. It is the revised and enhanced edition of the renowned book edited by the late P. Haasen in 1990 (Vol. 5, Materials Science and Technology).

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