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COMPREHENSIVE MATERIALS PROCESSING

Newnes **Comprehensive Materials Processing provides students and professionals with a one-stop resource consolidating and enhancing the literature of the materials processing and manufacturing universe. It provides authoritative analysis of all processes, technologies, and techniques for converting industrial materials from a raw state into finished parts or products. Assisting scientists and engineers in the selection, design, and use of materials, whether in the lab or in industry, it matches the adaptive complexity of emergent materials and processing technologies. Extensive traditional article-level academic discussion of core theories and applications is supplemented by applied case studies and advanced multimedia features. Coverage encompasses the general categories of solidification, powder, deposition, and deformation processing, and includes discussion on plant and tool design, analysis and characterization of processing techniques, high-temperatures studies, and the influence of process scale on component characteristics and behavior. Authored and reviewed by world-class academic and industrial specialists in each subject field Practical tools such as integrated case studies, user-defined process schemata, and multimedia modeling and functionality Maximizes research efficiency by collating the most important and established information in one place with integrated applets linking to relevant outside sources**

TMS 2013 142ND ANNUAL MEETING AND EXHIBITION, ANNUAL

MEETING

John Wiley & Sons **Presenting papers from the 2013 annual meeting of The Minerals, Metals & Materials Society (TMS), this volume covers developments in all aspects of high temperature electrochemistry, from the fundamental to the empirical and from the theoretical to the applied.**

SECOND UNITED STATES MICROGRAVITY PAYLOAD: ONE YEAR REPORT

PHASE CHANGE WITH CONVECTION: MODELLING AND VALIDATION

Springer **This unique volume offers a review of state-of-the-art modelling methods of phase change problems, numerical and experimental methods used in the field. It combines the experience of theoreticians with those using numerical tools for modelling problems of solidification.**

ADVANCES IN THE SCIENCE AND ENGINEERING OF CASTING SOLIDIFICATION

AN MPMD SYMPOSIUM HONORING DORU MICHAEL STEFANESCU

Springer **This collection encompasses the following four areas: (1) Solidification processing: theoretical and experimental investigations of solidification processes including castings solidification, directional solidification of alloys, electromagnetic stirring, ultrasonic cavitation, mechanical vibration, active cooling and heating, powder bed-electron beam melting additive manufacturing, etc. for processing of metals, polymers and composite materials; (2) Microstructure Evolution: theoretical and experimental studies related to microstructure evolution of materials including prediction of solidification-related defects and particle pushing/engulfment aspects; (3) Novel Casting and Molding Processes: modeling and experimental aspects including high pressure die casting, permanent casting, centrifugal casting, low pressure casting, 3D silica sand mold printing, etc.; and (4) Cast Iron: all aspects related to cast iron characterization, computational and analytical modeling, and processing.**

DYNAMICAL THEORY OF DENDRITIC GROWTH IN CONVECTIVE FLOW

Springer Science & Business Media **Convective flow in the liquid phase is always present in a realistic process of freezing and melting and may significantly affect the dynamics and results of the process. The study of the interplay of growth and convection flow during the solidification has been an important subject in the broad fields of materials science, condensed matter physics, fluid physics, micro-gravity science, etc. The present book is concerned with the dynamics of free dendritic growth with convective flow in the melt. It systematically presents the results obtained in terms of a unified asymptotic approach in the framework of the interfacial wave (IFW) theory. In particular, the book explores the effect of**

the various types of convection flow on the selection and pattern formation of dendritic growth based on the global stability analysis.

SOLIDIFICATION AND GRAVITY VI

Trans Tech Publications Ltd **The results of many foreign and Hungarian researchers presented at the 6th International Conference on Solidification and Gravity, in Miskolc-Lillafüred, on September 2-5, 2013 have been collected in this volume. This conference series is aimed to attract all those having interest in the investigation and simulation of different types of solidification processes and both micro- and macro-gravity effects. Within the framework of the conference a MICAST meeting (Microstructure Formation in Casting of Technical Alloys under Diffusive and Magnetically Controlled Convective Conditions) was organized on September 5-6, 2013. The 2013 conference was a memorial one for Professor Hans Eckart Exner and Professor Erik György Fuchs who had died in the period between the previous (2008) and the last (2013) conference.**

PROCEEDINGS OF THE ASME HEAT TRANSFER DIVISION

CFD MODELING AND SIMULATION IN MATERIALS PROCESSING 2016

Springer

INTERFACIAL WAVE THEORY OF PATTERN FORMATION IN SOLIDIFICATION

DENDRITES, FINGERS, CELLS AND FREE BOUNDARIES

Springer **This comprehensive work explores interfacial instability and pattern formation in dynamic systems away from the equilibrium state in solidification and crystal growth. Further, this significantly expanded 2nd edition introduces and reviews the progress made during the last two decades. In particular, it describes the most prominent pattern formation phenomena commonly observed in material processing and crystal growth in the framework of the previously established interfacial wave theory, including free dendritic growth from undercooled melt, cellular growth and eutectic growth in directional solidification, as well as viscous fingering in Hele-Shaw flow. It elucidates the key problems, systematically derives their mathematical solutions by pursuing a unified, asymptotic approach, and finally carefully examines these results by comparing them with the available experimental results. The asymptotic approach described here will be useful for the investigation of pattern formation phenomena occurring in a much broader class of inhomogeneous dynamical systems. In addition, the results on global stability and selection mechanisms of pattern formation will be of particular interest to researchers working on material processing and crystal growth. The stability mechanisms of a curved front and the pattern formation have been fundamental subjects in**

the areas of condensed-matter physics, materials science, crystal growth, and fluid mechanics for some time now. This book offers a stimulating and insightful introduction for all physicists, engineers and applied mathematicians working in the fields of soft condensed-matter physics, materials science, mechanical and chemical engineering, fluid dynamics, and nonlinear sciences.

IUTAM SYMPOSIUM ON RECENT ADVANCES IN MOVING BOUNDARY PROBLEMS IN MECHANICS

PROCEEDINGS OF THE IUTAM SYMPOSIUM ON MOVING BOUNDARY PROBLEMS, CHRISTCHURCH, NEW ZEALAND, FEBRUARY 12-15, 2018

Springer **Many problems in mechanics involve deformable domains with moving boundaries, including fluid-structure interaction, multiphase flows, flows over soft tissues and textiles, or flows involving accretion/erosion to name but a few. The presence of a moving boundary presents considerable challenges when it comes to modelling and understanding the underlying system dynamics. This proceedings volume collects contributions made at the IUTAM Symposium on Recent Advances in Moving Boundary Problems in Mechanics held in Christchurch, New Zealand in February 2018.**

METALS: ADVANCES IN RESEARCH AND APPLICATION: 2011 EDITION

ScholarlyEditions **Metals: Advances in Research and Application: 2011 Edition is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Metals. The editors have built Metals: Advances in Research and Application: 2011 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Metals in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Metals: Advances in Research and Application: 2011 Edition has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.**

THERMOELECTRIC MAGNETOHYDRODYNAMICS IN DENDRITIC SOLIDIFICATION

The focus of this work is to investigate the effects of applying an external magnetic field to a solidifying liquid metal melt. The principle is that thermoelectric currents that are naturally inherent to solidification processes will interact with this magnetic field, resulting in a Lorentz force. This force will exist in a microscopic region in the vicinity of the

solidification front, generating microscopic fluid flow in the liquid region which can significantly effect the mechanism of dendritic growth. The work contained in this thesis provides an initial insight into the complex behaviour of this process, through the use of numerical models. To model the soldification dynamics, an enthalpy based model for dendritic growth in a supercooled melt is used in 2-dimensions and extended into 3-dimensions. The dendrite is defined as being equiaxed in nature and, for purely diffusion driven growth, numerical calculations show a good agreement with other methods under similar growth parameters. To investigate the effects of fluid dynamics, dendritic growth is tested under forced convection conditions and significant morphological changes occur. The incident tip velocity is increased and the downstream tip velocity is decreased; in agreement with many other authors investigating similar situations. In the presence of a magnetic field the Lorentz force will form in planes perpendicular to the direction of the magnetic field. Due to the morphology and anisotropy of the surface temperature, the nature of the flow is dependent on the relative orientation of the magnetic field and the crystallographic orientation of the lattice. Using a low magnetic field strength approximation, thus removing the non-linear and resistive terms in Navier-Stokes equation, the resulting fluid velocity is arbitrarily small so that convective transport is negated. At some time, when the morphological features of a dendrite are apparent, steady state simulations show the flow fields that exist with different orientations of the magnetic field. The results are compared to an analytic solution for the Lorentz force, which is described by reducing the morphology of a dendrite to a sphere and assuming that the surface temperature is equivalent to the anisotropy in the surface energy. When the thermoelectric currents are large and the magnetic field strength is substantial the convective transport, non-linear and resistive terms become significant. The problem is purely 3-dimensional and it is shown that classical 2-dimensional boundary conditions lead to stagnant conditions. A 2-dimensional quasi 3-dimensional approximation is proposed and, with the magnetic field orientated in the (001) direction, the effect of heat and solute redistribution through convection on the crystal morphology is modelled. Two significant morphological changes occur; the first is a deflection of the dendrite tip and the second is the initiation of secondary branching into the incident flow. The deflection is caused by circulations at the tips of the dendrite; the circulations continuously provide a region of higher free energy on the incident side while lowering it on the other. The net effect is a bias of growth in the direction of incident flow. The increase in secondary branching, in a similar fashion to the deflection, is caused by both a circulation at the tip and also a global circulation around the entire dendrite, destabilising the incident interface and initiating secondary growth. To qualify the quasi 3-dimensional approximation, a moving mesh technique is developed that tracks a single tip of 3-dimensional growth and the similar morphological features are observed in comparison to the quasi

3-dimensional case. Finally a discussion into possible extensions of this work is proposed and preliminary results for grain growth in the presence of a magnetic field are given.

MANUFACTURING TECHNIQUES FOR MATERIALS

ENGINEERING AND ENGINEERED

CRC Press **Manufacturing Techniques for Materials: Engineering and Engineered provides a cohesive and comprehensive overview of the following: (i) prevailing and emerging trends, (ii) emerging developments and related technology, and (iii) potential for the commercialization of techniques specific to manufacturing of materials. The first half of the book provides the interested reader with detailed chapters specific to the manufacturing of emerging materials, such as additive manufacturing, with a valued emphasis on the science, technology, and potentially viable practices specific to the manufacturing technique used. This section also attempts to discuss in a lucid and easily understandable manner the specific advantages and limitations of each technique and goes on to highlight all of the potentially viable and emerging technological applications. The second half of this archival volume focuses on a wide spectrum of conventional techniques currently available and being used in the manufacturing of both materials and resultant products. Manufacturing Techniques for Materials is an invaluable tool for a cross-section of readers including engineers, researchers, technologists, students at both the graduate level and undergraduate level, and even entrepreneurs.**

RECENT ADVANCES IN NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS AND APPLICATIONS

PROCEEDINGS OF THE 2001 JOHN H. BARRETT MEMORIAL LECTURES, TRENDS IN COMPUTATIONAL MATHEMATICS, MAY 10-12, 2001, THE UNIVERSITY OF TENNESSEE, KNOXVILLE, TN

American Mathematical Soc. **An emerging field over the past 15 years, computational mathematics is a vast area which has experienced major developments in both algorithmic advances and applications to other fields. These developments have had profound implications in mathematics, science, engineering and industry. Compiled here are six of nine in-depth survey papers with an expository discussion on computational mathematics that were presented at the 2001 John H. Barrett Memorial Lectures at the University of Tennessee, Knoxville. They focus on parallel numerical algorithms for partial differential equations, their implementation and applications in fluid mechanics and material science. Each of the lecturers is a leading researcher in the field of computational mathematics and its applications. This book will be a useful reference for graduate students as well as the many groups of researchers**

working in advanced computations, including engineering and computer scientists. Prior knowledge of partial differential equations and their numerical methods is helpful.

TMS 2012 141ST ANNUAL MEETING AND EXHIBITION, MATERIALS PROPERTIES, CHARACTERIZATION, AND MODELING

John Wiley & Sons **This book contains chapters on cutting-edge developments presented at the TMS annual conference of 2012.**

THEORY OF SOLIDIFICATION

Cambridge University Press **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.**

SCIENCE AND ENGINEERING OF CASTING SOLIDIFICATION

Springer **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.**

ADVANCED MATERIALS '93

COMPUTATIONS, GLASSY MATERIALS, MICROGRAVITY AND NON-DESTRUCTIVE TESTING

Newnes **Computations, Glassy Materials, Microgravity and Non-Destructive Testing is a compilation of the papers presented during the Third IUMRS International Conference on Advanced Materials International Union of The Materials Research Societies that discussed the concepts and methods**

behind glassy materials. The book is divided into parts. Part 1 tackles the progresses in sol-gel science and technology; the reaction mechanisms of ormosils and effects of ultrasonic irradiation; and the preparation of different glasses and their properties. Part 2 covers topics such as the neural network system for the identification of materials; the use of computers for simulations of many-body systems; computer system for meeting the supercomputing needs of materials; quality control of materials information by knowledge base; and the development of knowledgebase system for computer-assisted alloy design. Part 3 deals with the properties of different materials, the concepts, and the techniques behind them, and Part 4 discusses the non-destructive evaluation. The text is recommended for chemists and engineers in the field of materials science, especially those who wish to know more about the progress in its field of research.

SOLIDIFICATION OF CONTAINERLESS UNDERCOOLED MELTS

John Wiley & Sons **All metallic materials are prepared from the liquid state as their parent phase. Solidification is therefore one of the most important phase transformation in daily human life. Solidification is the transition from liquid to solid state of matter. The conditions under which material is transformed determines the physical and chemical properties of the as-solidified body. The processes involved, like nucleation and crystal growth, are governed by heat and mass transport. Convection and undercooling provide additional processing parameters to tune the solidification process and to control solid material performance from the very beginning of the production chain. To develop a predictive capability for efficient materials production the processes involved in solidification have to be understood in detail. This book provides a comprehensive overview of the solidification of metallic melts processed and undercooled in a containerless manner by drop tube, electromagnetic and electrostatic levitation, and experiments in reduced gravity. The experiments are accompanied by model calculations on the influence of thermodynamic and hydrodynamic conditions that control selection of nucleation mechanisms and modify crystal growth development throughout the solidification process.**

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

MICROGRAVITY SCIENCE AND APPLICATIONS PROGRAM TASKS

MICROGRAVITY SCIENCE AND APPLICATIONS PROGRAM TASKS, 1990 REVISION

MICROGRAVITY SCIENCE AND APPLICATIONS PROGRAM TASKS

1991 REVISION

ELI RUCKENSTEIN

A SPECIAL ISSUE IN HIS HONOR

Taylor & Francis **First published in 1987. Routledge is an imprint of Taylor & Francis, an informa company.**

TRANSPORT PHENOMENA IN FOOD PROCESSING, FIRST INTERNATIONAL CONFERENCE PROCEEDINGS

CRC Press

EPD CONGRESS 2013

John Wiley & Sons **This state-of-the-art reference presents papers from one of the largest annual gatherings of extraction specialists from around world, the 2013 Annual Meeting of The Minerals, Metals & Materials Society. Addressing many aspects of extraction and processing metallurgy, this volume covers in three sections modeling of multi-scale phenomena in materials processing; production, refining, and recycling of rare earth metals; and solar cell silicon. Essential reading for scientists, engineers, and metallurgists in the global extractive and process metallurgy industries.**

DYNAMICS OF CURVED FRONTS

Elsevier **In recent years, much progress has been made in the understanding of interface dynamics of various systems: hydrodynamics, crystal growth, chemical reactions, and combustion. Dynamics of Curved Fronts is an important contribution to this field and will be an indispensable reference work for researchers and graduate students in physics, applied mathematics, and chemical engineering. The book consist of a 100 page introduction by the editor and 33 seminal articles from various disciplines.**

INTERACTIVE DYNAMICS OF CONVECTION AND SOLIDIFICATION

Springer Science & Business Media **The phase transformation from liquid to solid is a phenomenon central to a wide range of manufacturing and natural processes. The presence of phase transformation can drive convection in the melt through the liberation of latent heat, the rejection of solute, and the change of density upon freezing. The fluid mechanics itself can playa central role; the phase transformation can be strongly altered by convective transport in the liquid through the modification of the thermal and solutal environment of the solid-liquid interface; these local fields control the freezing characteristics at the interface. The convection can be generated naturally by buoyancy forces arising from gradients of temperature and concentration in the liquid, by density changes upon freezing, and by thermocapillary and solutocapillary forces**

on liquid-solid interfaces. The interactive coupling between solidification and convection forms the subject of this volume. Such coupled processes are significant on a large range of scales. Among the applications of interest are the manufacture of single crystals, the processing of surfaces using laser or molecular beams, and the processes of soldering and welding. One wants to understand and predict macrosegregation in castings, transport and fractionation in geological and geophysical systems, and heat accumulation in energy redistribution and storage systems. This volume contains papers presented at the NATO Advanced Research Workshop on "Interactive Dynamics of Convection and Solidification" held in Chamonix, France, March 8-13, 1992.

NUMERICAL SIMULATION OF DENDRITIC SOLIDIFICATION WITH CONVECTION

ADVANCES IN MECHANICS AND MATHEMATICS

Springer Science & Business Media **Advances in Mechanics and Mathematics (AMMA) is intended to bridge the gap by providing multi-disciplinary publications. This volume, AMMA 2002, includes two parts with three articles by four subject experts. Part 1 deals with nonsmooth static and dynamic systems. A systematic mathematical theory for multibody dynamics with unilateral and frictional constraints and a brief introduction to hemivariational inequalities together with some new developments in nonsmooth semi-linear elliptic boundary value problems are presented. Part 2 provides a comprehensive introduction and the latest research on dendritic growth in fluid mechanics, one of the most profound and fundamental subjects in the area of interfacial pattern formation, a commonly observed phenomenon in crystal growth and solidification processes.**

MICROGRAVITY SCIENCE & APPLICATIONS

PROGRAM TASKS AND BIBLIOGRAPHY FOR FY1992

CRYSTAL GROWTH IN SCIENCE AND TECHNOLOGY

Springer Science & Business Media **Science and art of crystal growth represent an interdisciplinary activity based on fundamental principles of physics, chemistry and crystallography. Crystal growth has contributed over the years essentially to a widening of knowledge in its basic disciplines and has penetrated practically into all fields of experimental natural sciences. It has acted, more over, in a steadily increasing manner as a link between science and technology as can be seen best, for example, from the achievements in modern microelectronics. The aim of the course "Crystal Growth in Science and Technology" being to stress the interdisciplinary character of the subject, selected fundamental principles are reviewed in the following contributions and cross links between basic and applied**

aspects are illustrated. It is a very well-known fact that the intensive development of crystal growth has led to a progressive narrowing of interests in highly specialized directions which is in particular harmful to young research scientists. The organizers of the course did sincerely hope that the program would help to broaden up the horizon of the participants. It was equally their wish to contribute within the traditional spirit of the school of crystallography in Erice to the promotion of mutual understanding, personal friendship and future collaboration between all those who were present at the school.

PHASE TRANSFORMATIONS IN MULTICOMPONENT MELTS

John Wiley & Sons **Bringing together the concerted efforts of the multicomponent materials community in one decisive reference work, this handbook covers all the important aspects from fundamentals to applications: thermodynamics, microscopic processes, solidification, simulation and modeling. As such, it provides a vital understanding of melt and solidification processes, treating all simulation techniques for continuous and discrete systems, such as molecular dynamics, Monte Carlo, and finite elements calculations.**

AIAA 26TH AEROSPACE SCIENCES MEETING

JANUARY 11-14, 1988, RENO, NEVADA

ADVANCED MANUFACTURE

Trans Tech Publications Ltd **Booming economic development in Asia, particularly of the leading manufacturing industries which produce flat-panel displays, communication-devics, computers and other products in the micro/nano field has stimulated an intense research effort in universities, development-oriented institutions and industrial corporations. Such knowledge-based industries have been enjoying an immense growth-potential and thus there is an urgent need for a solid forum for the exchange of various scientific, technical and management aspects ranging across the entire spectrum of society.**

RECAPTURING A FUTURE FOR SPACE EXPLORATION

LIFE AND PHYSICAL SCIENCES RESEARCH FOR A NEW ERA

National Academies Press **More than four decades have passed since a human first set foot on the Moon. Great strides have been made in our understanding of what is required to support an enduring human presence in space, as evidenced by progressively more advanced orbiting human outposts, culminating in the current International Space Station (ISS). However, of the more than 500 humans who have so far ventured into space, most have gone only as far as near-Earth orbit, and none have traveled beyond the orbit of the Moon. Achieving humans' further progress**

into the solar system had proved far more difficult than imagined in the heady days of the Apollo missions, but the potential rewards remain substantial. During its more than 50-year history, NASA's success in human space exploration has depended on the agency's ability to effectively address a wide range of biomedical, engineering, physical science, and related obstacles--an achievement made possible by NASA's strong and productive commitments to life and physical sciences research for human space exploration, and by its use of human space exploration infrastructures for scientific discovery. The Committee for the Decadal Survey of Biological and Physical Sciences acknowledges the many achievements of NASA, which are all the more remarkable given budgetary challenges and changing directions within the agency. In the past decade, however, a consequence of those challenges has been a life and physical sciences research program that was dramatically reduced in both scale and scope, with the result that the agency is poorly positioned to take full advantage of the scientific opportunities offered by the now fully equipped and staffed ISS laboratory, or to effectively pursue the scientific research needed to support the development of advanced human exploration capabilities. Although its review has left it deeply concerned about the current state of NASA's life and physical sciences research, the Committee for the Decadal Survey on Biological and Physical Sciences in Space is nevertheless convinced that a focused science and engineering program can achieve successes that will bring the space community, the U.S. public, and policymakers to an understanding that we are ready for the next significant phase of human space exploration. The goal of this report is to lay out steps and develop a forward-looking portfolio of research that will provide the basis for recapturing the excitement and value of human spaceflight--thereby enabling the U.S. space program to deliver on new exploration initiatives that serve the nation, excite the public, and place the United States again at the forefront of space exploration for the global good.

CUMULATIVE INDEX TO NASA TECH BRIEFS

AIAA 27TH AEROSPACE SCIENCES MEETING

JANUARY 9-12, 1989 : RENO, NEVADA

MATERIALS PROCESSING IN THE REDUCED GRAVITY ENVIRONMENT OF SPACE: VOLUME 87

Materials Research Society **The MRS Symposium Proceeding series is an internationally recognised reference suitable for researchers and practitioners.**