Book Reviews

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1 Light Metals 2012, Proceedings of the Technical Sessions presented by the TMS Aluminum Committee at the TMS 2012 Annual Meeting & Exhibition, Orlando, Florida, USA, March 11–15, 2012

by: C.E. Suarez
Published 2012
by WILEY, John Wiley & Sons, Inc. Hoboken, New Jersey
111 River Street, Hoboken, NJ 07030-5774, USA, 1407pp
ISBN: 978-1-11829-139-9
ISSN: 1096-9586

This book collects selected papers presented at the *Symposium on Light metals organised in conjunction with the 2012 TMS Annual Meeting* in Orlando, FL, USA.

To process minerals, metals and materials, it is always necessary to understand the chemistries, physical properties, forms, structures, occurrences, functions, relations, etc., of the associated materials prior, during, and after the processing of materials. This type of work, which is broadly understood as characterisation, is usually the first step taken to define and solve the industrial processing problems. Various characterisation technologies have been developed and applied to meet the needs. In many cases, characterisation has served as the grain for the processing of materials.

The Materials Characterization Committee of TMS sponsors this symposium annually as a major event of its activities. The committee is under the Extraction & Processing Division and has extended its focus from the Process Mineralogy for the mineral processing industry in the early days to the downstream metals and materials processing fields. Light metals are the common theme for all these areas.

Conference proceedings include the following main topics:

- *Alumina and bauxite*: Bauxite digestion, red mud bauxite residue, hydrate precipitation, calcinations and environment, energy and processing alternative raw materials.
- *Aluminium processing*: Rolling, general, casting.
- *Fabrication, characterisation and applications of aluminium alloys*: Development and application, solidification, thermal mechanical processing, solution and aging behaviours, material characterisation, emerging technologies.
- *Aluminium reduction technology*: Environment, energy saving, anode effect, process control, cell fundamentals, phenomena and alternatives, cell technology and operation, equipment, modelling and measurement.

- *Cast shop for aluminium production*: Grain refinement and castings, furnace, dross and melt quality control, direct-chill casting and microstructures.
- *Electrode technology for aluminium production*: Paste plan design and improvement, bake oven design and improvement, carbon materials for anode and cathode, characterisation of anode materials, characterisation of cathode materials, inner anode and wettable cathode materials.

There are very few books published with a focus on characterisation. The book serves as a good reference book in this area. The books provide the up to date information on the current and newly developed technologies with examples on how they have been applied for the processing of various materials. This can be handy and simulative for people trying to solve problems in the material industries.

The proceedings are most useful for engineers in practice, students, experts and researchers in the field of highs metals.

2 Characterization of Minerals, Metals, and Materials, Proceedings of a Symposium sponsored by the Materials Characterization Committee of the Extraction and Processing Division of TMS (The Minerals, Metals & Materials Society), Held during the TMS 2012 Annual Meeting & Exhibition, Orlando, Florida, USA, 2012 by: J.Y. Hwang, S.N. Monteiro, C.G. Bai, J. Carpenter, M. Cai, D. Firrao and B.G. Kim

Published 2012
by WILEY, John Wiley & Sons, Inc. Hoboken, New Jersey
111 River Street, Hoboken, NJ 07030-5774, USA, 533pp
ISBN: 978-1-11829-122-1

This book collects selected papers presented at the *Symposium on Characterization of Minerals, Metals and Materials organised in conjunction with the 2012 TMS Annual Meeting* in Orlando, FL, USA.

To process minerals, metals and materials, it is always necessary to understand the chemistries, physical properties, forms, structures, occurrences, functions, relations, etc., of the associated materials prior, during, and after the processing of materials. This type of work, which is broadly understood as characterisation, is usually the first step taken to define and solve the industrial processing problems. Various characterisation technologies have been developed and applied to meet the needs. In many cases, characterisation has served as the brain for the processing of materials.

The materials characterisation committee of TMS sponsors this symposium annually as a major event of its activities. The committee is under the extraction and processing division and has extended its focus from the Process mineralogy for the mineral processing industry in the early days to the downstream metals and materials processing fields. Characterisation is the common theme for all these areas.

This symposium received more than 150 abstracts from all over the world. Among them, 105 were selected for presentations at the symposium and 60 papers were accepted for publication in this book after a peer review process.

The book is divided into nine sections and each section has a different focus. They include Characterisation technologies, minerals and ceramics, ferrous metals, nonferrous metals, light metals, environmental and construction materials, carbon and soft materials, and energy, electronic and optical materials. In each section, the characterisation technologies developed and applied to the specific material are discussed with various examples.

There are very few books published with a focus on characterisation. The book serves as a good reference book in this area. The book provides the up to date information on the current and newly developed characterisation technologies with examples on how they have been applied for the processing of various materials. This can be handy and stimulative for people trying to solve problems in the material industries.

3 Astronautics: The Physics of Space Flight, 2nd, Enlarged and Improved Edition

by: U. Walter
Published 2012
Wiley-VCH Verlag GmbH & Co. KgaA, P. O. Box 10 11 61
69451 Weinheim, Boschstrasse 12, 69469 Weinheim, Germany, 568pp
ISBN: 978-3-527-41065-1 (Print)
ISBN: 978-3-527-41035-4

As a crewmember of the D-2 shuttle mission and a full professor of astronautics at the Technical University in Munich, Ulrich Walter is an acknowledged expert in the field. He is also the author of a number of popular science books on space flight.

The second edition of this textbook is based on extensive teaching and his work with students, backed by numerous examples drawn from his own experience. With its end-of-chapter examples and problems, this work is suitable for graduate level or even undergraduate courses in space flight, as well as for professionals working in the space industry.

The book contains the following chapters:

- Rocket fundamentals
- Rocket flight
- Rocket staging
- Thermal propulsion
- Electric propulsion
- Ascent flight
- Orbits
- Orbital manoeuvring
- Interplanetary flight
- Re-entry

- Three-body problem
- Orbit perturbations
- Reference frames
- Orbit determination
- Rigid body dynamics.

As the author said, the goal of this book is to build up a network of astronautic relationships in the mind of the reader. If someone does not understand something while reading this book, by his opinion he makes a mistake. The problem of relation network, though, is that the underlying logic can be very complex, and sometimes it seems that our brains are not suitable for even the simplest logic.

4 Electrolytic in-Process Dressing (ELID) Technologies

by: H. Ohmori, I.D. Marinescu and K. Katahira
Published 2011
by CRC Press, Taylor & Francis Group, 6000 Broken Sound Parkway NW, Suite 300, Boca Raton, FL 33487-2742, USA, 249pp
ISBN: 978-1-4398-0036-2

The needs of manufacturing and technological industries for materials that have certain characteristics have driven the development of hard and ultrahard materials. These characteristics include the ability to retain strength at increasingly higher temperatures, to survive in any chemical environment, and to meet certain electrical or magnetic properties.

The market for hard and ultrahard materials is increasing at a very rapid rate. These materials are increasingly being used in aerospace and automotive industries because they are lightweight, offer high-temperature strength, have a high resistance to wear and corrosion, and need less lubrication. Because of the high hardness of these materials, it is not possible to effectively use other material removal methods commonly utilised with metals such as turning, milling, and drilling. Grinding with diamond wheels has become one of the primary methods used in machining of hard and ultrahard materials. At the same time, these materials are brittle, so grinding consists of a combination of microbrittle fracture and quasiplastic cutting. The mechanism of quasiplastic cutting, typically referred to as ductile-mode grinding, results in grooves on the surface that are relatively smooth in appearance. The transition from brittle to ductile-mode grinding is hard to predict because there is no universal mechanism for the grinding of a brittle material to another, and it is hard to tell how many grinding grits will be in contact with the workpiece.

The problem commonly associated with the grinding of hard and ultrahard materials is the surface defects induced during the grinding process. The fracture damages can be avoided or reduced by the careful choice of grinding parameters and control of the process to obtain ductile-mode grinding. But ductile-mode grinding is a costly process and requires a lot more energy than the brittle grinding, which in turn generates a high grinding temperature.

The electrolytic in-process dressing (ELID) technique has been introduced to conduct high-efficiency grinding of ceramics using cast-iron bonded wheels. ELID grinding was first proposed by the Japanese researchers Ohmori and Nakagawa in 1990.

The grinding process can be made more economically efficient with online process control. This can be achieved by means of advanced sensing technology based on acoustic emission (AE). Acoustic emission has been in use since the late 1960s as a nondestructive testing method for the evaluation of fatigue and fracture of solid materials, and for the monitoring of flaw and crack growth in pressure vessels.

Acoustic emission is referred to as the release of a transient elastic wave in the lattice of crystalline materials due to rearrangements of the internal structure of a material under deformation. The transient elastic wave is detected by the sensor attached to the material, and the sensor converts it into electric signals and sends them to the hardware system for further processing.

A piezoelectric crystal is strained and an electric signal is generated due to the displacement of the surface to which it is attached. Acoustic emission ELID investigation is part of a new strategy for monitoring the process from a quantitative viewpoint.

This book presents for the first time a new technology with various applications and the science behind this method. In order to improve any process, they must first understand the fundamentals of the process (physics, chemistry, and mechanics).

5 Szycher's Handbook of Polyurethanes, Second Edition
by: M. Szycherm
Published 2013
by CRC Press, Taylor & Francis Group, 6000 Broken Sound Parkway NW, Suite 300, Boca Raton, FL 33487-2742, USA, 1126pp
ISBN: 978-1-4398-3958

A handbook is a compilation of data from many sources presented in a logical and easy-to-follow sequence. The data must be compiled from disparate sources; the sources may be strictly academic, commercial, or promotional. It may come from technical publications, seminars, or the patent literature.

The US patent literature is one of the most comprehensive sources of technical information. The technical information provided in patents is exhaustive, current, and represents the most valuable technology discovered by corporations, universities, and independent inventors. Because of the wealth of information contained in patents, this handbook features many full-text-patents. These patents have been carefully selected by the authors to best illustrate the complex principles involved in polyurethane chemistry and technology.

This handbook is not composed of original papers; instead, it is based on hundreds of published references. The authors have tried to credit original sources by providing an extensive bibliography. The reader is encouraged to refer to the original sources for a complete information and insight.

Polyurethanes are arguably the most complex family of polymers. Polyurethanes range from soft elastomeric polymers to hard elastoplastics that rival metals. Polyurethanes are used as structural materials, coatings, adhesives, and sealants. Polyurethanes can be synthesised as thermoplastics, thermosets, and curable

compositions by either heat or UV energy- and all by molecular design, as opposed to compounding by the addition of plasticisers or other modifiers.

The book contains the following chapters: Introduction, basic concepts in polyurethane chemistry and technology, structure-property relations in polyurethanes, isocyanate chemistry, polyols, chain extenders, flexible and semiflexible foams, rigid polyurethane foams, polyurethane foam surfactants, catalysis of isocyanate reactions, elastomers, reaction injection moulding, polyurethane adhesives, waterborne polyurethanes, health and safety, radiation-curable adhesives and coatings, processing methods, compounding ingredients, copolymers and polyblends, polyurethane coatings, castables, sealants, and caulking compounds, medical applications, resorbable polyurethanes, biodurable polyurethanes, antimicrobial polyurethanes, hydrophilic polyurethanes, biocompatibility testing, eco-friendly polyurethanes, processing thermoplastics urethanes via twin screw extrusion, infrared analysis of medical-grade polyurethane elastomers: can durometer hardness be determined by IR analysis?

6 Ceramics and Composites Processing Methods

by: N.P. Bansal and A.R. Boccaccini
Published 2012
by The American Ceramic Society 2013, by John Wiley & Sons, Inc.
Hoboken, New Jersey, 111 River Street,
Hoboken, NJ 07030-5774, USA, 585pp
ISBN: 978-0-470-55344-2

There is increasing interest in the application of advanced ceramic materials in areas as diverse as transport, energy, environment, communications, health, and aerospace. The increasing scope for the utilisation of ceramic materials in a wide range of applications makes the in-depth understanding of processing technologies more necessary than ever before, which can lead to ceramic products and components having the desired properties and performance in-service. This book was conceived to offer in a single volume a broad selection of key processing techniques for ceramics and their composites incorporating different chapters written by internationally recognised experts in their respective fields. This book includes traditional fabrication routes as well as advanced approaches, which are being developed to tackle the increasing demand for more reliable ceramic materials.

This book is divided into three sections: ‘Densification’, ‘Chemical Methods’ and ‘Physical Methods’. The fundamentals and practice of sintering pulsed electronic current sintering and viscous phase silicate consists of eight chapter covering colloidal methods, sol-gel casting, polymer processing, chemical vapour deposition, chemical vapour infiltration, reactive melt infiltration, and combustion synthesis. The chapter on directional solidification, solid free-form fabrication, microwave processing, electrophoretic deposition, and plasma spraying are included under Physical Methods. Each chapter is focused on a particular processing method/approach based on the expertise of respective authors who are specialists and internationally renowned researchers from various countries. The readers of this book will thus be able to find at one place state-of-the-art and comprehensive information on various approaches, techniques, and methods for processing and fabrication of advanced ceramics composites.

The book contains the following chapters:

Part I: Densification

- Sintering: Fundamentals and practice
- The role of the electric current and field during pulsed electric current sintering
- Viscous-phase silicate processing.

Part II: Chemical methods

- Colloidal methods
- Processing and applications of sol-gel glass
- Gelcasting of ceramic bodies
- Polymer processing of ceramics
- Chemical vapour deposition of structural ceramics and composites
- CVI processing of ceramic matrix composites
- Reactive melt-infiltration processing of fibre-reinforced ceramic matrix composites
- Combustion synthesis: an update.

Part III: Physical Methods

- Directional solidification
- Solid free-form fabrication of 3-D ceramic structures
- Microwave processing of ceramic and ceramic matrix composites
- Electrophoretic deposition
- Processing of ceramics by plasma spraying.

This book is directed toward scientists, engineers, technologists, and researchers working in the industry, national research laboratories, and academia with interest in traditional and advanced ceramics as well as ceramic composites. Senior undergraduates as well as graduate students pursuing a degree in ceramic or materials science and engineering will also find this book useful. All chapters are stand-alone pieces. Some duplication, especially in the introductory section, and non-uniformity of symbols and nomenclature may be present.

7 Glass-Ceramic Technology, Second Edition

by: W. Höland and G.H. Beall
Published 2012
by The American Ceramic Society 2013, by John Wiley & Sons, Inc.
Hoboken, New Jersey, 111 River Street,
Hoboken, NJ 07030-5774, USA, 414pp
ISBN: 978-0470-48787-7 (hardback)

The aim of the second edition of this reference book is to present the research and development work that has been conducted on glass-ceramic materials since 2002, the year in which the first edition of this book was published. Significant advances have been made since that time in the development of glass-ceramics, which exhibit either special optical properties or exceptional mechanical characteristics, such as high strength and toughness. In this new edition, these development trends are discussed with emphasis on controlled nucleation and crystallisation in specific materials systems. In this regard, readers are given a deeper understanding of inorganic solid-state chemistry through the examination of crystalline phase formation reactions. The authors have attached great importance to recording these crystal phase formation processes in close relation to the primary glass phase using a wide variety of analytical methods and to clearly presenting their work. Based on their findings the properties and special applications of materials are then introduced. Here, special attention is given to the application of glass-ceramics as materials with special optical properties and biomaterials for dental application. Also, new composite materials, containing glass-ceramics and high-strength polycrystalline ceramics, as well as on new bioactive materials that have been developed to replace bone, are reported.

Based on its contents, the present book may be classified somewhere between a technical monograph, textbook, or reference book. It contains elements of all three categories and is thus likely to appeal to a broad readership all over the world. As the contents of the book are arranged along various focal points, readers may approach the book in a differentiated manner.

The book contains the following chapters:

- Principles of designing glass-ceramic formation
- Composition systems for glass-ceramics
- Microstructure control
- Applications of glass-ceramics
- Epilogue: Future directions
- Appendix: Twenty-one figures of 23 crystal structure
- References.

Designed as a resource for anyone looking to learn more about glass-ceramics materials, their scientific and technological background, and their applications, glass-ceramic technology, second edition is essential regarding for scientists, engineers, technicians and student working in the natural and medical sciences and technology and related fields.