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## Book Reviews

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Reviewed by Janez Grum

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- 1 Quenching Theory and Technology, Second Edition**  
**by: B. Lišićić, H. Tensi, L.C.F. Canale and G.E. Totten**  
**Published 2010**  
**by CRC Press, Taylor & Francis Group**  
**6000 Broken Sound Parkway NW, Suite 300,**  
**Boca Raton, FL 33487-2742, USA, 710pp**  
**ISBN: 978-0-8493-9279-5**

Quenching is one of the most fundamentally complex processes in the heat treatment of metals, and it is something on which mechanical properties and distortion of engineering components depend.

With chapters written by the most respected international experts in the field, *Quenching Theory and Technology, Second Edition* presents the most authoritative, exhaustive, and recent findings in this vital area. Understanding and control of quenching and quenchants is a critical constant in all well established and emerging heat treatment process technology. The collection of up-to-date knowledge in this book is the latest outcome from continuing formal and informal discussions by experts within the framework of the *International Federation for Heat Treatment and Surface Engineering (IFHTSE)*.

With revised and update content from the first edition, this book adds coverage of important technological developments. Although the primary focus continues to be on the quenching of steel, it also details quenching of aluminium and titanium alloys, quench severity of selected vegetable oils, gas quenching, intensive quenching, and simulation of quenching.

Presenting the most recent findings in this area, this essential piece of literature is a substantial contribution to the general field of the thermal processing of metals. It is useful not only for specialists in heat treatment practice, but also those in higher education or numerous specialised courses and seminars worldwide.

It covers topics including:

- thermo-and fluid dynamic principles of heat transfer during cooling
- updates and expands coverage of high pressure gas quenching (HPGQ) in vacuum furnaces
- explores intensive quenching, a promising new technology that facilitates compressive surface stresses and minimised distortion

- discusses computer modelling, simulation and prediction of coupled quenching phenomena: heat transfer, microstructure transformation, hardness, stress and strain development residual stress, and distortion of quenched workpieces
- analyses new quenching media, especially quench oils based on renewable basestocks (vegetable oils)
- wetting kinematics
- offers new details about quenching of aluminium alloys and titanium alloys, which are being used increasingly for lightweight constructions.

The book contains the following chapters:

- 1 hardening of steels
- 2 quenching of aluminium alloys
- 3 quenching of titanium alloys
- 4 mechanical properties of ferrous and non-ferrous alloys after quenching
- 5 thermo- and fluid-dynamic principles of heat transfer during cooling
- 6 heat transfer during cooling of heated metals with vaporisable liquids
- 7 wetting kinetics and quench severity of selected vegetable oils for heat treatment
- 8 residual stresses after quenching
- 9 effect of work piece surface properties on cooling behaviour
- 10 determination of quenching power of various fluids
- 11 types of cooling media and their properties
- 12 gas quenching
- 13 techniques of quenching
- 14 intensive steel quenching methods
- 15 prediction of hardness profile in work piece based on characteristic cooling parameters and material behaviour during cooling
- 16 simulation of quenching.

- 2 Light Metals 2011, Proceedings of the Technical Sessions Presented by the TMS Aluminium Committee at the TMS 2011 Annual Meeting & Exhibition, San Diego, California, USA, February 27–March 3, 2011**  
**by: S.J. Lindsay**  
**Published 2011**  
**by John Wiley & Sons, Inc.**  
**Hoboken, New Jersey, 111 River Street, Hoboken,**  
**NJ 07030-5774, USA, 1232pp**  
**ISBN: 978-1-11800-935-0**

The conference proceedings of TMS annual meeting and exposition in San Diego, California represent a large fraction of the accumulated knowledge about light metals.

The proceedings include 206 papers presented at six sessions. Papers are presented by authors coming from universities, research institutes as well as from industry.

Topics cover the following areas:

- 1 Alumina and bauxite:
  - bauxite resources and utilisation
  - Bayer process I
  - red mud
  - precipitation, calcination and properties
  - energy and environment
  - alternative alumina sources
- 2 Aluminium reduction technology:
  - environment-emissions/anode effect I
  - cells thermal balance
  - cells technology, development and sustainability
  - cells process control
  - improvement in cell equipment and design
  - cells process modelling
  - energy savings by cell design improvements
- 3 Aluminium rolling:
  - an investigation of deformation behaviour of bimetal clad sheets by asymmetrical rolling at room temperature
  - coil build up compensation during cold rolling to improve off-line flatness
  - through process effects on final al-sheet flatness
- 4 Cast shop for aluminium production:
  - casthouse productivity and safety
  - direct chill casting
  - dross formation, control and handling
  - melt quality control

- grain refinement, alloying, solidification and casting
- 5 Electrode technology for aluminium production:
- anode baking
  - anode raw materials and green carbon
  - petroleum coke VBD
  - anode quality and rodding processes
  - cathode design and operation
  - cathode materials and wear
  - inert anodes and wettable cathodes
  - poster session – electrode
- 6 Furnace efficiency – energy and throughput:
- furnaces designed for fuel efficiency
  - latest trends in post consumer and light gauge scrap processing to include problematic materials such as UBC, edge trimming and loose swarf
  - investigation of heat transfer conditions in a reverberatory melting furnace by numerical modelling
  - operational efficiency improvements resulting from monitoring and trim of industrial, combustion systems
  - new technology for electromagnetic stirring of aluminium reverberatory furnaces
  - evaluation of effects of stirring in a melting furnace for aluminium
  - business analysis of total refractory costs
  - improved furnace efficiency through the use of refractory materials
  - study on the energy-saving technology of Chinese shaft calciners.

**3 Handbook of Engineering and Speciality Thermoplastics, Volume 2, Water Soluble Polymers**

**by: J.K. Fink**

**Published 2011**

**by John Wiley & Sons, Inc.**

**Hoboken, New Jersey, 111 River Street, Hoboken, NJ 07030-5774, USA,**

**and Scrivener Publishing LCC, Salem, Massachusetts, 436pp,**

**ISBN: 978-1-118-06275-3**

This book focuses on common types of polymers belonging to the class of water soluble polymers. It covers a wide range of applications: food, cosmetic, medical, lithography and ink jet printing, agricultural, wastewater cleaning, and oilfield.

The text is arranged according to the chemical constitution of polymers and reviews the developments that have taken place in the last decade. Each chapter follows the same template. A brief introduction to the polymer type is given a previous monographs and reviews dealing with the topic are listed for quick reference. The text continues with

monomers, polymerisation, fabrication techniques, properties, applications, as well as safety issues.

Providing a rather encyclopaedic approach to water soluble polymers, the Handbook of Engineering and Specialty Thermoplastics: presents a listing of suppliers and commercial grades, reviews current patent literature, essential for the engineer developing new products, contains an extensive trade names index with information that is fairly unique, concludes with an index of acronyms and a general index.

The handbook provides a comprehensive reference for chemical engineers and offers advanced students a textbook for use in courses on chemically biased plastics technology and polymer science.

- 4 Magnesium Technology, 2011, Proceedings of a Symposium Sponsored by the Magnesium Committee of the Light Metals Division of the Minerals, Metals & Materials Society (TMS), TMS 2011 Annual Meeting & Exhibition, San Diego, California, USA, February 27–March 3, 2011**  
**by: W.H. Sillekens, S.R. Agnew, N.R. Neelameggham and S.N. Mathaudhu**  
**Published 2011**  
**by John Wiley & Sons, Inc.**  
**Hoboken, New Jersey, 111 River Street,**  
**Hoboken, NJ 07030-5774, USA, 649pp**  
**ISBN: 978-1-11802-936-7**

Conference proceedings contain the following chapters:

- Magnesium Technology 2011: opening session
- primary production; characterisation and mechanical performance
- casting and solidification
- alloy design/development; grain refinement and severe plastic deformation
- high-temperature alloys; high-strength alloys; precipitation
- deformation mechanisms I
- deformation mechanisms II: formability and forming
- new applications (biomedical and other)
- advanced materials and processing
- corrosion and coatings
- poster session.

The world of today faces a number of immense challenges relating to such diverse issues as sustainability security and quality of life. Most interestingly, magnesium can – and likely will – increasingly contribute to the resolution of several of these issues. Weight saving by introducing magnesium alloy components in vehicles is a recognised means of

enhancing fuel efficiency and thus of reducing energy consumption and greenhouse gas emissions. Different from several other metals, magnesium is virtually inexhaustibly available from natural resources. By using attributes of magnesium-based materials other than low density (such as impact resistance, biocompatibility and chemical affinity), a variety of new applications relating to ballistic armour, biomedical implants and hydrogen storage rises at the horizon.

The symposium was organised in an opening session, a poster session and nine technical oral sessions, covering a broad range of topics. This included primary production and characterisation, casting and solidification, alloy design, high-temperature and high-strength alloys, deformation mechanisms, formability and forming, new applications', advanced materials and processing, and corrosion and coatings.

The volume at hand represents the proceedings of this symposium. Like in previous years, contributions come from countries around the globe that are active in magnesium research and development and reflect the latest advancements in the field. To ensure TMS standards, all papers were peer reviewed by a pool of volunteers acting on behalf of the Magnesium Committee. In addition to these proceedings, some symposium contributions on biomedical applications will be published in full in an upcoming JOM special issue sponsored by the Magnesium Committee and entitled 'Biomedical applications of magnesium'.

While symposium proceedings traditionally reflect the state-of-the-art and spirit of the age, may this volume become a valuable part of your reference library for the years to come and in retrospect mark a memorable period in advancing the field of magnesium technology.

## **5 Fundamentals and Applications of Nanomaterials**

**by: Z. Guo and L. Tan**

**Published 2009**

**by ARTEC HOUSE**

**685 Canton Street, Norwood, MA 02760, USA, 249pp**

**ISBN-13: 978-1-59693-262-3**

The intention of this book is to introduce readers to a broad view of nanomaterials, from fundamental principles to fabrication techniques, and from characterisation to applications. It is primarily intended as a textbook for seniors and/or graduate students in materials science and other related engineering fields. It can also serve as a reference book for professionals that are interested in this field. This book has the following unique features compared to other books in this field:

- This book is comprehensive and self-explanatory. Unlike most books in the nanomaterials field that focus mainly on current developments, this textbook covers fundamental principles, nanofabrications as well as nanomaterial properties and applications. Each part can be read independently or combined to create the complete book. Additionally, only a college level understanding of math, physics, and chemistry is required. We try to cover the most fundamental principles in this book, making it very suitable for a college level textbook or a handy reference book for professionals.

- This book covers a wide range of nanomaterials, such as nanodevice fabrications, nanomaterials characterisation, and nanoelectronic, bio, and structural materials. The information included in this textbook accurately reflects the current state of nanomaterials, partially due to the author's diverse experience and broad interests in nanomaterials science and engineering. More importantly, we connected these developments with the fundamentals so that the readers will not only appreciate the magical aspects, but also understand the underlying principles.
- Whenever possible, we try to explain complicated problems with examples and physical concepts instead of mathematic formulas. The purpose of this book is not just to introduce the knowledge, but also to stimulate the interest of our young minds to nanomaterials. It is not magic or mysterious; it is rather scientific. The authors have also listed many reference books and articles for those who would like to explore topics further.

The book discusses the following topics:

Part I Fundamentals of nanomaterials science:

- quantum mechanics and atomic structures
- bonding and band structure
- surface science for nanomaterials
- nanomaterials characterisation

Part II Nanomaterials fabrication:

- thin-film deposition: top-down approach
- nanolithography: top-down approach
- synthesis of nanoparticles and their self-assembly: bottom-up approach

Part III Nanomaterials properties and applications:

- nanoelectronic materials
- nano biomaterials
- nanostructural materials.

## **6 Transmission Electron Microscopy, A Textbook for Materials Science by D.B. Williams and C.B. Carter**

**Published 2009**

**by Springer**

**233 Spring Street, New York, NY 10013, USA, 760pp**

**ISBN: 978-0-387-76500-6, ISBN: 978-0-387-76502-0,**

**ISBN: 978-0-387-76501-3**

Electron microscopy has revolutionised our understanding of materials by completing the processing-structure-properties links down to atomistic levels. It is now even possible to tailor the microstructure and mesostructure of materials to achieve specific sets of properties; the extraordinary abilities of modern transmission electron microscopy-TEM-instruments to provide almost all the structural, phase, and

crystallographic data allow us to accomplish this feat. Therefore, it is obvious that any curriculum in modern materials education must include suitable courses in electron microscopy. It is also essential that suitable texts be available for the preparation of the students and researchers who must carry out electron microscopy properly and quantitatively.

In case there are people out there who still think TEM is just taking pretty pictures to fill up one's bibliography, please stop, pause, take a look at this book, and digest the extraordinary intellectual demands required of the microscopic in order to do the job properly: crystallography, diffraction, image contrast, inelastic scattering events, and spectroscopy. Remember, these used to be fields in themselves. Today, one has to understand the fundamentals of all these areas before one can hope to tackle significant problems in materials science. TEM is a technique of characterising materials down to the atomic limits. It must be used with care and attention, in many cases involving teams of experts from different venues. The fundamentals are, of course, based in physics, so aspiring materials scientist would be well advised to have prior exposure to, for example, solid-state physics, crystallography, and crystal defects, as well as a basic understanding of materials science, for without the latter, how can a person see where TEM can be put to best use?

This fine new book definitely fills a gap. It provides a sound basis for research workers and graduate students interested in exploring those aspects of structure, especially defects that control properties. Even undergraduates are now expected, to know the basis for electron microscopy, and this book, or appropriate parts of it, can also be utilised for undergraduate curricula in science and engineering.