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## **Book Reviews**

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- 1 Inelasticity of Materials, an Engineering Approach and a Practical Guide, Series on Advances in Mathematics for Applied Sciences – Vol. 80 by: A.R. Srinivasa, S.M. Srinivasan  
Published 2009 by World Scientific Publishing Co. Pte. Ltd.,  
5 Toh Tuck Lin, Singapore 596224, 541pp  
ISBN-13: 978-981-283-749-3, ISBN-10: 981-283-749-3**

Acquiring the capacity to model inelastic behaviour and to choose the right model in commercial analysis software has become a pressing need for practicing engineers with the advent of a host of new materials ranging from shape memory alloys to bio-materials to multiphase alloys. Even with the traditional materials, there is a continued emphasis on optimising and extending their full range of capability in the applications. This book builds upon the existing knowledge of elasticity and thermodynamics, and allows the reader to gain confidence in extending ones skills in understanding and analysing problems in inelasticity.

This book is written in three parts:

- Part I Introduction to inelasticity, simple structural elements.

The first part is primarily focused on lumped parameter models and simple structural elements such as trusses and beams. It comprises the following items: introduction to inelasticity, thermodynamics of inelastic materials: a lumped parameter approach, inelastic response of truss elements, elastoplastic beams: an introduction to a boundary value problem, simple problems: case studies: rehabilitation of a crane girder and passive damping of a frame structure using super-elastic shape memory alloys bracings.

- Part II Inelasticity of continua – small deformations.

The second part of this book focuses on small deformation multidimensional inelasticity. Sufficient material is included on how to numerically implement an inelastic model and solve either using a simple stress function type of approach or using commercial software. Simple examples are included. There is also an extensive discussion of thermodynamics in the context of small deformations.

It deals with the following items: introduction to small deformation plasticity, the boundary value problem for J2 elastoplasticity, examples of other yield surfaces: associative and non-associative plasticity, thermodynamics of elasto-plastic materials: the central role, of dissipation and numerical solutions of boundary value problems.

Part III Inelasticity of continua, finite deformations.

More advanced situations such as finite deformation inelasticity, thermo-dynamical ideas and crystal plasticity are dealt with in the third part of the book.

It relates to the following items: summary of continuum thermodynamics, finite deformation plasticity and inelasticity of single crystals.

Advanced case studies: shot peening – a process for creating wear resistant surfaces, equal channel angular extrusion – a materials processing route, modelling of an aging face – an application in biomechanics.

This book is written in a modular fashion, which provides adequate flexibility for adaptation in classes that cater to different audiences such as senior-level students, graduate students, research scholars, and practicing engineers.

## **2 Physical Metallurgy of Direct Chill Casting of Aluminum Alloys**

**by: D. Mitry, G. Eskin**

**Published 2008 by CRC Press, Taylor & Francis Group,  
6000 Broken Sound Parkway NW, Suite 300, Boca Raton,  
FL 33487-2742, USA, 3286pp  
ISBN-13: 978-1-4200-6281-6**

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 the physical phenomena involved in the solidification and to the process parameters.

The book draws on the authors' advanced research, providing a unique application of physical metallurgy. He examines structure and defect formation-including macrosegregation and hot tearing-that occurs during direct chill (DC) casting. Each technology-centred 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.

In the book the following chapters are included: DC casting: development of the technology.

- solidification of aluminium alloys: effect of cooling rate and melt temperature on solidification of aluminium alloys, microsegregation in aluminium alloys, solidification reactions and phase composition, effect of alloy composition on structure formation: grain refinement

- solidification patterns and structure formation during DC casting: shape and dimensions of the billet sump, solidification rate and cooling rate during DC casting, effects of process parameters on the formation of grain structure, effect of process parameters on the amount of non-equilibrium eutectics, effect of process parameters and alloy composition on the occurrence of some casting defects
- macrosegregation: mechanisms of macrosegregation, effects of process parameters on macrosegregation during DC casting, effect of composition on macrosegregation: macrosegregation in commercial aluminium alloys
- hot tearing: thermal contraction during solidification, mechanical properties of semi-solid alloys, mechanisms and criteria for hot tearing, effects of process parameters on hot tearing-during DC casting.

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.

### **3 Microstructure of Metals and Alloys: An Atlas of Transmission Electron Microscopy Images**

**by: G. Zlateva, Z. Martinova**

**Published 2008 by CRC Press, Taylor & Francis Group,  
6000 Broken Sound Parkway NW, Suite 300, Boca Raton,  
FL 33487-2742, USA, 328pp  
ISBN-13: 978-1-4200-7556-4**

The contemporary teaching in the field of materials science, which encompasses physical metallurgy as an integral part, is based on the structure-properties-processing-performance relationship.

This book is a teaching aid, designed as an atlas that comprises a collection of original transmission electron micrographs contributed by the authors. The micrographs were carefully selected and integrated with the purpose of demonstrating typical crystal lattice defects, elements of the microstructures of metals and alloys, and the basic processes occurring in the crystal structure during plastic deformation, polygonisation, recrystallisation, heat treatment, and rapid solidification. Considerable attention was given to the nanostructural features that can be visualised by the TEM and that represent the basis of solid-state reactions and transformations. Thus, the reader will be able, in a step-by-step fashion, to interpret TEM images, both correctly and easily, as well as better understand the processes occurring in metallic structures at the nanolevel.

This book is organised into six chapters. Each chapter deals with a particular problem in the field of physical metallurgy and starts with a short description of the basic concepts and terms in order to enable the reader to achieve a better understanding of the essential issues related to that problem.

- imperfections of the crystal structure: dislocations, multiplication of dislocations, vacancies, grain and sub-grain boundaries, twins

- formation of a dislocation substructure by plastic deformation: formation of a dislocation substructure at room temperature in metals of high stacking fault energy, formation of a dislocation substructure at higher temperature in metals of high stacking fault energy, formation of a dislocation substructure at room temperature in metals of medium-low stacking fault energy, formation of a dislocation substructure at room temperature in metals of very low stacking fault energy, formation of a dislocation substructure at higher temperature in metals of low stacking fault energy
- changes in the deformation structure caused by heating
- growth of the crystals and rapid solidification: growth of the crystals, rapid solidification process
- solid-state phase transformations: continuous precipitation in age-hardening alloys, interaction of dislocations with second-phase precipitates, discontinuous (cellular) precipitation, eutectoid transformation, martensitic transformations, the bainite transformation
- case studies: application of TEM in the solving of problems in engineering practice: deformation behaviour of nickel-silver alloy in the temperature range from 100°C to 900°C, distribution of strengthening phases in precipitation-hardening alloys, specific features of the structure developed during deformation in superplastic state, the influence of modification and heat treatment on the microstructure of aluminium-silicon alloy, sigma-phase formation in a duplex stainless, chromium-manganese-nitrogen steel, corrosion resistance of particular structure components of austenitic stainless steels, characterisation of ferrite in welds of austenitic steels
- recommended literature for further reading.

This book will provide a useful reading to undergraduate, graduate, and PhD-level students in materials science, metallurgy, and mechanical engineering departments and that they will benefit from its use as a teaching aid.

**4 Budgeting, Costing and Estimating for the Injection Moulding Industry**  
**by: P. Jones**  
**Published 2009 by Smithers – A Smithers Group Company,**  
**Shawbury, Shrewsbury, Shropshire, SY4 4NR, UK, 274pp**  
**ISBN: 978-1-84735-211-8 (hardback),**  
**ISBN: 978-1-84735-212-5 (softback)**

The intention of this book is to provide a clear understanding of the interrelated processes of budgeting, costing and estimating for the injection moulding industry. It is designed to give a clear account of all the stages involved that lead to a company costing and estimating procedure for the injection moulding industry. It includes examples of all procedures at every stage and as such, it should prove of interest to anyone concerned with these most important topics.

The underlying theme of this book is the maximisation of profits through the control of costs. Hence, emphasis is placed on ensuring the understanding of costing and estimating models through discussion and examples.

All companies have a hierarchical structure. This is necessary to define the duties and responsibilities of all the departments and employees. This example is typical of a medium sized company, whereas in a smaller company several staff may have multifunctional roles combining two or more departments while other departments may not exist at all – like research and development for example. Conversely, larger companies may have much more complex structures with more departments and managers. Hence, the hierarchical structure of any company is a function of its size and the type of business it operates.

The topics of budgeting, costing and estimating for injection moulding are the source of much confusion in the plastics industry and from the research carried out by the author, there does not appear to be any kind of authoritative published work that addresses these topics. This book addresses them head-on to explain in detail all the stages involved from budgeting to the final estimate.

This book discusses and defines the different methods of budgeting, costing and estimating that are normally used within the injection moulding industry. In order to establish the costing system, the operating costs first have to be identified and quantified by means of a budget. Based on the budget, a costing system can then be developed that can be applied to determine the manufacturing cost of each product a company manufactures.

The underlying theme of this book is the maximisation of profits through the control of costs. Hence, emphasis is placed on ensuring the understanding of costing and estimating models through discussion and examples.

In the book the following chapters are included: terms and definitions, planning and budgeting, methods of costing, job costing, overlooked costs, controlling the costs: measuring the true cost of a job, reducing the costs of production, maximum metal conditions and operating windows, the cooling cycle and its effect on cost, the loss leader, the estimating function, the estimating procedure, estimating a typical job, estimating mould tool costs, profit and loss accounts.

This book will be of considerable value to managers of injection moulding companies, to accountants who work in these companies and users of the equipment who may have involvement in the costing and budgeting of new projects.

## **5 Food Contact Materials – Rubbers, Silicones, Coatings and Inks**

**by: M.J. Forrest**

**Published 2009 by Smithers – A Smithers Group company,**

**Shawbury, Shrewsbury, Shropshire, SY4 4NR, UK, 362pp**

**ISBN: 978-1-84735-141-8 (hardback),**

**ISBN: 978-1-84735-414-3 (softback)**

The review is a completely revised and updated version of a review, which was published in 2000. Since that time a number of important developments have taken place, notably the beginning of the harmonisation of the legislation within Europe with the issuing of the CoE Resolution on rubber in 2004.

A rubber can be defined as a polymeric material which, above its glass transition temperature, can be stretched repeatedly to at least twice its original length and, on release of the stress, rapidly returns to its original length. These properties are brought about by a combination of the chemical structure of the polymer backbone and the vulcanisation process which brings about the formation of a lightly cross linked three dimensional structure.

The objective of the FSA silicone food contact materials project was to provide detailed information on the types and composition of silicone-based products that are used in contact with food and identify the extent to which the migration of specific constituents into food could occur. It built on information previously obtained on silicone food contact materials, such as seals and tubing, by routes such as the MAFF rubber contact rubber project.

The objective of FSA coating and inks project was to assess the potential for the migration of substances from coatings and inks that were used in food packaging applications. As a significant amount of work had already been carried out on coatings that were in direct contact with food, a boundary that was set was that only coatings and inks in non-direct food contact situations would be considered.

Coatings and Inks for use with food have been a very topical subject over the last couple of years, mainly due to the culmination of the work that has been carried out by the Council of Europe. As a result of its efforts, we have seen the adoption of both a resolution for coatings, and a resolution for inks used on non-food contact surfaces.

In practice, this encompasses an extremely wide range of polymer systems and formulations, and an emphasis has been placed on coatings and inks used in food packaging, as this is usually regarded as representing the most important application category with respect to the potential for migration to occur. All three of the major material classes used in food packaging products, i.e., metal, paper and board, and plastic, are covered by this review.

In the book the following chapters are included:

- food contact rubbers – products, migration and regulation: introduction, rubber materials and products used in contact with food, regulations covering the use of rubber as a food contact material, assessing the safety of rubber as a food contact material, improving the safety of rubber as a food contact material, future trends in the use of rubber with food, conclusion: sources of further information and advice
- coatings and inks for food contact materials: introduction, coating and ink products for food contact materials, coatings and inks used in the food chain, application techniques for inks, regulations covering the use of inks and coatings with food, assessing the safety of inks and coatings for food applications, potential migrants and published migration data, improving the safety of inks and coatings for food use, future trends
- silicone products for food contact applications: introduction, silicone products for food contact applications, regulations covering the use of silicones with food, assessing the safety of silicone materials and articles for food applications, foods standards agency silicone project, migration mechanisms, potential migrants and published migration data, improving the safety of silicones for food use and future trends.

This handbook will be an invaluable resource to all working in the packaging industry and for those who produce food.

- 6 Advances in Energy Materials, Ceramic Transactions,  
Vol. 205, A Collection of Papers Presented at the 2008 Materials Science  
and Technology Conference (MS&TO8), October 5–9,2008,  
Pittsburgh, Pennsylvania  
by: F. Dogan, N. Manjooran  
Published 2009 by John Wiley & Sons, Inc., Hoboken,  
New Jersey, USA, 2009, 168pp  
ISBN: 978-0-470-40843-8**

Increasing awareness of environmental factors and limited energy resources have led to a profound evolution in the way we view the generation and supply of energy. Although fossil and nuclear sources will remain the most important energy provider for many more years, flexible technological solutions that involve alternative means of energy supply and storage need to be developed urgently.

The search for cleaner, cheaper, smaller and more efficient energy technologies has been driven by recent technology advancements particularly in the field of materials science and engineering. This volume documents a special collection of articles from a select group of invited prominent scientists from academia, national laboratories and industry who presented their work at the symposia on Energy Materials and Nanotechnology for Power Generation at the 2008 Materials Science and Technology (MS&T'08) conference held in Pittsburgh, PA. These articles represent a summary of the presentations focusing on both the scientific and technological aspects of energy storage, nuclear materials, nano-based sensors, catalysts and devices for applications in power generation, solar energy materials, super conductors and more.

In the book proceedings the following chapters are included: industrial perspective overview, energy materials, nanotechnology for power generation.