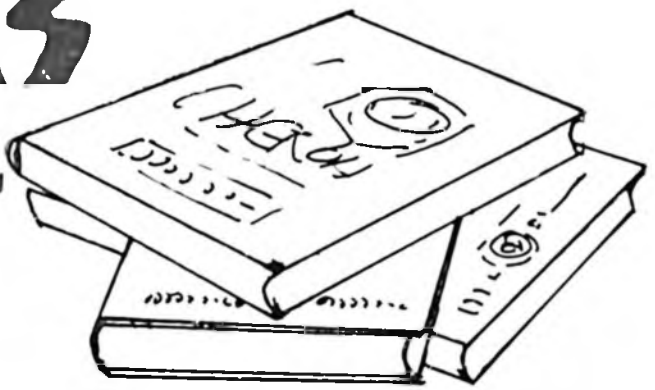
Books section



"ADVANCES IN SURFACE TREATMENTS" edited by **A. Niku Lari**, vol.4 in the series "International guide Book on RESIDUAL STRESSES. *Pergamon Press*, pp.566 including author & subject index.

The text contains five sections viz: Generation; Measurement & prediction; Nondestructive methods of measurments; Relaxation; Effect on the mechanical behaviour of components & Design. Twenty two papers contributed by experts in the field cover the whole subject.

Various processes contributing to creation of residual stresses can be broadly classified as Thermal, Thermochemical & mechanical. Discussion of the effects of temperature during welding, as also the subsequent modes of cooling leading to inhomogeneity of shrinkage and tranformation and consequent tensile or compressive stress with particular reference to single & multipass welds in plates & tubes is presented in one paper. In two other papers the authors cover the effects of mechanical operations in work-shop practice, resulting in elastic & plastic deformation of components, on the fatigue strength as also the mechanism involved in introduction of compressive stresses in operations, like shot penning, overloading of beams, bars & springs and autofrettage of tubes & holes.

Principle involved in various thermal treatments such as induction or laser hardening and thermochemical processes such as Carburizing, nitriding & nitrocarburizing and boriding, and their influence on residual stress, supported by data, and the underlying mechanism is discussed in another paper, with the aid of computer models.

Several papers cover the measurement of residual stresses by nondestructive & destructive methods. One paper presents a very exhaustive treatment of the subject on nondestructive methods such as X-ray, neutron diffraction, optical (Raman Spectroscopy), ultrasonics & magnetic methods, their limitations & the role of various factors such as texture, micro & macro stresses and provides very helpful formulae, tables, recommendations & references. Another paper discusses the applicability of the nondestructive testing methods to filament and planar composites. Yet another examines the effectiveness of these methods in evaluating C.V.D. & P.V.D. refractory films (coatings) such as carbides & nitrides which generate compressive stresses.

The destructive methods of residual stress measurement are presented and discussed in several papers. One paper describes the trepan or ring core, central hole, Sach's and blind hole methods and deep hole technique. These are intended to measure surface/near surface or subsurface through thickness stresses with the aid of strain gauges or other devices, which respond to the geometry of the structure. Another briefly reviews the different methods of calibration in determining residual stresses in hole drilling method and discusses, with experimental results the utility of the incremental hole drilling method in both shot penned and water quenched specimens. A third paper presents an analytical treatment of the Liku Lari and stress source methods with the aid of simple beam bending theory, with reference to shot penned plates.

Two papers furnish a theoretical and analytical approach to the study of residual stresses. One discusses, with the aid of numerical calculation codes the nonlinear mechanical behaviour of a material undergoing deformation involving macro stresses, during any transformation processes, owing to temperature gradient, variation in chemical composition or structural transformation. Another presents details of MARC finite element programme to determine temperature distribution thermal

and residual stress in quenching high strength 7075 alloy and the good correlation between theoretical calculations and experimental values, obtained by the layer removal method.

One paper is a review of literature relating to compressive models used to predict effects observed in relaxation of residual stresses by the thermal, mechanical or vibrational means. Yet another gives an analytical treatment with specific case histories of certain alloys under thermal and mechanical processes such as shot penning, unidirectional plastic deformation and deformation under cyclic stress.

Structural failures due to residual stresses as also the correlation between fatigue and fracture behaviour and residual stresses are presented in several papers. One records case histories of failures due to improper processing and the identification of the causes by X-ray and other methods. Another is an exceptionally good review covering theoretical analysis and experimental data relating to the three stages viz: Crack initiation, crack propagation, and fracture-an excellent contribution to the subject of fracture mechanics. A third paper discusses the role of residual stresses in increasing/decreasing, resistance to fatigue failures and means of intensionally introducing them in structural design, to improve mechanical behaviour of structures. The fourth paper is a review of the analytical model developed for failure of weldments and its extension in estimation of residual stresses and the fatigue life of notched components.

Fretting as a cause of crack initiation and propagation and the remedial measures, with a clear understanding of the roles of surface hardness and compressive residual stresses, with specific examples is presented in one paper.

Consequences of primary and secondary working operations as well as heat treatment on Uranium & its alloys, such as centerline bursting of bars, stress corrosion cracking and others. The methods of relieving the stresses and their measurement by relaxation and nuetron diffraction, is the subject matter of another paper.

An account of the role of National Bureau of Standards and the several subcommittees, of the A.S.T.M. in developing physical measurement standards and results achieved thus far are presented in one paper.

Analytical examination of the base aspects of assessment of statically and cyclically loaded components with macro stresses, is the topic of discussion. Failure analysis, is the concluding paper in this series on Residual stresses.

The publication, with contributions, by experts in the field is an invalauble guide to metallurgists and structural engineers concerned with manufacturing and treatment processes introducing residual stresses in structures and components reflecting their fatigue and fracture behaviour. The text has been amply illustrated with graphs, sketches and tables. Except for minor typographical errors, the book has been elegantly printed.

J. Balachandra
ECSI

"GASEOUS DETONATIONS - THEIR NATURE, EFFECTS AND CONTROL" by **M.A. Nettleton,** Published by *Chapman and Hall* (1987) 255 pages ISBN 0-412-27040-4.

This book deals with the subject of gaseous detonations-their causes, effects and methods of control. The author has laid emphasis on hazards in industrial environment. The presentation of topics is clear and well laid out in 9 chapters. After an introductory chapter, the theories of detonation and the experimental evidences for the multi-dimensional nature of detonation are described in chapters 2 and 3 respectively. The important topic of detonable media and thier various aspects such as the experimental results for confined and unconfined gaseous detonations and detonation limits are dealt in chapter 4. This chapter also includes a brief section on detonations in dust clouds. Chapter 5 gives the energy requirements for initiation of exothermic reactions in gaseous media. A novel semi-empirical treatment of the run-up distance to detonation is also given here. This treatment offers useful practical applications. The recent geometric shapes which exist in chemical plants is discussed in chapter 6. Finally the last three chapters (7 to 9) are important to the design engineer since they deal with stress and damage effects due to detonation, prevention techniques, and their limitations. An exhaustive list of about 400 references is given after chapter 9. However, a few important papers especially those published in the U.S.A. (from the U.S. Bureau of Mines) and in Russia have been omitted. One shortcoming of the book is that it does not cover effectively two topics viz., the influence of energy

losses on detonation propagation and gas/dust explosions, especially methane gas - coal dust explosions, an area of importance in the coal mining industry. However, these are minor limitations and this book is useful for researchers and practitioners concerned with detonation hazards and safety in the chemical industry.

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ADVANCES IN MEASUREMENT AND INSTRUMENTATION EDUCATION: Proceedings of the colloquium of the IMECO Technical Committee on Higher Education, September 26-28 (1984) Graz (Austria). Ed. and published by *IMECO Secretariat H-1371 Budapest POB - 457* (1985).

The proceedings begins with three invited papers mainly dealing with instrumentation Science and Education in measurement technology. The paper by Prof.Dr.H. Weiss of Austria is very interesting. This deals with three aspects of the problem in education in measurement - the need, the method and the syllabus - for both graduate and undergraduate level. The paper by Prof. Hg. W. Meyer of Hannover discusses the advance in Education methods and gives a theoretical account of the learning process.

There are four sections in addition to invited papers. Section I contains three papers mostly on digital method of signal processing and some block schemetic of the instrumentation and experimental results. Section II contains three papers on education. Out of this Prof. J. Horivchi's paper makes interesting reading. This gives detailed planning and course titles of graduate programme in instrumentation. Section III has seven contributed papers on Advanced Techniques and methods in instrumentation. All these papers are interesting. Most of the papers describe microprocesser based or personal computer based instrumentation.

Section IV contains seven papers on Advanced topics in instrumentation like chemical Engineering, Measurement of Electrical Quantities, Nuclear Radiation etc.,

The figures could have been better. The content sheet is not present at the begining of the book. It is at the end and so it is inconvenient and exasperating. However for the content of the book, it would be a good reference source in Engineering colleges and Polytechniques.

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THE PHYSICS OF WELDING II Ed. International Institute of Welding Ed. **J.F. Lancaster,** Publishers: *Pergamon Press* (1986)

The book, as the title indicates, deals with the physical phenomena and properties associated with Welding. The first chapter of the book is devoted to symbols, units and dimensions associated with the various physical quantities. This is fairly exhaustive.

The book makes no apology for its highly mathematical treatment of the subject since the physical phenomena dealt with has necessarily to be quantitative in treatment. The properties of fluids so far as they play a part in welding viz dissociation, ionization, plasma, and other properties such as viscosity, surface tension, thermal conductivity, vapour pressure etc., are dealt with theoretically in the second chapter.

The electromagnetic and electrostatic forces encountered in the field of welding has been exhaustively dealth with in the third chapter. The "pinch effect" by which a directional contraction of non-flowing liquid conductor by self induced magnetic effect has been explained.

Dynamics of fluid, with and without magnetic force has been dealt with in the fourth chapter. Different types of fluid flow encountered under different conditions have been exhaustively explained.

The next two chapters are devoted to study of electric arc, in Arc Welding. The physical characteristics of the electric arc, the various phenomena associated with such an electric arc clolumn have been exhaustively explained.

The phenomena of ion bombardment, surface cleaning by the electric arc and its affect on the arc itself, the properties of the vapour and plasma jets, relation between ionization and temperature have been thoroughly covered characteristics of the various types of arc welding viz Argon Arc, Tungsten arc, etc have been considered exhaustively with a large

number of illustrative curves. Isothermal maps have been included. Massflow, axial velocity dissipation and various other physical characteristics and their variation with parameters encountered, in arc welding such as arc pressure, electrical frequency, effect of magnetic forces have been explained with a large number of illustrative curves.

The practical information which would be useful for a practicing welder, has been dealt with in chapter 7. Metal transfer and mass flow in the weld pool is the subject matter of this chapter. Various modes of transfer of weld metal for different types of weldings and electrodes have been illustrated. Effect of a few surface active elements on these characteristics have been explained.

The last chapter briefly deals with power density welding comprising of plasma arc welding, Electron beam welding, laser beam welding and glow dischange electron beam welding. The basic characteristic of high depth penetration of these types of welding has been brought out and the cause of such beneficial characteristic has been explained. Principles of operation, application and advantages of these specialized processes have been dealt with.

The book is extremely useful in academic field and for persons engaged in R and D work in the field of welding technology.

T.G. Shamanna

HIGH TEMPERATURE BRAZING IN CONTROLLED ATMOSPHERES. The Pergamon Materials Engineering Practicals services by **G. Sheward**, *Pergamon Press* (1985)

The book deals with brazing techniques and use of controlled atmosphere therein. After a brief historical review of bonding, soldering and brazing have been discussed. Distinction between these two processes has been indicated. Different types of brazing processes such as torch brazing, furnace brazing, induction brazing etc and their application have been given.

A general historical review of controlled atmospheres in brazing from 1930's to 1980 has been made. Demands for brazing materials containing chromium, titanium and aluminium in Aircraft industry and development of processes and special filler metals for this purpose have been indicated. Requirments of brazing different types of materials in a single assembly and adoption of "step brazing" for this purpose has been explained.

Design consideration form the subject matter of the next chapter. Properties of parent materials, filler materials, their compatibility, the flux and its function, theoretical aspects of capillary action in brazing, effect of surface condition, different types of joints and their relation to performance required have been discussed.

Composition of filler materials (special), their performance characteristics and related eqilibrium diagrams to explain their function have been given in the next chapter. Filler materials based on nickel, gold, palladium, copper, aluminium and the special ones required for joining refactory materials such as molybdenum and tungsten have been discussed. Interactions between constitutents of filler metals and parent metal have been dealt with, by use of relevant constitutional diagrams.

There is a brief chapter on the different types of furnaces used for brazing under controlled atmospheres. Induction heating and methods adopted for controlled atmosphere in reduction brazing have been dealt with. This chapter is naturally followed by a chapter on different types of controlled atmospheres.

In the chapter dealing with brazing process itself, sequence of process, cleaning methods, methods of assembly, jigs and fixtures, use of "Stop offs" while employing jigs and fixtures have been dealt with. Some of the typical applications in Aerospace industry, nuclear field and others have been discussed.

The last chapter deals with quality control, inspection and testing methods. At the end of each chapter relevent references have been given.

The book is specially useful for those engaged in brazing of metals, especially in fields of high technology such as aerospace, nuclear field etc.

T.G. Shamanna

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