



Wear of orthopaedic implants and artificial joints

Edited by Saverio Affatato

Wear Of Orthopaedic Implants And Artificial Joints

Woodhead Publishing Series In Biomaterials

**Ashutosh Tiwari,N. Arul
Murugan,Rajeev Ahuja**

Wear Of Orthopaedic Implants And Artificial Joints Woodhead Publishing Series In Biomaterials:

Applications of Nanocomposite Materials in Orthopedics Inamuddin,Abdullah M. Asiri,Ali Mohammad,2018-10-27

Applications of Nanocomposite Materials in Orthopedics provides a solid understanding of recent developments in the field of nano composites used in orthopedics The book covers joint replacement the load bearing capability of fractured bones bone soft tissue regeneration hard tissue replacement artificial bone grafting bone repair bone tissue transplantations and related topics thus helping readers understand how to resolve problems associated with bone fracture and orthopedic surgery A variety of nanocomposite materials are discussed with their properties and preparation methods given Outlines the use of nanotechnology for bone tissue transplantation Describes nanocomposites for bone grafting and artificial bones also including their properties Includes discussions on tissue engineering of bone and tissue regeneration and transplantation Describes many composite materials and their preparation methods

Mechanical Properties and Characterization of Additively Manufactured Materials Ravi. K. Kumar,S.C. Vettivel,R. Subramanian,2023-09-13 The book highlights mechanical thermal electrical and magnetic properties and characterization of additive manufactured products in a single volume It will serve as an ideal reference text for graduate students and academic researchers in diverse engineering fields including industrial manufacturing and materials science This text Explains mechanical properties like hardness tensile strength impact strength and flexural strength of additive manufactured components Discusses characterization of components fabricated by different additive manufacturing processes including fusion deposition modeling and selective laser sintering Highlights corrosion behavior of additive manufactured polymers metals and composites Covers thermal electrical and magnetic properties of additively manufactured materials Illustrates intrinsic features and their Influence on mechanical properties of additive manufactured products This text discusses properties wear behavior and characterization of components produced by additive manufacturing technology These products find applications in diverse fields including design manufacturing and tooling aerospace automotive industry and biomedical industry It will further help the readers in understanding the parameters that influence the mechanical behavior and characterization of components manufactured by additive manufacturing processes It will serve as an ideal reference text for graduate students and academic researchers in the fields of industrial engineering manufacturing engineering automotive engineering aerospace engineering and materials science

Medical Modelling Richard Bibb,Dominic Eggbeer,Abby Paterson,2014-12-13 Medical modelling and the principles of medical imaging Computer Aided Design CAD and Rapid Prototyping also known as Additive Manufacturing and 3D Printing are important techniques relating to various disciplines from biomaterials engineering to surgery Building on the success of the first edition Medical Modelling The application of Advanced Design and Rapid Prototyping techniques in medicine provides readers with a revised edition of the original text along with key information on innovative imaging techniques Rapid Prototyping technologies and case studies Following an overview of medical imaging for Rapid Prototyping

the book goes on to discuss working with medical scan data and techniques for Rapid Prototyping In this second edition there is an extensive section of peer reviewed case studies describing the practical applications of advanced design technologies in surgical prosthetic orthotic dental and research applications Covers the steps towards rapid prototyping from conception modelling to manufacture manufacture Includes a comprehensive case studies section on the practical application of computer aided design CAD and rapid prototyping RP Provides an insight into medical imaging for rapid prototyping and working with medical scan data

Joint Replacement Technology Peter A. Revell, 2014-06-13 This second edition of Joint Replacement Technology provides a thoroughly updated review of recent developments in joint replacement technology Joint replacement is a standard treatment for joint degradation and has improved the quality of life of millions of patients

Collaboration between clinicians and researchers is critical to its continued success and to meet the rising expectations of patients and surgeons Part one introduces the advances in joint replacement technology tribological considerations and experiments and immune and regenerative responses to joint replacements Part two covers the materials and techniques used in joint replacement The advantages and disadvantages of different metals are explained here as well as the use of ceramics This section also addresses challenges in joint bearing surfaces design and cementless fixation techniques

Biological and mechanical issues are considered in part three including healing responses to implants and biological causes of prosthetic joint failure and a new chapter on imaging of joint prostheses Each chapter in part four describes the clinical challenges of replacing specific joints with specific focus on hip knee intervertebral disc joint shoulder arthroplasty elbow arthroplasty and pyrocarbon small joint arthroplasty Thanks to its widespread collaboration and international contributors Joint Replacement Technology is useful for materials scientists and engineers in both academia and biomedical industry Chemists clinicians and other researchers in this area will also find it invaluable This second edition provides an updated comprehensive review of recent developments in joint replacement technology Provides coverage for the most pertinent materials science and engineering issues in depth Reviews the specific joints biological and mechanical issues and fixation techniques

Nanotechnology-Enhanced Orthopedic Materials Lei Yang, 2015-07-28 Nanotechnology Enhanced Orthopedic Materials provides the latest information on the emergence and rapid development of nanotechnology and the ways it has impacted almost every aspect of biomedical engineering This book provides readers with a comprehensive overview of the field focusing on the fabrication and applications of these materials presenting updated practical and systematic knowledge on the synthesis processing and modification of nanomaterials along with the rationale and methodology of applying such materials for orthopedic purposes Topics covered include a wide range of orthopedic material formulations such as ceramics metals polymers biomolecules and self assemblies Final sections explore applications and future trends in nanotechnology enhanced orthopedic materials Details practical information on the fabrication and modification of new and traditional orthopedic materials Analyzes a wide range of materials designs and applications of

nanotechnology for orthopedics Investigates future trends in the field including sections on orthopedic materials with bacterial inhibitory properties and novel materials for the control of immune and inflammatory responses **Nanomedicine**,2012-10-19 Nanotechnology is at the forefront of advances in medicine Nanomedicine Technologies and applications provides an important review of this exciting technology and its growing range of applications After an introduction to nanomedicine part one discusses key materials and their properties including nanocrystalline metals and alloys nanoporous gold and hydroxyapatite coatings Part two goes on to review nanomedicine for therapeutics and imaging before nanomedicine for soft tissue engineering is discussed in part three including organ regeneration skin grafts nanotubes and self assembled nanomaterials Finally nanomedicine for bone and cartilage tissue engineering is the focus of part four with electrically active biocomposites as smart scaffolds investigated as is cartilage and bone tissue engineering regeneration and replacement With its distinguished editor and international team of expert contributors Nanomedicine Technologies and applications is an indispensable guide for all those involved in the research development and application of this exciting technology whilst providing a comprehensive introduction for students and academics interested in this field Provides an important review of nanomedicine technology and its growing range of applications Discusses key nanomedicine materials and their properties including nanocrystalline metals and alloys nanoporous gold and hydroxyapatite coatings Reviews nanomedicine for therapeutics and imaging and nanomedicine for soft tissue engineering *Inhaler Devices* Polina Prokopovich,2013-04-23 Given their direct impact on the health and quality of life for millions inhalers represent a major turning point in the history of modern medicine Inhaler devices Fundamentals design and drug delivery provides readers with an introduction to the fundamentals of inhaler technology with a comprehensive discussion of the history of inhalers as well as a discussion on current research and development Part one discusses the fundamentals and development of inhaler devices as well as drug formulations for inhalers The treatment of asthma is also discussed Part two reviews recent developments in drug formulation and nanotechnology for inhaler devices emerging inhaler technology and possible future trends Inhaler devices Fundamentals design and drug delivery is an essential design guide for good industrial practice and will be an invaluable resource for those researching and treating conditions such as asthma and those developing and manufacturing inhalation devices Introduces the fundamentals of inhaler technology Discusses the history of inhalers as well as current research and development as well as possible future trends Considers the development of inhaler devices drug formulations and discusses the treatment of asthma

[The Hip Resurfacing Handbook](#) K De Smet,P. N. Campbell,C Van Der Straeten,2013-04-22 Hip resurfacing arthroplasty HRA using metal on metal bearings is an established but specialised technique in joint surgery Based on the experience of leading experts in the field The hip resurfacing handbook provides a comprehensive reference for all aspects of this important procedure The first part of the book reviews and compares all the major hip resurfacing prostheses their key design features relevant surgical techniques and clinical results Part two

discusses clinical follow up of the hip resurfacing patient including pre and post operative examination acoustic phenomena and rehabilitation It also covers the use of techniques such as radiography and metal ion measurement as well as bone scans ultrasound CT MRI PET and DEXA to evaluate hip resurfacings Part three reviews best practice in surgical technique including the modified posterior and anterior approaches as well as instrumentation anaesthesia and revision surgery Based on extensive retrieval studies Part four includes examples of the main failure modes in HRA The final part of the book includes patients own experiences a comparison of HRA with total hip arthroplasty THA regulatory issues and relevant web sites Comprehensive in its scope and authoritative in its coverage The hip resurfacing handbook is a standard work for orthopaedic surgeons and all those involved in HRA A standard work for orthopaedic surgeons and all those involved in HRA Reviews and compares all the major hip resurfacing prostheses their key design features relevant surgical techniques and clinical results Clinical follow up of the patient is discussed

Wear of Orthopaedic Implants and Artificial Joints Saverio Affatato,2012-04-12 Although hip knee and other orthopaedic implants are well established prostheses much remains to be understood about how these implants wear in use This important book summarises the wealth of recent research in this area and its implications for implant and joint design After an introductory overview the book reviews the causes and prevention of implant wear Part one discusses fundamental issues such as tissue response to wear the anatomy and biomechanics of hips and knees as well as the materials and design issues they raise for hip knee and other types of orthopaedic implant Part two considers wear phenomena in a range of materials including ultra high molecular weight UHMWPE metal and ceramic joints It also covers surgical and other factors influencing wear as well as ways of detecting analysing and predicting implant wear and failure With its distinguished editor and international team of contributors Wear of orthopaedic implants and artificial joints is a standard reference for implant manufacturers surgeons and those researching this important area Summarises the wealth of recent research into the wear of orthopaedic implants and artificial joints and discusses the implications for implant and joint design Reviews the causes and prevention of implant wear tissue response to wear the anatomy and biomechanics of hips and knees and the materials and design issues they raise for orthopaedic implants Considers wear phenomena in a range of materials including ultra high molecular weight UHMWPE metal and ceramic joints

Advanced Engineering Materials and Modeling Ashutosh Tiwari,N. Arul Murugan,Rajeev Ahuja,2016-08-12 The engineering of materials with advanced features is driving the research towards the design of innovative materials with high performances New materials often deliver the best solution for structural applications precisely contributing towards the finest combination of mechanical properties and low weight The mimicking of nature s principles lead to a new class of structural materials including biomimetic composites natural hierarchical materials and smart materials Meanwhile computational modeling approaches are the valuable tools complementary to experimental techniques and provide significant information at the microscopic level and explain the properties of materials and their very existence The modeling also provides useful insights

to possible strategies to design and fabricate materials with novel and improved properties The book brings together these two fascinating areas and offers a comprehensive view of cutting edge research on materials interfaces and technologies the engineering materials The topics covered in this book are divided into 2 parts Engineering of Materials Characterizations Applications and Computational Modeling of Materials The chapters include the following Mechanical and resistance behavior of structural glass beams Nanocrystalline metal carbides microstructure characterization SMA reinforced laminated glass panel Sustainable sugarcane bagasse cellulose for papermaking Electrospun scaffolds for cardiac tissue engineering Bio inspired composites Density functional theory for studying extended systems First principles based approaches for modeling materials Computer aided materials design Computational materials for stochastic electromagnets Computational methods for thermal analysis of heterogeneous materials Modelling of resistive bilayer structures Modeling tunneling of superluminal photons through Brain Microtubules Computer aided surgical workflow modeling Displaced multiwavelets and splitting algorithms

Bio-tribocorrosion in biomaterials and medical implants Y. Takakubo,A. Berce,R. Trebše,Y. Tamaki,I. Milošev,A. Al-Samadi,V.-M. Tiainen,null Orton,Y.T. Konttinen,2013-09-30 Total joint replacement TJR is one of the success stories of modern medicine which has reliably provided dramatic pain relief and improved the quality of life for several million patients with a destructive end stage joint disease However the main long term complication of TJR surgery is prosthetic loosening often combined with osteolysis following wear corrosion and failure of the implant Over the past decade the biological interactions between various types of wear particles and metal ions from metal on polyethylene MoPE metal on metal MoM and ceramic on ceramic CoC implants endogenous danger signals alarmins and or bacterial components of the microbiome with the innate and adaptive host defence immune system have become better known In this chapter we discuss the role of biomaterials and implant derived wear and corrosion debris in loosening of TJRs with particular emphasis on MoM total hip replacements THR and hip resurfacing arthroplasty HRA

Bio-tribocorrosion in biomaterials and medical implants M.T. Mathew,M.A. Wimmer,2013-09-30 During the last few years tribocorrosion evaluation of artificial joints has become an attractive research area for biomedical scientists and medical professionals This particular field of study deals with a complex artificial human joint system and many unknown parameters In this chapter an attempt is made through the perspective of a clinician to bring some insights into this area of research This chapter addresses the basic tribocorrosion aspects of artificial joints and their clinical implications beginning with clinical problems cell responses to the presence of metal particles and ions and evidence of tribocorrosion from retrieved implants Then comparisons are made between in vivo and in vitro test conditions and the complex nature of in vivo joint conditions is discussed Finally novel case studies influence of protein and environment evidence of synergistic interactions between corrosion and wear on the research of tribocorrosion of metal on metal MoM hip joints are also included

Mechanical Testing of Orthopaedic Implants

Elizabeth Friis,2017-05-24 Mechanical Testing of Orthopaedic Implants provides readers with a thorough overview of the

fundamentals of orthopedic implants and various methods of mechanical testing Historical aspects are presented along with case studies that are particularly useful for readers Presents information on a range of implants from dental to spinal implants Includes case studies throughout that help the reader understand how the content of the book is applied in practice Provides coverage and guidance on FDA regulations and requirements Focuses on application of mechanical testing methods

Perspectives in Total Hip Arthroplasty Saverio Affatato,2014-05-01 Total hip arthroplasty the most commonly performed orthopedic procedure is used to replace or reconstruct the hip with an artificial joint **Perspectives in Total Hip Arthroplasty** outlines developments in technologies and biomaterials used for this procedure with a focus on the tribological interactions of the materials used Part one outlines the history of total hip arthroplasty and goes on to explore advances in techniques and biomaterials Part two focuses on the tribology of materials used to perform this procedure explaining the impact of wear on the load bearing surface a major cause of failure in hip prostheses Chapters review a range of materials including modern biomaterials hybrid materials metal ceramic and polyethylene The book also discusses the tribological interactions of these materials when used in total hip arthroplasty **Perspectives in Total Hip Arthroplasty** is a key resource for clinicians researchers and academics interested in the tribology of total hip arthroplasty as well as materials researchers engineers and academics concerned with the tribology of biomaterials Covers techniques from innovative surgeons and designs from multinational manufacturers as well as information on improvements in technologies and biomaterials Discusses the tribology of all the major materials used in total hip arthroplasty [Mechanical Testing of Orthopaedic Implants](#) Elizabeth Friis,2016-10-01 [Mechanical Testing of Orthopaedic Implants](#) provides readers with a thorough overview of the fundamentals of orthopedic implants and various methods of mechanical testing Historical aspects are presented along with case studies that are particularly useful for readers Presents information on a range of implants from dental to spinal implants Includes case studies throughout that help the reader understand how the content of the book is applied in practice Provides coverage and guidance on FDA regulations and requirements Focuses on application of mechanical testing methods

Joint Replacement Technology Peter A. Revell,2008-07-09 Joint replacement has been one of the major successes of modern medicine Its continued success depends on effective collaboration between clinicians and researchers across many different areas in science and medicine This important book brings together the wide range of research in this area and its implications for clinical practice The book sets the scene with introductory chapters on joint biomechanics and tribology materials for joint replacement and their interactions with the body and regulatory issues Part two reviews the use of metals and ceramics as joint replacement materials joint design bone cements and cementless fixation techniques failure mechanisms and ways of predicting the lifetime of replacement joints The third part of the book summarises research on how prosthetic joints interact with the body including biological causes of joint failure sterilisation techniques and the use of drug delivery systems to enhance joint replacement The final group of chapters reviews key issues in replacing particular joints

including the hip knee ankle shoulder and elbow as well as developments in intervertebral disc and temporo mandibular joint replacement technology With its distinguished editor and international team of contributors Joint replacement technology is a standard reference for the engineering and materials scientific communities as well as surgeons seeking the best treatment for their patients Reviews joint biomechanics and tribology Considers the use of metals and ceramics as joint replacement materials joint design and bone cements Summarises research on prosthetic interaction with the body *Biomaterials and Medical Tribology* J. Paulo Davim, 2013-07-31 Medical tribology can be defined as the science of tribological phenomena in the human body both those that naturally occur in the tissues or organs and those that arise after implantation of an artificial device while biomaterials are inert substances designed to be incorporated into living systems Biomaterials and medical tribology brings together a collection of high quality articles and case studies focussing on new research and developments in these two important fields The book provides details of the different types of biomaterial available and their applications including nanoparticles for biomedical applications synergism effects during friction and fretting corrosion experiments application of biomedical grade titanium alloys in trabecular bone and artificial joints fatigue strengthening of an orthopaedic Ti6Al4V alloy wear determination on retrieved metal on metal hip arthroplasty natural articular joints the importance of bearing porosity in engineering and natural lubrication tribological characterization of human tooth enamel and finally liposome based carrier systems and devices used for pulmonary drug delivery Biomaterials and medical tribology is an essential reference for materials scientists engineers and researchers in the field of medical tribology The title also provides an overview for academics and clinicians in this area

UHMWPE Biomaterials for Joint Implants

Jun Fu, Zhong-Min Jin, Jin-Wu Wang, 2019-05-23 This book presents a comprehensive state of the art review of the latest progresses in UHMWPE biomaterials which has been critical for the performance and longevity of joint implants Oriented by clinical challenges to UHMWPE based joint implants it introduces the processing crosslinking structural manipulation oxidation mechanism stabilization drug delivery and wear as well as clinical performance biomechanics and simulated studies of joint implant based on UHMWPE with low wear which are aimed to tackle or minimize the adverse effect related to wear and wear debris These contributions provide fundamentals of chemistry and physics of UHMWPEs to help understand the clinical performances of UHMWPE based joint implants Perspectives to next generation UHMWPE to meet the unmet challenges in clinical use are included

Biomaterials in Orthopedics

Michael J. Yaszemski, 2003-10-17 Written by respected experts in the field Biomaterials in Orthopedics discusses bioabsorbable biomaterials for bone repair nondegradable materials in orthopaedics and delivery systems Topics in this text include biocompatibility and the biomaterial tissue interface self reinforced bioabsorbable devices and guided regeneration bone substitutes *Joint Replacement and Bone Resorption* Arun Shanbhag, Harry E. Rubash, Joshua J. Jacobs, 2005-11-09 This first guide devoted to this burgeoning topic this authoritative reference presents the current understanding of the phenomenon of aseptic loosening of total joint

replacements from the molecular and cellular mechanisms of periprosthetic bone loss to the clinical presentation and management strategies reviewing the properties of ceramic metal and polymer materials used in the replacement of joints as well as current research on bone remodeling wear resistance the long term care of implants and emerging developments in gene therapy and tissue engineering

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