This publication, *Materials and Processes for Medical Devices*, is a compilation of research that was presented at the ASM International sponsored conference of the same name held in Minneapolis, Minnesota, August 10–12, 2009.

This was the 5th MPMD conference presented by ASM to focus on the materials used in medical devices. This conference brought the perspectives of industrial, academic, national laboratory and clinical researchers together, seeking to develop and/or understand materials for medical devices. This focus on real applications, real devices and real materials issues for medical devices has set ASM International apart from other materials organizations in the realm of biomaterials. The focus areas of this conference, including processing, structure and properties of biomaterials, surfaces of biomaterials, degradation, wear, fracture and fatigue, etc., are all critical elements of any medical device design and will continue to be the focus of research into new technologies and materials.

ASM has now established itself as a venue for learning about research on medical materials used in actual medical devices and the complex interactions at play between device materials and the biological environment. There are outstanding papers focused on fabrication, fatigue, corrosion, tissue biocompatibility, cell-surface interactions, regulatory issues, shape memory alloys and a host of other cutting edge efforts. This proceeding will provide the academic translational researcher, the industrial researcher and the regulatory scientist with state-of-the-art understanding in medical device material performance and the advancement of new technologies associated with the manufacture and use of medical devices.
I would like to thank the organizing committee for their diligent and dedicated assistance in promoting and developing this conference and in preparing this publication. I would also like to thank ASM staff for doing an outstanding job at all stages of this process in assisting and coordinating the conference and these proceedings. This conference was a success, in part, because of the sponsors and their efforts, and because of all of the contributors who presented their work. It is my firm belief that the MPMD conference will see many more successes into the future as we continue to focus on medical devices and the materials from which they are made.

Dr. Jeremy Gilbert  
Chair, MPMD Organizing Committee  
Professor, Department of Biomedical and Chemical Engineering  
L.C. Smith College of Engineering and Computer Science  
*Syracuse Biomaterials Institute*  
Syracuse University
CONTENTS

Biostability and Biocompatibility of Medical Devices

Cytotoxicity Assessment of Corrosion Products of Nitinol Alloys ...........................................3
Florida International University, Miami, FL, USA

Inhibiting Microbial Biofilm Formation by Brominated Furanones .......................................6
S. Hou, M. Duo, Y. Han, Y.-Y. Luk, D. Ren;
Syracuse Biomaterials Institute, Syracuse, NY, USA

Corrosion, Fatigue and Durability of Medical Devices

Characterization of ‘As-Received’ Nickel – Titanium Alloy Wire by Cyclic Potentiodynamic Polarization ..........................................................13
R.J. Pylkki, M.J. Koval;
Aspen Research Corporation, Saint Paul, MN, USA

Can a Critical Breakdown Potential be Established for Electrochemical Corrosion Testing of Medical Devices According to ASTM F2129? .................................................19
B. Choules, J. Metcalf, J. Merk;
MED Institute Inc., West Lafayette, IN, USA

The Effects of Heat Treatment, Surface Condition and Strain on Nickel-Leaching Rates and Corrosion Performance in Nitinol Wires .........................................................23
A. Fasching¹, E. Kuş², B. James², Y. Bhargava², L. Eiselstein²;
(1) Memry Corporation, Menlo Park, CA, USA
(2) Exponent, Menlo Park, CA, USA

The Effect of Surface Abrasion on the Polarization Behavior of CoCr, Ti-6Al-4V and 316L SS in PBS at pH 7 and 2 .................................................................30
J.L. Gilbert, B. Lam;
Syracuse University, Syracuse, NY, USA

Improving the Reliability of Medical Devices Coatings ..........................................................35
E. Guyer¹, M. Lane²;
(1) Exponent Failure Analysis Associates, Menlo Park, CA, USA
(2) Emory & Henry College, Emory, VA, USA
Active Biomaterials .......................................................................................................................................................... 100
A. Lendlein, M. Behl;
GKSS Research Centre Geesthacht, Teltow, Germany

Catheter and Specialty Needle Alloys ...................................................................................................................................... 105
E. Keehan, V. Gergely;
Creganna, Galway, Ireland

Texture and Microstructure of Ag Core MP35N Wire with NDR Process ................................................................. 111
B. Li, T. Steigauf, P. McIntyre, D. Sorensen;
Medtronic Inc., Minneapolis, MN, USA

Effect of Materials on Treatment & Surgical Techniques

Evaluation of Biodegradable Adjunctive Therapy for Extremity Wound Infection Reduction .................................................. 117
J. Jennings¹, S. Noel¹, B. Reves¹, K. Smith¹, S. Jackson¹, J. Bumgardner¹, W. Haggard¹,
H. Courtney², J. Wenke³;
(1) University of Memphis, Department of Biomedical Engineering, Memphis, Tennessee, USA
(2) University of Tennessee Health Sciences Center, Memphis, Tennessee, USA
(3) US Army Institute of Surgical Research, Fort Sam Houston, Texas, USA

Outcomes in the Treatment of Benign Bone Lesions Using an Engineered Bioceramic: Preclinical and Clinical Results .................................................................................................................. 123
Rush University Medical Center, Chicago, IL, USA

Mechanical Properties of a Sintered Asymmetric Particle Ingrowth Coating .............................................................. 129
L. Gilmour, B. Jones, J. Dickinson;
Smith and Nephew Inc., Memphis, TN, USA

Clinical Consequences of CoCr Wear Products in the Hip ........................................................................................ 132
P. Campbell, K. Takamura, A. Battenberg, E. Ebramzadeh, S. Nelson;
UCLA Orthopaedic Hospital, Los Angeles, CA, USA

Materials Modeling

Effects of Wire Contact Conditions on the Bending and Torsion Behaviors of Metal Wire Braids ............................................. 141
R. He, P. Zhou, H. Zhang, J. Uschold;
Boston Scientific Corporation, Minneapolis, MN, USA
Poster Session

Fabrication of Nano-Gap Electrodes and Nano-Wires by Using Electrochemical and Chemical Etching Technique for a Nano-Pore DNA/RNA Sequencer .............................................................147

J. Sutanto\(^1\), R.L. Smith\(^2\), S.D. Collins\(^2\);
(1) Genesis BioTechnology, Chandler, AZ, USA,
(2) University of Maine, Orono, ME, USA

Influence of Silicon Carbide Layers on the Mechanical Behavior of Silicon-Alloyed Isotropic Pyrolytic Carbon .................................................................153

J. Redmond;
Medtronic CardioVascular, Minneapolis, MN, USA

Oxygen Plasma Treatment on Adhesion Improvement of Au Deposited on Pa-c Substrates .............................................................157

J.H. Lee\(^1\), H.S. Kim\(^1\), K.S. Hwang\(^2\), T.S. Kim\(^2\);
(1) Kwangwoon University, Korea
(2) Korea Institute of Science and Technology, Korea

Bioactive/Biomimetic Surface

Towards Bioactive Titanium Maxillofacial Implants .................................................163

R.A. Omar, L.D. Silvio, M. Ditta, F. Festy, R.V. Curtis;
King’s College London, London, UK

Developing Cell Selectivities of Acrylonitrile Based Copolymers and Porous Bodies from Poly(ether imide) .............................................................169

K. Luetzow, A.T. Neffe, A. Lendlein
GKSS Research Center Geesthacht GmbH, Teltow, Germany

Luer Tip Roughness and Texture to Prevent Breakage in Critical Applications ..........175

A.C. Farinella, D.F. Vincenti, M. Bowen;
BD, Franklin Lakes, NJ, USA

Cellular Response to Anodic and Cathodic Surface Voltage and Metal Ion Release in Polarized CoCr Biomedical Alloy .................................181

M. Haeri, J.L. Gilbert;
Syracuse University, Syracuse, NY, USA

Fabrication Processes for Medical Devices

Titanium Alloys Manufactured with Electron Beam Melting Mechanical and Chemical Properties ............................................................189

M. Svensson, U. Ackelid;
Arcam AB, Malmö, Sweden
LASER Deposited Engineered Surfaces for Orthopedic Implants for Increased Device Longevity .................................................................195
J. Fuerst1, J. Sears1, D.J. Medlin1, D. Neufeld2, T. Yescas3;
(1) South Dakota School of Mines and Technology, Rapid City, SD, USA
(2) University of South Dakota, Vermillion, SD, USA

Machining of Stent-Like Geometries in Thin NiTi Sheets Using Water Jet Cutting ..........201
M. Frotscher1, H. Gugel1, K. Neuking1, W. Theisen1, G. Eggeler1, F. Kahleyß2, D. Biermann2;
(1) Ruhr-Universität Bochum, Bochum, Germany
(2) Technische Universität Dortmund, Dortmund, Germany

Micro-Resistance Spot Welding of 55.8wt% Ni-Ti Crossed Wires ........................................207
B. Tam, M.I. Khan, Y. Zhou;
University of Waterloo, Waterloo, ON, Canada

Effects of Welding Parameters on the Mechanical Performance of Laser Welded Nitinol ..........................................................................................................................210
M.I. Khan, Y. Zhou;
University of Waterloo, Waterloo, ON, Canada

Numerical Modeling and Simulation of High Speed Machining Biomedical Magnesium Calcium Alloy .................................................................214
M. Salahshoor, Y.B. Guo;
The University of Alabama, Tuscaloosa, AL, USA

Effect of Low Plasticity Burnishing on Fatigue Strength of Spinal Rods .........................220
J. Disegi1, C. Sax2;
(1) Synthes, West Chester, PA, USA
(2) Swiss Federal Institute of Technology, Zurich, Switzerland

Materials Research and Development/Fabrication

Combustion Synthesis of CoCr, NiTi Intermetallic and Calcium Phosphate Ceramic Biomaterials .................................................................227
R. Ayers, M. Karsh, N. Vollmer, N. Hannigan, J. Moore;
Colorado School of Mines, Golden, CO, USA

Thermomechanical Treatment of Thin NiTi Filaments for Textile Applications by Electric Current .................................................................232
J. Pilch, L. Heller, P. Sittner;
Institute of Physics of the ASCR, Prague, Czech Republic

Nitinol

Shape Recovery Effects of Solid, Forged Nitinol for Orthopedic Applications ..............241
M. Fonte, A. Saigal;
Tufts University, Medford, MA, USA
The Stress-Induced R-phase Transition in Nitinol and Its Impact on Applications
S. Zhang; Ev3 Inc., Plymouth, MN, USA

Regulatory Affairs Related to Materials
Overview of China’s Medical Device Market and Government Regulatory Agencies
Y. Liu†, M. Pecht‡;
(1) Medtronic, Inc., Mounds View, MN, USA
(2) University of Maryland, College Park, MD, USA

Nanotechnology
Emerging Applications for Nano-Engineered Surfaces in Medical Devices
D. Facchini, C.L. Birmingham, P. Lin, F. Gonzalez, G. Palumbo;
Integran Technologies, Inc., Toronto, ON, Canada

Author Index