2012 Technical Symposia

Call For Papers
Abstract Deadline: October 1, 2011
Manuscript Deadline: March 1, 2012

The International Conference on Metallurgical Coatings and Thin Films or ICMCTF is internationally recognized as a vibrant technical conference that integrates fundamental and applied research focused on thin film deposition, characterization, and advanced surface modification techniques. It is the premier international meeting in this field, bringing together scientists and technologists from both academia and industry, thereby merging up to date research with cutting edge applications.

The conference consistently draws more than 700 attendees each year within 32 oral technical sessions and a well-attended poster session.

ICMCTF 2012 is organized in seven concurrent technical symposia A through G and four special topical symposia, which address experimental, theoretical, and manufacturing issues associated with development of new coating materials and processes, and evolving approaches to scale-up for commercial applications.

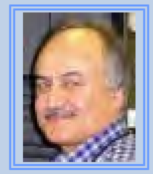
In addition to the technical program, the conference features a two-day industry exhibition, which is open to the public, showcasing the latest in equipment, materials and services used for the deposition, monitoring and characterization of coatings and thin films. Short courses and Focused Topic Sessions (FTS) will be offered throughout the conference week.

Select the links below for detailed information as to the individual Symposia and sessions. . . . .

2012 Technical Symposia:

A. Coatings for Use at High Temperature
B. Hard Coatings and Vapor Deposition Technology
C. Fundamentals and Technology of Multifunctional Thin Films
D. Coatings for Biomedical and Healthcare Applications
E. Tribology & Mechanical Behavior of Coatings and Engineered Surfaces
F. New Horizons in Coatings and Thin Films
G. Applications, Manufacturing, and Equipment

2012 Topical Symposia:
TS1. Surface Engineering for Thermal Transport, Storage and Harvesting
TS2. Advanced Characterization of Coatings and Thin Films
TS3. Energetic Materials and Micro-Structures for Nanomanufacturing
TS4. Graphene and 2D Nanostructures



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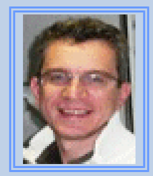

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Sponsored by:
AVS Advanced Surface Engineering Division

Coatings for Biomedical and Healthcare Applications
Room: Sunset - Session D1.1

Bioactive and Biocompatible Coatings and Surface Functionalization of Biomaterials

Moderator: D.V. Shtansky, National University of Science and Technology “MISIS”, Russian Federation, S. Rodil Posada, Universidad Nacional Autonoma de Mexico

10:00am **D1.1-1 The effect of the surface treatment of Ti alloy on the nanomechanical response of bone grown on Ti6Al4V in vitro**, ***J. Chen*** *(Jinju.chen82@gmail.com), MA. Birch, S.J. Bull, S. Roy,* Newcastle University, UK

The long term clinical success of an orthopaedic implant is strongly related to bone formation at the biomaterial–tissue interface. Surface parameters that include topography and roughness influence this process of osseointegration. Electropolishing is a cost effective approach for surface treatment of metallic implant materials such as titanium alloys.

In this study, it is found that the electropolished surface enhances levels of bone formation. However, the mechanical property of the neo–bone remains unknown. In this study, we use nanoindentation with in–situ AFM imaging to identify and characterize the small features (such as calcospherulite) of the neo-bone. The measured Young’s modulus and hardness of the neo–bone formed on the electropolished surface is higher, which may indicate the formation of more mature bone. The length scale of the current tests (100nm) is commensurate with the dimensions at which individual cells interact with the extracellular environment. Therefore, understanding the mechanical properties of bone at this scale can reveal the likely role that substrate conformity plays in the control of cell behaviour.

10:20am **D1.1-2 A comparative study on bactericidal efficiency of nano structured pure TiO_2 thin films and Al-TiO_2 composite thin films**, *A.B. Panda (atalabit@gmail.com),* Mesra, INDIA, *SK. Mahapatra, P.K. Barhai,* ***I. Banerjee***, Birla Institute of Technology, India

A pure TiO_2 and three Al-TiO_2 composite nano thin films were prepared on glass, quartz and silicon substrates at Ar:O_2 gas ratio of 70:30 in sccm by reactive magnetron sputtering method. For pure TiO_2, titanium target was mounted on the magnetron connected to 200W DC power supply while for Al-TiO_2 composite film an additional aluminium target was connected to RF power supply of 15W, 30W and 45W in a dual magnetron co-sputtering unit. The crystallinity and phase of the films were determined by Grazing Incidence X-ray Diffraction where as the surface chemical composition was obtained by X-ray Photoelectron Spectroscope. It was found that aluminium was in the form of $Al_2Ti_xO_{2-x}$ and so in the films and in surface it was weakly bonded with oxygen to form its oxides. The band gap was observed to increases as we increase the Al content in the films as compared to pure TiO_2 thin films as calculated from UV- Visible transmission spectra. The Scanning Electron Microscopic image revealed that Al-TiO_2 composite nano thin films displayed rough and flake-like morphology having less porosity with the increase in the Al content. Photoinduced hydrophilicity was examined with the help of OCA. The qualitative and quantitative bactericidal efficiency was observed through SEM image of the treated E.coli cells and optical density (OD) measurement respectively under UV irradiation. The better bactericidal efficiency was observed in the film with 30W of RF power to Al magnetron. The crystallinity, surface chemical composition, band gap in context of Al present in the films was discussed and correlated to bactericidal efficiency.

10:40am **D1.1-3 Surface Engineering and Modification of Biomaterials**, ***P. Chu*** *(paul.chu@cityu.edu.hk),* City University of Hong Kong **INVITED**

Development of new artificial biomaterials is typically quite time consuming and demanding due to the stringent requirements by the government, industry, and consumers. Therefore, it is sometimes faster to improve existing biomedical devices to meet these increasing demands. Surface engineering and modification can be quite useful and selected biomedical and related surface properties can be enhanced while the favorable properties of the bulk materials such as strength can usually be preserved. In particular, plasma immersion ion implantation and deposition which combines energetic ion implantation and low-energy plasma deposition is very useful. In this invited talk, recent research activities pertaining to plasma surface modification and engineering of biomaterials conducted in the Plasma Laboratory of City University of Hong Kong are described. Examples include bone fixation devices, total hip replacements, automatic scoliosis correction devices, biodegradable metallic and polymeric materials, and other biomedical applications.

11:20am **D1.1-5 Corrosion and ion release characters of Cu/Ti films prepared by PVD in vitro as potential biomaterials for cardiovascular devices**, ***HQ. Liu*** *(miracle2005@yeah.net),* Shenzhen Graduate School, Harbin Institute of Technology, China, *F. Sheng,* Center of Research & Development, Lifetech Scientific (Shenzhen) Co., Ltd

The Cu/Ti films of various ratios of copper and titanium atoms were prepared on TiNi alloy (medical grade) by vacuum arc plasma deposition, and the phase composition, the concentrate of elements were investigated by X-ray diffraction (XRD), X-photoelectron energy spectrum(XPS) separately. The hemolysis ratio and platelet adhesion of differ films were characterized to evaluate blood compatibility. The corrosion and ion release behaviors were investigated by typical immersion test and electrochemical method, the growth of Endothelial cells on various samples and Methylthiazolyte-trazolium (MTT) method were employed to evaluate the effect of Cu ion, including various films and leach liquor. The result shows that the sophisticated films have a good compatibility, but increasing quality ratio of Cu/Ti, the hemolysis ratio also rises, and some platelets begin to break slightly. The immersion test result shows that the corrosion rate of film was aggravated in prio-three days, and the Cu ion release was gradually stabilized in flowing schedule. The open circuit potential (OCP) of the Cu/Ti film modified samples was lower than that of the TiNi substrate, the polarization test result indicates that the passivation stability performance of Cu/Ti film samples was less than TiNi substrate, and it’s favourable to copper ion release. The Endothelial cells would be inhibited while the Cu concentrate of film was 15%(wt.), and Endothelial cells would be apoptosis when this concentrate exceed 40%(wt.). The Cu/Ti film with good compatibility and anti-Endothelialization was a potential application of some especial cardiovascular devices.

11:40am **D1.1-6 Surface modification of zirconia nanofiber coatings for biomedical applications**, ***J. Piascik*** *(jpiascik@rti.org), B. Stoner,* RTI International, *D. Surman,* Kratos Analytical Inc., UK, *A. Charoenpanich, E. Loboa*, North Carolina State University

A variety of materials have been investigated for bone reconstructive and regenerative applications; however, delivering clinically viable synthetic alternatives have presented significant challenges. Specific material properties play a critical role in developing alternatives for bone replacement grafts, surface modifications for enhance cell growth, and novel scaffolding for immediate loading. Earlier research presented data of a promising surface modification, whereby, zirconia surfaces are converted to a more reactive surface using a gas-phase fluorination process. This investigation focuses on the modification of b iomedical-grade zirconia plates and zirconia electronspun nanofibers by sulfur hexafluoride plasma treatment, characterization of near-surface chemistry products by x-ray photoelectron spectroscopy (XPS), and qualitative analysis of osteoblast viability. Deconvolution of the Zr 3*d* core level spectra revealed formation of both $Zr(OH)_xF_y$ and ZrF_4 phases. Depth profiling determined the overlayer to be ~4.0 – 5.0 nm in thickness and angle resolved XPS showed no angle dependence on component percentages likely due to fluorination extending into the grain boundaries of the polycrystalline substrates. Importantly, the conversion layer did not induce any apparent change in zirconia crystallinity by inspection of Zr-O $3d_{5/2,3/2}$ peak positions and full-width-at-half-maximum values, important for retaining its desirable mechanical properties. However, increase in exposure time led to the proposed structures of $Zr(SO_4)_2$ and $Zr(SO_4)_xF_y$. It is thus hypothesized that these sulfate surface phases will lead to enhanced osseointegration between natural bone and modified zirconia surfaces. Cell proliferation and differentiation assays determining degrees of osteoblast adhesion will be presented. It is believed that this surface treatment has broad reaching impact when using high strength ceramics in a multitude of bio-applications; such as, nanofiber coated implants or modified surfaces for bone attachment. This research was supported through RTI International research and development fund.

12:00pm **D1.1-7 Immobilization of pamidronates on the nanotube surface of titanium discs and their interaction with bone cells**, ***Z.-C. Xing****, T.-H. Koo,* Kyungpook National University, Korea, *S. Moon, Y. Jeong,* Korea Institute of Materials Science, Korea, *I.-K. Kang (ikkang@knu.ac.kr),* Kyungpook National University, Korea

Bisphosphonates (BPs) are analogues of pyrophosphate, which are widely used for the treatment of different pathologies associated with imbalances in bone turnover. Titanium materials are extensively used for biomedical purposes, especially in medical implants and prostheses, because of their good biocompatibility, biological responses, osseointegration, excellent mechanical properties, corrosion resistance and relatively low cost. The purpose of this study is to immobilize pamidronate (PAM) on the nanotube surface of titanium discs(TiN) and to evaluate their interaction with MC3T3-E1 osteoblasts. PAM-immobilized TiN was prepared by the coupling of aminopropyltriethoxysilane on to TiN, followed by reaction first with L-glutamic acid and then pamidronate. These surface-modified