Coatings for Biomedical and Healthcare Applications
Room Palm 3-4 - Session MD1-2-ThM

Surface Coatings and Surface Modifications in Biological Environments II

Moderator: Mathew T. Mathew, University of Illinois College of Medicine at Rockford and Rush University Medical Center, USA

10:20am **MD1-2-ThM-8 The Biocompatibility of Thermal Sprayed Bioactive Glass Hydroxyapatite Composited Coatings***, **Pin-Jie Chen (mtou335@gmail.com)**, C. Wu, R. Chung, Y. Yang,* National Taipei University of Technology, Taiwan

In recent years, with the trend of demographic changes and aging, the demand for medical care has continued to rise, and the demand for orthopedic medical devices has increased day by day. In order to maximize the benefits of biomedical composite materials. This experiment uses flame spraying (FS) to coat the surface of Ti-6Al-4V to study the effects of modified hydroxyapatite composite coatings prepared with different proportions of bioactive glass powder on bone healing in rats. help. The experiment will be divided into two parts for discussion. The first part is the microstructure observation, phase composition analysis, mechanical properties and bonding strength test of the modified hydroxyapatite composite coating. The acetylene flow rate will be 1.60 Nm3/hr, the spray gun speed is 250 mm/s, the spraying distance is 125 mm, and the number of flame spray (FS) sprays is 2 times for animal experiments; the second part is the observation of the bone healing situation of the modified hydroxyapatite composite coating, The coated round rods were implanted into the femurs of 6-week-old SD rats for 2 weeks and 4 weeks. Finally, microstructure and through-compression tests were conducted to test the implant bonding strength.

10:40am **MD1-2-ThM-9 SERS Substrates Based on Self-Organized Dimple Nanostructures on Polyethylene Naphthalate Films Produced via Oxygen Ion Beam Sputtering***, S. Lee,* KIMS, Republic of Korea*; **Jun-Yeong Yang (yjy8184@kims.re.kr)**,* Korea institute of materials science, Republic of Korea

Surface-enhanced Raman spectroscopy (SERS) utilizes metal nanostructures to enhance the intensity of Raman signals. Although many methods have been developed for fabricating SERS nanostructures, most involve multiple steps. Herein, we employed oxygen ion beam sputtering (IBS), a one-step technique suitable for processing flexible substrates in roll-to-roll processes for mass production, Specifically, one-step oxygen IBS was used to fabricate self-organized dimple nanostructures, whose area and roughness could be controlled using the ion irradiation [https://www.sciencedirect.com/topics/physics-and-astronomy/ion-irradiation] energy density, on the surfaces of polyethylene naphthalate films. Gold nano-tips for SERS were subsequently obtained by evaporating gold onto the dimple nanostructures. Finite-difference time-domain (FDTD) simulations revealed that nano-tip structures with spacings of less than 10 nm increased the localized E-field enhancement, which improved the SERS signal. Fabrication at a low energy density (5.8 J/cm^2) produced more nano-tips with spacings of less than 10 nm, corresponding to a density of 61.4 nano-tips/μm2. SERS analysis conducted with methylene blue at 638 nm and 785 nm demonstrated that the Raman signal intensity was stronger for SERS substrates fabricated with low energy density (5.8 J/cm^2) than for substrates fabricated with high energy density (17.3 J/cm2), because of the high density of nano-tips on the former substrate.

11:00am **MD1-2-ThM-10 Design and Fabrication of a Hybrid IrOx/Polydopamine Thin Film via a Co-Electrodeposition Process as a Bendable Bio-Interface Microelectrode Array***, **Hung-Yu Chen (bryan950396@gmail.com)**, M. Tsou,* National Taipei University of Technology, Taiwan*; K. Tso, K. Sasagwa, J. Ohta,* Nara Institute of Science and Technology, Japan*; P. CHEN,* National Taipei University of Technology, Taiwan

Iridium oxide (IrOx) is a promising electrode material for implantable neural therapeutic devices owing to its remarkable performance on bio-interfaces. We demonstrate a unique chemical formula to co-electrodeposit hybrid iridium oxide thin film with polydopamine (PDA) on a flexible Parylene C substrate. In a mild alkaline solution, electrochemical deposition facilitated the formation of inorganic/organic nanoparticle (NP) corona structures. The NP-corona with an order atomic structure enabled enhanced electrochemical stability and bioactivity. The incorporated PDA contributed to nanorough surface structures that led to higher current storage capacity (CSC) and lower impedance than that of pristine IrOx. The IrOx/PDA microelectrode array also demonstrates an excellent sensitivity to dopamine which is an important neurotransmitter related to brain diseases. In addition, the hybrid IrOx/PDA thin film reveals an impressive mechanical property. In a bending test of 15,000 cycles, the hybrid IrOx/PDA thin film retains 90% of its initial CSC without any physical crack or delamination. Our results provide solid evidence of fabricating a robust flexible electrode for neural interfaces for potential use in implantable electronic devices.

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