VIth International Workshop
on Plasma-Based Ion Implantation

Abstracts

Website: https://www.lama.polytechnique.fr/P3H conference

Grenoble, France
June 26-28
Surface modification of polyurethane by acetylene plasma immersion ion implantation

J. Wang1, N. Huang1, P. Yang2, J. Y. Chen1,3, Z. P. Yang2, P. K. Chu1, R. Guenzel4 and Y. Leng3
1 Department of Materials Engineering, Southwest Jiaotong University, Chengdu 610031, China
2 Institute of Basic Medical Sciences, Chinese Academy of Medical Sciences, Beijing 100000, China
3 Department of Physics and Materials Science, City University of Hong Kong, 83 Tat Chee Avenue, Kowloon, Hong Kong, China
4 Institute of Ion Beam Physics and Materials Research, Research Center of Rossendorf, D-01314 Dresden, Germany
5 Mechanical Engineering Department, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, China

Acetylene (C2H2) plasma immersion ion implantation (PIII) into polyurethane (PU) is performed for different process time from 2 to 40 minutes. The surface properties are characterized by contact angle measurement, x-ray photoelectron spectroscopy (XPS) and attenuated total-reflection Fourier transform infrared spectroscopy (ATR-FTIR). The contact angle of water decreases from the original 67.2° to 42.5° and the surface energy increases from 36.3 dyn/cm² to 55.7 dyn/cm². The results reveal that PIII improves the water wettability of PU. The hemocompatibility of the modified PU is studied by platelet adhesion. The scanning electron microscopy (SEM) results indicate that platelet adhesion is reduced on the PU surface after C2H2 implantation at an appropriate voltage. Furthermore, XPS and ATR-FTIR spectra show that an amorphous carbon structure appears after C2H2 implantation. This suggests that the improvement in the water wettability of the modified PU may arise from the destruction of the original surface chemical bonds and formation of an amorphous carbon phase by PII. It is believed that the compositional change in the modified surface layer is responsible for the improvement in the platelet adhesion.

Controlled Synthesis of Ti-O/Ti-N Gradient Films by Plasma Immersion Ion Implantation

F. Wen1, H. Dai1, N. Huang1, H. Sun1, Y. X. Leng1, and P. K. Chu1
1 Institute of Surface Engineering of Biomaterials, Dept. of Materials Engineering, Southwest Jiaotong University, Chengdu, Sichuan, China
2 Department of Physics and Materials Science, City University Of Hong Kong, 83 Tat Chee Avenue, Kowloon, Hong Kong, China

Titanium oxide and titanium nitride gradient films are synthesized on silicon, titanium and low temperature isotropic pyrolytic carbon (LTIC) by plasma immersion ion implantation and deposition (PII-D). An intelligent control system has been designed to control the synchronization and other parameters of the metal arc plasma source as well as the variation in the gas composition utilizing programmable logic devices. Using this system, the cathodic arc parameters can be conveniently controlled. The gas mixture and composition are controlled by D/A and mass flow control (MFC), and consequently, the response time is very good and has excellent linearity. The system is stable, reliable, and flexible. It also possesses strong immunity against external interferences. Using this control system, we synthesize Ti-O/Ti-N gradient films on silicon, titanium and LTIC. The mechanical properties of the films are determined by microhardness test, pin-on-disc wear experiment, scratch adhesion test, and nanoindentation. Our results show that the characteristics of the Ti-O/Ti-N gradient films synthesized in this controlled manner are much better than those of multilayer films deposited using conventional methods.