DS 33: Surface Modification

Time: Thursday 14:45–15:30 Location: H 2032

DS 33.1 Thu 14:45 H 2032

Surface properties of medical CoCr alloys after plasma immersion ion implantation — •Johanna Lutz[1,2] and Stephan Mändl[2] — [1]Translationszentrum für regenerative Medizin, Universität Leipzig, Leipzig — [2]Leibniz-Institut für Oberflächenmodifizierung, Leipzig

Different medical CoCr alloys were treated with nitrogen plasma immersion ion implantation (PIII), an implantation method where the sample is immersed in a plasma and negative high voltage pulses are applied to it. This leads to the formation of surface layers with nitrogen contents up to 30 at.% and a thickness of more than 1 micrometer after 1 hour at 400 °C. This layer should exhibit an improved biocompatibility and mechanical surface properties.
Analysing the nitrogen diffusion data from SIMS measurements as well as the phase information data from XRD measurements and mechanical properties from nanoindentation and wear measurements, several conclusions can be drawn: the thermal activation energy for the nitrogen diffusion of about 0.5 eV indicates an interstitial diffusion path; at temperatures lower than 400 °C, a lattice expansion of the fcc base structure is observed, at higher temperature CrN precipitates are formed. At the same time, the hardness of the surface layers increases by a factor of 3 from 5 (untreated material) to 16 GPa with a corresponding increase in the wear resistance, nearly independent of the process temperature.

DS 33.2 Thu 15:00 H 2032

Field effect mobility and carrier concentration of graphitized polymer surfaces — •Y. Koval, I. Lazareva, and P. Müller — Institut für Physik der Kondensierten Materie, Universität Erlangen-Nürnberg, Erwin-Rommel Str. 1, 91058 Erlangen, Germany

Recently we have shown that surfaces of various polymers can be graphitized by low-energy ion irradiation [1]. Because of the low energy of ions, the thickness of the graphitized layers is less than 10 nm. By varying the irradiation conditions, the conductivity of the graphitized layers can be changed between 10^{-5} and 200 S/cm. This rather high conductivity makes graphitized layers interesting for several applications in microelectronics. We present our results of graphitized polyimide surfaces. We have found that the conductivity of low conducting samples can be described by variable range hopping, while highly conducting samples show a semi-metallic behavior. Field effect mobility and carrier concentration were determined for both low and highly conducting samples. It is worth to note that highly conducting surfaces show a field effect mobility as high as 5 cm^2/Vs. It was found that the rise of conductivity is caused by a simultaneous increase of the carrier concentration and the mobility of charge carriers. Moreover, a correlation between carrier concentration and mobility was found.

[1] I. Lazareva, Y. Koval, M. Alam, S. Strömsdörfer, P. Müller, Appl. Phys. Lett. 90, 262108 (2007)

DS 33.3 Thu 15:15 H 2032

Nano-patterning of diamond-like carbon by electron-assisted local oxidation in humid environment — •Thomas Mühl[1], Andreas Winkler[1], and Sverre Myhra[2] — [1]Leibniz-Institut für Festkörper- und Werkstoffforschung IFW Dresden, Helmholtzstr. 20, D-01069 Dresden — [2]Oxford University Begbroke Science Park, Department of Materials, University of Oxford, Oxford OX5 1PF, UK

Carbon-based materials such as diamond-like carbon (DLC) thin films and carbon nanotubes are attracting a great deal of attention due to their novel and versatile properties and likely applications. In particular, good chemical stability has been ascribed to these materials. Recently it has been shown that DLC can be patterned on the nm-scale by local electro-oxidation in a humid environment, where localization is defined by either "tunnel" current or spreading current in STM or AFM modes (Scanning Tunnelling and Atomic Force Microscopy), respectively. The process has now been extended to oxidative patterning of DLC films in an environmental SEM (Scanning Electron Microscope) in the presence of 10 to 100 Pa of water vapour.

Examples for nano-patterning of DLC thin films, both on substrates and self-supporting, will be presented. Preliminary data of the SEM-based process suggests that the volume removed by oxidation is linearly dependent on dose, approximately inversely proportional to the e-beam energy in the investigated energy range of 10 to 25 keV, while the dependence on partial pressure of water vapour has a minor effect.