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Medical applicability of bioactive polymer surfaces with DLC and noble metal-doped coatings

Jacek Ronda and B. Rajchel
AGH Universityof Science and Technology and the Institute of Nuclear Physics PAS, Poland

Two techniques for the formation of protective layers on polymers by using ions are known from the literature and from patent descriptions: IBSD (ion beam sputtering deposition) and DB IBAD (dual-beam ion beam assisted deposition).They enable the preparation of biologically active coatings on medical implantsmade of polyethylene, UHMWPE (ultra-high-molecular-weight polyethylene) or other biocompatible plastics.

The use of wear-resistant diamond like carbon coatings (DLC) to improve the tribological properties of head-cup hip joint replacement, which can greatly extend the working life of the endoprosthesis. Techniques using ions (IBSD, IBAD) enable the formation of composite coatings with excellent adherence to the substrate, and, given the appropriate layered structure, coatings formed using ion techniques can significantly reduce the mechanical stress of the coating/substrate. The aim of the presentation is to demonstrate the invention to obtain layers with special properties, ensuring physicochemical activity and bioactivity of the coating when in contact with pathogens.In this invention, the technique depends on the fact that a plate made of a heterogeneous mixture of carbon powder, iridium, and platinum, is placed in a high- vacuum chamber and is bombarded by an ion beam of noble gases while the sputtering rates for carbon, platinum, and iridium characterizing the sputtering process are calculated individually for each of the proposed coatings. The bioactive coating obtained via this technique, formed from a beam ofatoms and ions, is amorphousand is characterized by uniform distribution of carbon, iridium and platinum throughout the volume of the coating.This carbon-doped bioactive coating is hydrophobic because it is acted upon by electrical effects on a nanoscopic scale; therefore, bacterial-viral biofilms cannot moisten them and thus cause inflammation in the vicinity of the implant. On the implant coating appear nano-electrode matrices that are activated in the environment of the patient's physiological fluid with a pH of 7.2 and enable the occurrence of local potential differences on the surface of the implant in any physiological fluid of the patient so as to allow a very weak flow of electric charge and thus a Maxwell-Lorentz force on a nanoscopic scale.

Biography

Jacek Ronda has completed his Ph.D. and obtained his D.Sc. from the Institute of Fundamental Technological Research PAS in Warsaw. He is appointed as the Professor both in the AGH Academy of Science and Technology in Krakow, Poland and Cape Peninsula University of Technology in Belville, South Africa. He promoted 6 doctors and more than 30 M.Sc. graduates. He has published more than 80 papers in reputed journals and conference proceedings and has been serving as the referee in several journals and publishing boards.