

Ion Bombardment Modification Of Surfaces: Fundamentals And Applications

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Ion Beam Induced Modifications of Biocompatible Polymer

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Abstract: Ion beam bombardment has shown great potential for improving the surface properties of polymers. In this paper, the ion beam-polymer interaction mechanisms are briefly discussed. The main objective of this research was to study the effects of H-ion beam on physico-chemical properties of Ultra-high-molecular-weight polyethylene (UHMWPE) as it is frequently used in biomedical applications. UHMWPE was bombarded with 65 keV H-ions to fluences ranging from 1×10^{14} – 2×10^{16} ions/cm². Changes of surface layer composition produced by ion bombardment of UHMWPE samples were studied. The hydrogen release and oxygen uptake induced by ion beam bombardment were determined by Nuclear reaction analysis (NRA) using the $^1\text{H}(^{15}\text{N}, \alpha\gamma)^{12}\text{C}$ and Rutherford backscattering spectrometry (RBS), respectively. Tribological and hardness properties at the polymer near surface region were studied by means of friction coefficient and micro-hardness testers, respectively. Wettability of the bombarded surfaces was determined by measuring the contact angle for distilled water. The obtained results showed that the ion bombardment induced hydrogen release increases with the increasing ion fluence. An important effect observed, was the rapid oxidation of samples, which occurs after exposure of bombarded samples to air. These effects resulted in important modifications of the surface properties of bombarded material such as change of friction coefficient, hardness and improved wettability.

1. Introduction

Polymers are a very important class of materials; this is due to their mechanical properties, recyclability, manufacturability, good chemical resistance, and relatively low cost as compared to many alloys and ceramics. Applications of polymeric materials for medical purposes are growing very fast. A large number of polymers are widely used in various medical applications. This is mainly because they are available in a wide variety of compositions, properties, and forms and can be fabricated readily into complex shape [1]. The global trends are now towards development of more dedicated biomaterials using different techniques, such as surface coating technologies and surface functionalization by various chemical and physical methods. Most of the polymers are rather fragile upon dynamic load. These materials being a part of the artificial joint and due to this defect they are not able to absorb dynamic load accompanying human walking for a longer time [2]. To overcome this drawback surface layers are usually modified by γ -ray irradiation [3]. Gamma ray irradiation produced free radicals lead to cross-linking of the polymer making it harder but fragile [4]. The accumulated energy leads to producing crack formation that gradually propagates towards the surface [5]. The prosthetic wear debris from the implant is one of the essential factors for the aseptic loosening. The best solution of this problem is fabricating shock absorber polymeric material, i.e., the modification limited to the top surface, leaving the bulk of material intact. Ion bombardment seems to be a very promising tool for this purpose; this is due to the large stopping power and easily adjustable penetration depth [6–7]. Ion bombardment of polymers leads to break of

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Ion Bombardment Modification of Surfaces: Fundamentals and Applications (Beam Modification of Materials, 1) [Orlando Auciello, Roger Kelly] on Amazon. com. Ion bombardment modification of surfaces: fundamentals and applications. Front Cover Advanced surface coatings: a handbook of surface engineering. Finally, the practical aspects of ion bombardment modification of surface shape phenomenon, i.e. its application to sputtering yield and sputtering velocity. Fundamentals And Applications by Orlando Auciello ; Roger Kelly. Ion bombardment modification of surfaces: fundamentals and. The morphology of surfaces. bombardment: fundamentals and applications Modification of the surface properties of Applications of ion beam assisted smoothing. smoothing of surfaces by ion bombardment: fundamentals and applications .. Modification of metals by plasma immersion ion implantation. Ion Bombardment Modification of Surfaces by Orlando Auciello, Ion Bombardment Modification of Surfaces: Fundamentals and Applications. The Hardcover of the Ion Bombardment Modification of Surfaces: Fundamentals and Applications by Orlando Auciello at Barnes & Noble. J. M. E. Harper, J. J. Cuomo, R. J. Gambino, and H. R. Kaufman, in Ion Bombardment Modification of Surfaces: Fundamentals and Applications, edited by O. Examples of property modification are given, including intrinsic stress Ion Bombardment Modification of Surfaces: Fundamentals and Applications, Elsevier. In "Ion Bombardment Modification of Surfaces: Fundamentals and Applications," Ch. 9, Eds. O. Auciello and R. Kelly (Elsevier Science Publishers,) Multiparticle bombardment-induced synergism in erosion of materials has (Eds.), Ion Bombardment Modification of Surfaces: Fundamentals and Applications.

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