ABSTRACT

Ti6Al4V alloy is one of the most frequently used titanium alloys, with diverse applications in aerospace and biomedical fields due to its favorable mechanical and biocompatible properties. To improve the surface hardness and corrosion resistance of the Ti6Al4V alloy, its polished samples were implanted with 50 keV argon ions (Ar+) using an ion implanter at a dose of 10^{17} ions-cm^{-2}. X-ray diffraction (XRD) measurements were conducted to analyze the crystal structure, crystallite size, and lattice strain in both un-implanted and ion-implanted samples. Hardness testing was carried out using a Vickers hardness tester. Electrochemical analysis before and after ion implantation was performed using open circuit potential (OCP) and potentiodynamic polarization techniques in Ringer lactate solution. The post-corrosion surface morphology of the samples was studied using a scanning electron microscope (SEM). The XRD results showed peaks of titanium along different planes in both the unimplanted and ion-implanted samples. The average crystallite size of the Ti6Al4V alloy increased after ion implantation, while lattice strain decreased. These changes were attributed to ion implantation-induced localized heating of the material. Ar+ implantation in the Ti alloy produced structures on its surface due to the re-deposition of sputtered material caused by ion-induced heating. The hardness of the Ti6Al4V alloy decreased upon ion implantation in it. The open circuit potential of the alloy shifted to a more positive value, and the corrosion rate and current density of the material significantly decreased due to ion-implantation. These results were consistent with the post-corrosion surface morphology observed using SEM, which indicated less deterioration of the ion-implanted alloy's surface, compared to the un-implanted one. The improvement in corrosion resistance of the Ti alloy was attributed to the formation of ion-induced surface structures and the reduction in grain boundaries due to ion implantation.