ABSTRACT

This study investigates the surface and structural properties of carbon ions irradiated Zirconium. The samples of Zirconium were irradiated with 1 MeV carbon ions at different doses (1×10^{13} ions/cm^2, 1×10^{14} ions/cm^2 and 1×10^{15} ions/cm^2) with the help of Pelletron accelerator at room temperature. The structural analysis of irradiated Zirconium samples was carried out by x-ray diffraction (XRD) technique. The XRD results revealed that after irradiation, intensity and width of the different peaks of the Zr are changed. The intensity of (002) of Zr is higher as compared to the intensity of its other planes. The crystallite size and microstrain of unirradiated and carbon irradiated zirconium was calculated by Williamson-Hall (W-H) analysis. The results depicted an increase in the crystallite size of Zr after its irradiation at 1×10^{13} ions/cm^2. The crystallite size and strain were decreased with further increase of the carbon dose. The surface morphology of Zirconium before and after irradiation was investigated by field emission electron microscope (FESEM). The surface morphology of the irradiated samples showed the formation of cavities, pits, spots and agglomers on the Zirconium surface. These defects were more prominent at lower ion doses whereas at the highest dose, these defects became less prominent. Electrochemical tests of unirradiated and carbon ions irradiated Zirconium specimens were performed in Phosphate Buffer Saline (PBS) solution and their potentiondynamic curves were obtained. The results depicted an increase in corrosion resistance of Zirconium after carbon ions irradiation. The corrosion current density and corrosion rate were significantly reduced after carbon ions irradiation. The decrease in corrosion parameters were attributed to formation of oxides/carbides on the surface of Zirconium.