ABSTRACT

In this study, the structural and surface properties of pure iron (Fe) have been investigated after different ions implantation in it. The purppse of the study was to improve the surface hardness and electrochemical corrosion resistance of Fe using ions implantation technique. The samples of pure iron were subjected to singly charged Gold (Au^+), Nickle (Ni^+), Cobalt (Co^+), Copper (Cu^+), Yttrium (Y^+) ions irradiation at room temperature using Pelletron accelerator. The ion dose and energy was kept constant at 5×10^{14} ions/cm^2 and 1 Mev, respectively. The characterization of unirradiated and irradiated samples were made by different techniques. The X-ray diffraction analysis revealed polycrystalline nature of iron. The analysis showed that the Au^+ ions are more effective in increasing the crystallinity of iron as compared to other ions. On the other hand the yttrium ions considerably decreased the crystallite size of iron. After irradiation with metallic ions, surface defects in the form pits, cavities (black color) and protruded structures (white color) can be clearly noticed with SEM analysis. The ejected material mix with up to form agglomerates of different shapes that appear on the specimen surface. Potentiodynamic polarization (PDP) results revealed that decrease in the corrosion current density after ions irradiation of Fe samples. The corrosion resistance is significantly improved on irradiation with different types of ions, with gold Au^+ ions better is the corrosion resistance. The surface hardness followed Classical Hall–Petch relation, i.e., larger the crystallite size (26-83nm) smaller the surface hardness (190 – 182 HV), i.e., With implantation of gold and copper the hardness will decreases, while with implantation of cobalt, nickel and yttrium the hardness will increases. The ion range of Au^+, Co^+, Cu^+, Ni^+ and Y^+ ions inside the samples was 100 nm, 327nm, 99 nm, 322.7nm and 218.6 nm, respectively estimated using the SRIM software.