

ABSTRACT

This work demonstrates the carbon ion irradiation induced changes in Aluminium (Al) at different ion energies. The Aluminium samples were irradiated with carbon ions of different energies such as 0.25 MeV, 0.5 MeV, 1 MeV, 2 MeV and 4 MeV by using Pelletron Accelerator while maintaining the constant dose at 1×10^{15} ions/cm². The structural changes in irradiated Al were investigated by X-ray diffraction (XRD), surface morphology was observed by field emission scanning electron microscope (FESEM) and the electrochemical corrosion behavior of Al was studied through potentiodynamic polarization tests. The analysis of structural features of irradiated Al by the XRD showed aluminium carbide (Al₄C₃) precipitates in Al irradiated with different ion energies. The amount of Al₄C₃ was decreased in Al irradiated with carbon energy larger than 1 MeV. The FESEM and EDS results validated the existence of these precipitates in the irradiated samples. However, the hexagonal Al₄C₃ precipitates were more significant in 0.25 MeV irradiated Al as compared to the samples irradiated higher energy ions. The micro-cracks were found in Al after increasing the carbon irradiation energy above 0.25 MeV. The electrochemical corrosion of unirradiated and irradiated Al was studied in 3.5 % NaCl solution. The corrosion current density and corrosion rate of unirradiated and irradiated Al were evaluated from the potentiodynamic polarization tests. The results indicated a significant decrease in corrosion rate and corrosion current density in Al irradiated by after 0.25 MeV carbon ions. By further increasing the ion irradiation energy, the corrosion rate became increased. The decrease of corrosion rate was related with the formation of Al₄C₃ that offer resistance to Al oxidation and this improves the corrosion resistance of the Al.