Abstract

The effects of Nickel ions irradiation at different energies and fluences on surface, structural, electrical, hydrophilic and mechanical properties of Kapton have been investigated. One set of kapton specimens is irradiated with 1 MeV singly charged Ni^+ ions at various fluences ranging from 1×10^{13} ions/cm^2 to 6×10^{13} ions/cm^2 by using Pelletron accelerator. Another set of kapton specimen is exposed with 1.2 KeV Ni plasma species at the fluences ranging from 3×10^{15} ions/cm^2 to 9×10^{15} ions/cm^2. The investigation of sample surface topography using optical microscope illustrates the pronounced modification after irradiation. The growth of wrinkles and dendrites like structure is detected after 1 MeV ions beam irradiation whereas plasma treatment supports the formation of elongated sputtered channels. The irradiation induced structural modifications in Kapton were investigated by employing Fourier Transform Infrared Spectroscopy (FTIR) technique. The considerable decrease in existing peaks intensities is noticed with the increase of fluence. However, no new bands formation is detected after irradiation. The investigations of electrical properties by using four probe method reveals that electrical resistivity of kapton after 1 MeV ions beam irradiation linearly decreases with the increase of fluence. Similarly an overall decrease in electrical resistivity is detected with 1.2KeV plasma ions irradiations except at fluence of 8×10^{15} ion/cm^2 where an increase in resistivity is observed. The surface wettability of pristine and irradiated specimens were observed by measuring the de-ionized water droplet contact angle with sample surface and corresponding work of adhesion. The results reveal that Kapton specimen become highly hydrophilic after Ni ions irradiation in both cases. Additionally, a more pronounced decrease in contact angle and increase in work of adhesion value are detected for the samples irradiated with 1.2 KeV Ni plasma ions. The Vicker micro hardness analysis indicates the increase in surface hardness with the increase of ions fluence except at higher fluences of Ni plasma ions irradiation. The UV-Visible spectroscopy analysis reveals that the optical transmission of Kapton is decreases with the increase of ions irradiation fluence in both cases. However the decrease in transmission is linear and pronounced after plasma treatment.