ABSTRACT

In this work, Yttrium ions (Y^+) irradiation effects on the triboelectric performance of a carbon polymer were investigated. The samples of carbon polymer were irradiated by singly charged Y^+ of energy 500 keV at different doses such as 5×10^{11}, 5×10^{12}, 5×10^{13} and 5×10^{14} ions-cm^{-2} using Pelletron Accelerator. Structural properties of the un-irradiated and Y^+ irradiated samples were studied through X-ray diffraction (XRD) analysis. The XRD results showed a single halo peak of carbon polymer along (002) plane both in un-irradiated and irradiated samples. The Y^+ irradiation of the carbon polymer resulted in a decrease in the full width at half maximum and shifting of this peak to higher angle with increase of the ion dose. The improved crystallinity of the carbon polymer with increase of the yttrium ion dose was attributed to structural ordering of the polymer due to energy deposition by the incident ions in it. The triboelectric performance of the un-irradiated and Y^+ irradiated carbon polymer was investigated by taking Al as tribo-positive and carbon polymer as tribo-negative material. An Al foil was used as an electrode which was fixed on the back side of the carbon polymer. The fabricated triboelectric nanogenerator (TENG) was operated in a vertical contact-separation mode. The Al was constantly pressed and released on the carbon polymer to generate voltage signal through the combine effects of triboelectric and electrostatic induction effects. The open circuit voltage (OCP) of the fabricated TENG was increased after the Y^+ irradiation. The value of the OCP continued to increase with increase of the ion dose under a constant force. The increase in OCP was attributed to improvement in the crystallinity of polymer that resulted in an increase in the triboelectric effect between the two materials. The OCP was also found to increase with increase of the applied force. The maximum value of OCP was found to about 80 V at the applied force of 12 N. Different load resistors were connected in the circuit to obtain the values of output potential and the current. The output potential was increase while the current decreased with increase of the applied potential.