A novel carbon-polymer electrode for CdTe-based X- and gamma-ray detectors

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CdTe-based diode-type X- and γ-ray detectors have a lot of advantages due to excellent characteristics of CdTe semiconductor. High atomic numbers of the compound components Cd (Z = 48) and Te (Z = 52) provide a high photon absorption and power stopping resulting in high detection efficiency. The large band-gap energy of CdTe (E_g ~ 1.5 eV) hence, high electrical resistivity, allows detectors to operate at room temperature. Generally, metal electrodes are used to form near-ohmic contacts or a Schottky barrier on the both CdTe faces. The barrier height can be tuned applying specific chemical treatment of a CdTe surface, employing laser radiation or varying electrode metals of different work functions. In our previous studies, Indium was used as an electrode to form a Schottky barrier. Besides, Induim film, predeposited on a CdTe surface, was used as a dopant source employing laser-induced doping technique in order to create a p-n junction. To increase a barrier and to obtain various barrier heights on a CdTe-electrode interface, carbon-based electrodes of different properties can be used. Due to the features of carbon materials provided by interatomic bonding type, it is expected to develop a carbon-based electrode with a controllable band gap.

In this work, a CdTe-based diode with a carbon-polymer electrode was fabricated. The electrode was made with a carbon-polystyrene layer deposited on a semiconductor surface. Polystyrene was stirred in suspension of carbon particles in toluene. Obtained viscous mixture was dripped onto the CdTe surface preliminary rinsed in toluene, and then, dried during 1 hour until hardened. In I-V measurements, a conductive rubber was used as a bottom and top layer to increase contact ability. Electrical characteristic of the carbon-CdTe structure is shown in Fig. 1 and demonstrates a barrier-like behavior.

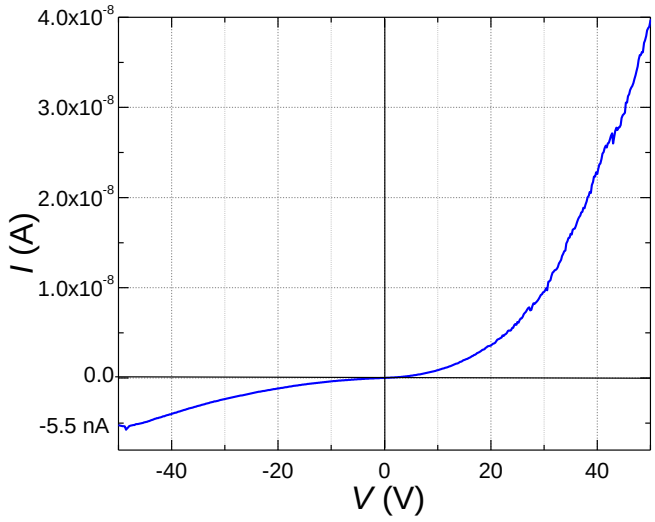

Fig. 1. I-V characteristics of a carbon-CdTe structure.