Nanocomposites and nanomaterials

Effect of irradiation by high-energy electrons with energy 2 MeV on conductivity and Seebeck coefficient in array of carbon nanotubes

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Carbon nanotubes, which were obtained by CVD were identified by transmission electron microscopy (JEM-100CX11, Japan). The average diameter of carbon nanotubes is 18 ± 7 nm. Multiwall CNTs were irradiated at a linear electron accelerator U-10 of 2 MeV energy with a current of 200 mA. Radiation doses were $0.63 \cdot 10^{17}$ e/cm^2 and $1.9 \cdot 10^{17}$ e/cm^2. In a state of loose CNTs are not conductors, in order to switch to conductors state should establish contact between nanotubes and between nanotubes and electrons. Therefore, the conductivity and thermopower measured in a dielectric cylinder under piston.

Our results of investigations demonstrated that after irradiation CNTs conductivity decreases due to the formation of defects. If σ before irradiation is higher in annealed nanotubes, then after irradiation σ is higher in unannealed nanotubes. This means that density of annealed samples should be higher, because they form less distorted, for current flow between the electrodes through array of carbon nanotubes before irradiation.

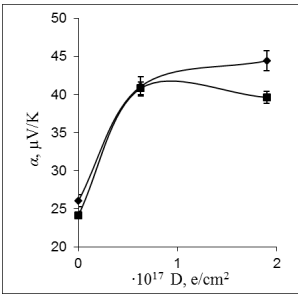

Fig. 1. The dependence of the Seebeck coefficient (α) of the dose (D) exposure to carbon nanotubes irradiated with energy 2 MeV.

The form of unannealed samples, conversely, is less distorted after irradiation. Irradiation of annealed CNTs reduces conductivity from 0.602 $(\Omega \cdot cm)^{-1}$ to 0.30 $(\Omega \cdot cm)^{-1}$ for lower dose and to 0.104 $(\Omega \cdot cm)^{-1}$ for higher dose. Coefficient α increases for unannealed sample from 26 to 44 μV/K and for annealed sample from 24 to 40 μV/K after

CNTs were irradiated by high-energy electrons with E=2MeV (Fig. 1). It is associate with changes in the structure of CNTs, which leads to more dense packing CNTs array when it were deformed directionally, that this leads to reduce the elasticity in association with changes in form and configuration of the carbon

nanotubes due of radiation defects.