Thermoelectric Performance of Heusler Alloys/ Ion irradiated multi-walled carbon nanotubes composites

Emad M. Elsehly1, \*), N.G. Chechenin2)

1) Damanhour University, Egypt

2) SINP MSU, Russia

\*) elsehlyfigo@yahoo.com

Improved electrical and reduced thermal conductivities are characteristics of desirable thermoelectric compounds. Incorporating nanostructures to Heusler alloys can enhance their performance as a thermoelectric material. The doping impact of ion irradiated multi-walled carbon nanotubes (I-MWNTs) on the thermoelectric performance of half Heusler alloys is examined and explained. Both NbFeSb-based, and TiNiSn-based compounds have been investigated as a p-type and n-type, respectively. Thermal and electronic transport parameters were recorded at temperatures ranging from ambient to 875 K. The prepared samples are characterized using XRD, SEM, and EDAX. Utilizing TiNiSn-based samples, a promising figure of merit of 0.63 was obtained. The obtained thermoelectric results demonstrated that compositing the I-MWNTs with n-type compounds exhibited considerable impact on Seebeck coefficient and the electrical conductivity. However, for the p-type alloy the variations in these thermoelectric parameters were dramatically less. It is hypothesized that the development of annealed carbon tubes as a conducting cluster in the n-type Heusler alloy could be one explanation for this variation. These promising findings will open the way for further research on CNT/Heusler composites as a power generation material.