Nanocomposites and nanomaterials
FIR dielectric function of phase change materials for new data storages

K. Shportko[1,2], M. Wuttig [1] and E. Venger [2]

[1] *I. Institute of Physics (IA), RWTH University of Technology Aachen, Sommerfeldstr. 14, Aachen 52056, Germany.*
E-mail: konstantin@shportko.com

[2] *V.E. Lashkarev Institute for semiconductor physics of NAS of Ukraine, Kyiv, Ukraine.*

Phase change (PC) materials are promising materials for data storage applications due to their unique properties, which include a remarkable difference of their electrical and optical properties in the amorphous and crystalline state. These materials have already been employed in rewriteable optical data storage. Memories based on PC materials are a candidate to replace flash memory for non-volatile data storage applications due to their lower power consumption and higher operation speed [1].

The amorphous state of phase change materials is bonded covalently, while crystalline phase crystalline utilizes resonant bonding. Due to this fact, dielectric permittivity of the crystalline phase below the optical band gap is several times bigger than that of the amorphous phase [2].

The aim of this study is to investigate the dielectric function of both amorphous and crystalline phases of PC materials in the FIR. Thin films of several Ge-Sb-Te alloys have been studied by FTIR and Raman spectroscopy at different temperatures.

Phonons have been observed in Raman spectra and they contribute to the dielectric permittivity of the PC materials in FIR range. The static dielectric constant of several Ge-Sb-Te alloys has been determined. Dielectric function of crystalline and amorphous PC samples in FIR is different due to the different bonding type and different atomic arrangement in amorphous and crystalline states. Influence of the temperature on the dielectric function of PC materials has been analyzed and discussed.

1. *Wuttig, M.* Phase change materials: Towards a universal memory? // Nature Materials -2008.-**4.**-P. 265-266.
2. *Shportko, K., Kremers, S., Woda, M., Lencer, D., Robertson, J. and Wuttig, M.* Resonant bonding in crystalline phase change materials // Nature Materials -2008.-**7.**-P. 653-658.