Lattice Disorder Effects on Thermal Properties of CdZnTe Crystals Grown by Vertical Bridgman Method

K. Strzałkowski, F. Firszt and A. Marasek

Institute of Physics, Faculty of Physics, Astronomy and Informatics, Nicolaus Copernicus University, Grudziadzka 5,87-100 Toruń, Poland.

Investigated in this work mixed $Cd_{1-x}Zn_xTe$ compounds are interested materials for modern electronics and materials science. CdTe based crystals are promising materials as x-ray and gamma-ray detectors [1] but also substrate for infrared sensors (HgCdTe) [2]. The variation in composition allows tuning of their fundamental parameters like energy band-gap and lattice constant, what is very important from application point of view.

The phenomenon of the transport of the heat in semiconductor materials is a complex matter, particularly in the case of mixed ternary and quaternary crystals. It depends on the composition, structural characteristics and the preparation process. From application point of view the most important parameters characterizing usable materials, in particular materials used in electronics, are the thermal conductivity and diffusivity. The knowledge about them is required in the design and construction of semiconductor devices. Determination of thermal parameters of completely new materials is therefore very important.

Photothermal methods are widely used in studying thermal properties of solid samples [3]. Among them, photopyroelectric technique is fast, simple, high sensitivity and non-destructive experimental method [4]. Photopyroelectric (PPE) calorimetry in the back (BPPE) and front (FPPE) configuration will be applied for thermal investigation of solid samples. The thermal diffusivity and effusivity of investigated crystals will be derived from the experimental data. Since dynamic thermal parameters are connected with each other, thermal conductivity of the specimens can be calculated from theoretical dependencies between them.

The aim of this work is to characterize the thermal properties (effusivity, diffusivity and conductivity) of $Cd_{1-x}Zn_xTe$ mixed crystals as a function of the composition and to investigate disorder effect in given materials. The results will be analyzed, among others, in the model proposed by Sadao Adachi [5] for mixed semiconducting crystals.

[1] T.E. Schlesinger, J.E. Toney, H. Yoon, E.Y. Lee, B. A. Brunett, L. Franks, R. B. James, *Mater. Sci. Eng. R* **32**, 103 (2001).
[2] S. Sen, C. S. Liang, D. R. Rhiger, J. E. Stannard, H. F. Arlinghaus, *J. Electron. Mater.* **25**, 1188 (1996).
[3] A. Mandelis and M. M. Zver, *J. Appl. Phys.* **57**, 4421 (1985).
[4] D. Dadarlat, M.N. Pop, M. Streza, S. Longuemart, M. Depriester, A. Hadj Sahraoui and V. Simon, *Int. J. Thermophys.* **31**, 2275 (2010).
[5] S. Adachi, *J. Appl. Phys.* **102**, 063502 (2007).