Nanocomposites and nanomaterials

Positron-positronium trapping algorithm in application to study of nanostructured effects in Ge-Ga-Se/S chalcogenide glasses

H. Klym[1], O. Shpotyuk[2], A. Ingram[3], L. Calvez[4]

[1] Lviv Polytechnic National University
Bandery str., 12, Lviv-79013, Ukraine
E-mail: halyna.i.klym@lpnu.ua; klymha@yahoo.com
2 Vlokh Institute of Physical Optics
Dragomanova str., 23, Lviv-79005, Ukraine
3 Opole University of Technology
Ozimska str., 75, Opole- 45370, Poland
4 Equipe Verres et et Céramiques, UMR-CNRS 6226, Institute des Sciences chimiques de Rennes, Université de Rennes 1, 35042 Rennes Cedex, France

Positron annihilation lifetime (PAL) spectroscopy is well-known technique to study atomistic imperfections such as free-volume defects (vacancies, vacancy-like clusters, voids and void agglomerates, pores and even macroscopic cracks, etc.) in different solids despite their structural organization [1]. In application to semiconductors, this method allows useful identification of intrinsic free volumes owing to simple models considering competitive channels of positron trapping from defect-free bulk states, deep ground states of positron traps and "pick-off" decaying of bounded positron-electron (positronium Ps) states [1]. But when dealing with nanomaterials possessing nanostructural inhomogeneities, the PAL method seems too ambiguous in view of numerous complications in the adequate meaningful interpretation of the detected PAL spectra.

In this work, we shall use positron-posironium trapping algorithm [2] to study effects nanostructurization in the $80GeSe_2$-$20Ga_2Se_3$ glasses caused by annealing at different duration (effects of void agglomeration and fragmentation) and in the $80GeS_2$-$20Ga_2S_3$ glasses with different amount of CsCl additives (effects of void agglomeration).

1. *Krause-Rehberg R., Leipner H.* Positron annihilation in semiconductors: defect studies, Springer, Heidelberg; 1999.

2. *Shpotyuk O., Filipecki J., Ingram A., Golovchak R., Vakiv M., Klym H., Balitska V., Shpotyuk M., Kozdras A.* Positronics of subnanometer atomistic imperfections in solids as high-informative structure characterization tool // Nanoscale Res Letters-2015.-10.-P. 77-1-77-5.