Nanocomposites and nanomaterials

Nanostructurization in GeS_2-Ga_2S_3-CsCl chalcogenide glasses studied with coupling positron-positronium trapping algorithm

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Modern nanomaterials science is required new high-informative instruments to characterize free volumes in atomic and subatomic scales. One of such probes is positron annihilation lifetime (PAL) spectroscopy [1]. This method allows identification of intrinsic free volumes in solids owing to simple models considering channels of positron trapping and positronium (Ps) decaying. But when dealing with materials possessing nanostructural inhomogeneities, the PAL method seems too ambiguous in view of numerous complications in adequate interpretation of PAL spectra.

In this work, we shall use modified positron-positronium (Ps) trapping (x3-x2-decomposition) algorithm [1] to analyze PAL spectra of $80GeS_2$-$20Ga_2S_3$ glasses with different amount of CsCl additions. It is proved that nanostructurization in these glasses is described by agglomeration of free volumes under increasing CsCl. In case of $(80GeS_2\text{-}20Ga_2S_3)_{100\text{-}x}(CsCl)_x$, $x = 15$ glass, this approach allows description of additional channel in terms of substitutional positron-Ps trapping, which occurs as transformation of positron-trapping sites in Ps-sites probably due to adsorbed water.

1. *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.