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Microstructure hierarchical model of competitive e^+-Ps trapping in nanostructurized substances: from nanoparticle-uniform to nanoparticle-biased systems

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Electron interaction with its antiparticle (positron) in lifetime mode is known as an effective tool to study nanostructurizion effects in solids possessing mixed positron (e^+) and positronium (Ps) trapping. Intrinsic inhomogeneities due to guest nanoparticles embedded in structurally-uniform substances can be adequately described in terms of substitution trapping in e^+- and Ps-related sites within the same host matrix, allowing estimation interfacial free-volume voids responsible for the positron trapping and the defect-free bulk lifetimes of nanostructurised matrix [1,2]. This model is modified for nanoparticle-biased systems composed of coarse- and fine-grained particles, forming interfacial and grain-boundary e^+-Ps traps.

The developed double-hierarchical model of competitive e^+-Ps trapping is considered at the example of As_4S_4/ZnS nanoparticles prepared by high-energy milling. Positron lifetime spectra are reconstructed from unconstrained three-term decomposition procedure and further subjected to parameterization in respect to coupling decomposition route [1]. The calculated trapping parameters can be adequately used to describe nanospace filling in As_4S_4/ZnS nanosystem.

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.

2. *Shpotyuk O., Ingram A., Filipecki J., Bujňáková Z., Baláž P.* Positron annihilation lifetime study of atomic imperfections in nanostructurized solids: On the parameterized trapping in wet-milled arsenic sulfides As_4S_4 // Phys Stat Sol B.-2016.-doi 10.1002/pssb.201552560.