

Nanocomposites and nanomaterials

Free-volume entities in the $\text{Cu}_{0.4}\text{Co}_{0.4}\text{Ni}_{0.4}\text{Mn}_{1.8}\text{O}_4$ ceramics studied by PAL tools

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Functional temperature-sensitive ceramics based on mixed transition-metal manganites is one of the typical representatives of so-called topologically disordered substances having wide industrial applications. In this work free-volume entities in functional ceramics [1] are studied with positron annihilation lifetime measurements. Obtained results are interpreted in terms of unified multi-channel positron annihilation model involving both positron trapping and ortho-positronium decay modes. For mixed transition-metal manganite $\text{Cu}_{0.4}\text{Co}_{0.4}\text{Ni}_{0.4}\text{Mn}_{1.8}\text{O}_4$ ceramics it is shown that a strict correlation exists between numerical values of free volume of potential positron traps and lifetime parameters. The extended defects near grain boundaries are supposed to be responsible for middle component at the level of 0.4 ns. The small third component is due to “pick-off” annihilation of o-Ps in the intergranular nanovoids. The observed o-Ps lifetime ~ 1.8 ns is related to the nanopores with radius of ~ 0.27 nm based on classic Tao-Eldrup equation. The reported data are addition information to Hg-porosimetry and scanning electron microscopy results.

1. Shpotyuk O., Brunner M., et al. Analytical description of degradation relaxation transformations in nanoinhomogeneous spinel ceramics // *Nanoscale research letters*, 2016, 11:499, pp.1-6.