Nanocomposites and nanomaterials

Nanostructurization in $MgO\text{-}Al_2O_3$ ceramics under the water influence tested with positron-positronium trapping algorithm

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A meaningful characterization of positron trapping in nanostructured $MgO\text{-}Al_2O_3$ spinel-type ceramics extensively studied as one of the most perspective materials for humidity sensors is developed at the basics of positron annihilation lifetime (PAL) measurements. But in water-immersed ceramics the two channel will be possible: positron trapping and positronium (Ps) decaying [1]. Adsorbed water influences on nanostructurization process in $MgO\text{-}Al_2O_3$ ceramics.

In this work, we shall use positron-positronium trapping algorithm to analyze PAL spectra of $MgO\text{-}Al_2O_3$ ceramics under water influence. PAL spectra were fitted on four components with positron lifetimes τ_1, τ_2, τ_3, τ_4 and corresponding unity-normalized intensities I_1, I_2, I_3, I_4. To apply positron-positronium trapping algorithm, the second and third components were averaged and interpreted as positron-trapping component. Thus, 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 due to adsorbed water in nanopores of ceramics.

1. *Klym H., Ingram A., Shpotyuk O., Hadzaman I., Solntsev V.* Water-vapor sorption processes in nanoporous $MgO\text{-}Al_2O_3$ ceramics: the PAL spectroscopy study // Nanoscale research letters, 2016, 11:133, p.1-7.