Nanocomposites and nanomaterials

Positron-positronium trapping effects near grain boundaries and in nanopores in the modified $MgO-Al_2O_3$ ceramics

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The positron annihilation lifetime (PAL) spectroscopy method based on the fact that the unstable positron-electron system (positronium Ps) is repelled from ionic cores of atoms and tends to location in open pores. In the case of oxide water-immersed ceramics, two channels of PAL should be considered – the positron trapping and o-Ps decaying [1]. In general, these processes are independent ones. However, if trapping sites will appear in a vicinity of grain boundaries neighboring with nanopores, they can become mutually interconnected resulting in a significant complication of the measured PAL spectra. In addition, adsorbed water influences on process near grain boundaries and in nanopores in the $MgO-Al_2O_3$ ceramics.

To clarify this feature, we shall study the PAL characteristics of modified $MgO-Al_2O_3$ ceramics affected to water sorption treatment enhancing o-Ps decaying over positron trapping modes using positron-positronium trapping algorithm. To apply positron-positronium trapping algorithm it was shown that the chemical-adsorbed water vapor modifies structural defects located at the grain boundaries in a vicinity of nanopores, this process being accompanied by void fragmentation during water adsorption and agglomeration during water desorption after drying.

1. *Klym H., Ingram A., Hadzaman I., Shpotyuk O.* Evolution of porous structure and free-volume entities in magnesium aluminate spinel ceramics // *Ceramics International*, vol. 40, 2014, pp. 8561–8567.