Nanocomposites and nanomaterials

Frequency domain kinetic of electron-positron annihilation in the $MgO-Al_2O_3$ spinel-type ceramics

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Kinetic response of any linear dynamical system can be characterized by pulse characteristic in time domain as a reaction on exciting signal in the form of delta function. In frequency domain the same kinetic can be presented in the form of complex spectra, every point of which shows the response of dynamical system on exciting signal amplitude of which is changing according to sinusoidal law with time. Electron-positron annihilation (EAP) kinetic response in solids are measured in time domain in form of pulse characteristic representing intensity of annihilation with time after very short and very powerful positron flux irradiation of the sample under study. Experimentally the pulse characteristic is a result of repetitive PEA measurements. However, PEA kinetic response in solids in frequency domain is interesting and useful particularly because of its high resolution features.

In this work kinetic of EPA in the $MgO-Al_2O_3$ spinel-type ceramics sintered at different temperatures (1100, 1200 and 1400 ^oC) [1] has been analyzed in a frequency domain. The spectra of real (in-phase) and imaginary (quadrature) components of EPA kinetic have been obtained from the standard temporal characteristics using integral Fourier transforms. The numerical calculations were carried out using cubic-spline interpolation of the pulse characteristics of $MgO-Al_2O_3$ ceramics in time domain with following analytical calculations of integrals.

Two Debye type responses are revealed on spectra of real and imaginary part of frequency domain EPA response of $MgO-Al_2O_3$ ceramics. Complex diagrams of frequency domain EPA responses have a shape of two semicircles with close characteristic frequencies. Sintering temperature dependencies of the relaxation times and characteristic frequencies of EPA processes have been obtained.

1. *Klym H., Ingram A., Shpotyuk O., Filipecki J., Hadzaman I.* Extended positron-trapping defects in insulating $MgAl_2O_4$ spinel-type ceramics // Physica status solidi (c). – 2007. – **4(3)**. – P. 715-718.