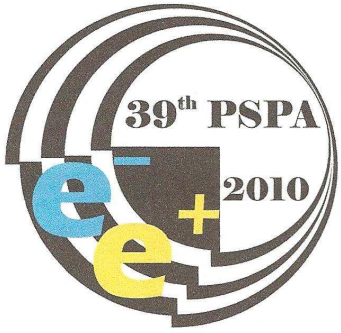
# 39th Polish Seminar on Positron Annihilation




## Book of Abstracts

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# TESTING ORTEC LIFETIME SYSTEM

Andrzej Karbowski, Janusz D. Fidelus[1], Grzegorz Karwasz

*Instytut Fizyki, Uniwersytet Mikołaja Kopernika, 87100 Toruń, Polska*
*[1]Instytut Wysokich Ciśnień PAN, ul. Sokołowska 29/37, 01-142 Warszawa, Polska*

We report performance tests of ORTEC PLS life time system based on plastic (St. Gobain BC418) scintillators and RCA 8850 photomultipliers. The system is under testing in a rather unusual configuration, using a very low-intensity (0.5 μCi) $^{22}$Na source, with one side covered by an inox, 1 mm thick plate. We have determined 146 ps lifetime for this backcover, in between 123 ps and 157 ps values, previously measured for Fe and Cr monocrystals, respectively [1]. The system is being proved for a number of samples, from metals, Si, ZnSe semiconductors to $ZrO_2$ nanostructures. The latter samples have been previously measured with Doppler-broadening depth-resolved method and nanovoids open towards surface were found [2]. Data analysis was done using LT programme by J. Kansy.

In our copper samples the defect-like (165 ps) lifetime dominates (90%) over the experimentally and theoretically well known 115 ps value [1]. For silicon monocrystals the well-expected [1] 220 ps lifetime was found. For pyrolithic graphite three lifetimes were found, 208 (34%) 233 (20%) and 420 (46%). The first two of them are typical for graphite [3] while the third one probably results from a rather loose structure of the pyrolithic graphite, as compared to the normal graphite.

In hydrothermally grown $ZrO_2$ samples we find only two lifetimes: 215 ps and 370 ps. The latter coincides with one of the values found by Prohazka et al. [4] for sintered $ZrO_2$ but the first lifetime is higher than theirs (189 ps). A possible nano-voids component is probably too weak (below 1%) to be detected in the present experimental configurations.

In ZnSe samples [2] we can distinguish two lifetimes - a short one (130 ps) and defect-like 330 ps (46% intensity). The latter one would agree with a theoretical prediction for Zn vacancies [5].

The lifetime resolution of the apparatus, as determined in all these tests is about 180 ps.

ORTEC PLS system has been purchased within NLTK laboratories at UMK.

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[2] J. D. Fidelus et al. Nukleonika 55 (2010) 85
[3] T. Onitsuka et al. J. Nucl. Mat. 283-287 (2000) 922
[4] I. Proházka et al. Acta Phys. Pol. 113 (2008) 1495
[5] F. Plazaola et al. J. Appl. Phys. 94 (2003) 1647