O13 | **Network properties of ureasil-based polymer matrixes for construction of amperometric biosensors as probed by PALS and swelling experiments**

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Recently, innovative amperometric biosensors for monitoring the level of wastewater pollution have been constructed [1] on the surface of the gold planar electrodes C220AT "DropSens" by using the organic-inorganic ureasil-based composites as host polymer matrixes and immobilized commercial laccase from *Trametes versicolor*. It has been found that the biosensor based on the ureasil-chalcogenide glass composite was characterized by very high sensitivity to be 38.3 times higher in compare with pure ureasil. On the other hand, application of the ureasil-chalcogenide glass composite with incorporated silver nanoparticles synthesized by high-dose 30 keV Ag^+ ion implantation results in decreasing the biosensor sensitivity up to 2390 times. Therefore, knowing the properties of the microstructure of such materials is important in terms of optimizing the regulated properties of the biosensors.

In the present work, the free-volume and swelling properties of various samples of pure ureasil and ureasil-chalcogenide glass composite were studied. Using positron annihilation lifetime spectroscopy (PALS), temperature dependencies of the *ortho*-positronium (*o*-Ps) lifetimes and their relative intensities were measured to estimate the evolution of microstructural free-volume. Glass transition temperatures and expansion coefficients of microscopical free-volume were determined. Differences in network behavior for older samples (aging effect) and the effect of chalcogenide (As_2S_3) particles on the free volume of ureasil network were observed. Swelling experiments using water and ethyl alcohol showed that the structure of the older sample network had less swelling ability for pure ureasil as well as composite. This suggests that the one of factors influencing swelling is the change of the basic ureasil network due to aging.

It is supposed that the network properties obtained by PALS and swelling experiments could be very helpful to understand better the bio-functionality of the constructed biosensor based on the ureasil-chalcogenide glass composite [1].

[1] T. Kavetskyy, O. Smutok, M. Gonchar, O. Demkiv, H. Klepach, Y. Kukhazh, O. Šauša, T. Petkova, V. Boev, V. Ilcheva, P. Petkov and A.L. Stepanov, *Journal of Applied Polymer Science* **134**, 45278 (2017)