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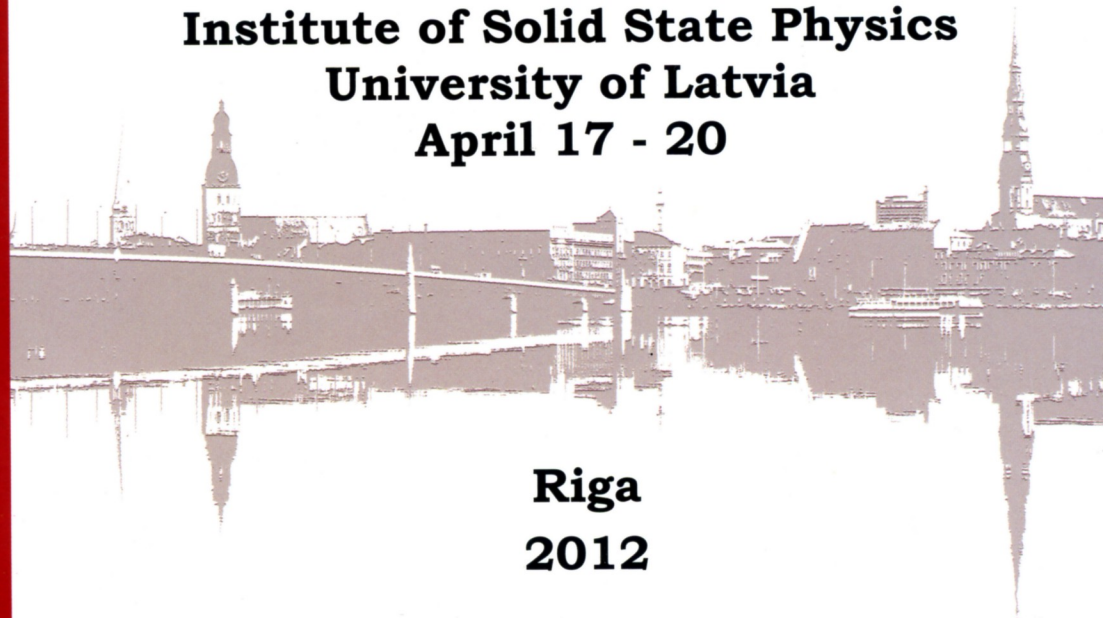

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Effect of the Plasticizers on Chemoresistivity of Polyvinylacetate-Nanostructured Carbon Composite

G. Sakale[1], E. Liepa[1], V. Tupureina[2], M. Knite[1], D. Jakovlevs[3]

[1]Institute of Technical Physics, Riga Technical University, Latvia

[2]Institute of Polymer materials, Riga Technical University, Latvia

[3]Biomaterial Innovation and Development Center, Riga Technical University, Latvia

e-mail: elinaLiepa@gmail.com

It is progressive to look for ecology, health and air quality nowadays. People, who work in factories and laboratories, are taken precautions to avoid serious health problems that are related with exposure to various volatile organic compounds (VOC) concentration in the air.

A sensor material polyvinylacetate – nanostructured carbon composite (PVAc-NCC) was created to detect various VOC. Its working principle is related to the ability of composite matrix to absorb VOC molecules that causes swelling and subsequent increase of composite electrical resistance. When the leak of VOC is removed, the composite relax fully to the initial electrical resistance value.

Experimental results showed that PVAc-NCC cannot determinate lower ethanol concentration than 10000 ppm because the sensor electrical resistance drift was comparable with the sensor response to VOC. To improve the sensitivity of the composite we used several plasticizers (polyethylene glycol (PEG) with low molecular weight (300; 400; 1000; 6000) and di-n-octyl sebacate (DOS)). We compared sensitivity in ethanol vapour of produced sensor materials and evaluted the significance of used plasticizer.

Of all tested composites the largest electrical resistance increase was observed for PVAc-NCC_PEG 300 20%, when exposed to ethanol vapour. That is related to decrease of composite glass transition temperature (T_g) due to addition of PEG 300 20%. The T_g of PVAc-NCC is 42,87^{0}C, but for the composite composition with PEG 300 T_g is -63,35^{0}C. It is known from the polymer glass transition theory that molecules have a great deal of freedom to move at temperatures well above T_g. Chains are free to take up all the conformations allowed by rotations around single bonds [1].

The possible lower detection threshold (130 ppm) of ethanol vapour has been determined for PVAc-NCC_PEG 300 20% (with thickness 30μm). Selectivity of PVAc-NCC_PEG300 20% to polar VOC has been determined as well.

References

1. David I. Bower. An Introduction to Polymer Physics. Cambridge University Press, 2002, p. 209.