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Glass transition in smectic e phase of alkyl-isothiocyanato-biphenyls

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In recent years, Positron Annihilation Lifetime Spectroscopy (PALS) has been extensively utilized in the studies of free volume characteristics in polymers but also low molecular weight glass formers. Efforts are made to connect the temperature changes of the o-Ps lifetime with changes of structure and dynamics in such systems. This can shed light on the nature of the glass transition which continues to be a subject of many studies. However, the phenomenon of vitrification in mesophases having partial long-range positional and/or orientational ordering of molecules is much less studied. Moreover, the majority of glass transition models concern only isotropic liquids.

In this presentation we report on application of the two order parameter model of glass transition proposed by Tanaka [1] to description of temperature dependencies of ortho-positronium lifetime and intensity of this component obtained for two members of 4-n-alkyl-4'-isothiocyanatobiphenyl homologous series with 4 and 6 carbon atom in the alkyl chain [2,3]. The PALS dependencies will be compared with the results of the dielectric spectroscopy and quasielastic neutron scattering (QENS) measurements in search of the glass transition signatures.

[1] H. Tanaka, J. Phys.: Condens. Matter 10(1998) L207

[2] E. Dryzek, E. Juszyńska, R. Zaleski, B. Jasińska, M. Gorgol, M. Massalska-Arodz, Phys. Rev. E, 88 (2013) 022504 (2013)

[3] E. Dryzek, E. Juszyńska-Gałązka, Phys. Rev. E 93 (2016) 022705

Primary authors: DRYZEK, Ewa (Institute of Nuclear Physics Polish Academy of Sciences, PL-31342 Kraków, Poland); Dr JUSZYŃSKA-GAŁĄZKA, Ewa (Institute of Nuclear Physics Polish Academy of Sciences); Dr JASIURKOWSKA-DELAPORTE, Małgorzata (Institute of Nuclear Physics Polish Academy of Sciences)

Presenter: DRYZEK, Ewa (Institute of Nuclear Physics Polish Academy of Sciences, PL-31342 Kraków, Poland)

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