Optical Films of Polyvinyl Alcohol withSilver Nanoparticles or Carbon Nanotubes

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In recent years keen interest in studying of spectral and optical properties of nanodimensional systems of metal nanoparticles (NP) and carbon nanotubes (CNT) as a part of film structures on the basis of substances where effects of superficial plazmonny resonances are observed remains. The last in turn strongly depend on geometry of NP and properties of environment that opens possibility of control of their optical response at change of their size, a form, an environment, etc. [1]. So, the polymeric films modified by nanoparticles of silver or CNT, can be used as transmissive, thermomoisture resistant polarizers [2,3], and also diffusion lenses as a part of passive sources of lighting on the basis of LCD indicators which at a certain range of corners of supervision are reflective polarizers [4].

Regularities of change of the spectral and optical characteristics determined by methods of electronic spectroscopy and a laser goniofotometric stokes-polarimetry, films from the polyvinyl alcohol (PVA), modified by silver nanoparticles or CNT by the quarternary ammonium connections (QAC), and also oriented by stretching and irradiated by UV radiation are studied.

Filling of PVA-films by nanoparticles of Ag happens at the expense of course of slow oxidation-reduction reaction when drying forming PVA of the composition containing dosed amounts of nitrate silver (0,01÷0,1 mas.%) and weak reducers: QAC (antistatik SAS) 0,1÷1,0 mas. % or glycerol (softener) 2,6÷2,8 mas %. Macromolecules of CNT which consisted of the cylindrical tubes of sheet graphite which had diameter of 20-50 nanometers and length to several microns, entered into QAC solution and dispersed at Ultra Sonic. The mass fraction of CNT in the stretched PVA-films varied from 0,2÷ 2,0 mas. %, and QAC – 1,0÷10,0 mas. %.

"Wave" dependence of character and values of optical density of films on the contents in them colloidal nanoparticles of Ag or CNT, SAS and also from influence of UV irradiation, orientation by stretching is established. Methods of stokes-polarimetry spectral and polarizing (operational) properties of films (transmission, polarizing ability, birefringence, etc.) and their angular distribution were determined. Recommendations about practical use of the developed films for optoelectronics products are made.

References

1 C. Noguez,*J.Phys. Chem. C*. 111(10):3806-3819(2007).
2 V. I.Studenov, M.G. Tomilin,*Optical Journal*.66(6):550-553(1999).
3 V. E. Agabekov, I. Yu. Globa, O. A. Daiineko, N. A. Ivanova, T. G. Kosmacheva, V. A. Dlugunovich, and A. V. Tsaruk,*Optical Memory & Neural Networks*. 18(2):77-84(2009).
4 Satoru Shoji et al. // Physical Review. B 77: 153407 (2008).