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ESR Study of New Dynamic Processes in Liquid and Frozen States of the Oriented Liquid Crystal Systems

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Nematic single crystals (NLC) find wide application in creating various optical devices, where the functioning is based on effects related to the change in orientation of the optical axis or the disruption of optical homogeneity of the crystal in electric, magnetic, and acoustic fields. The development of fundamentally new indicator devices based on electro-optic effects in LCs simul¬taneously imposes new requirements on their physicochemical properties. The study aimed to obtain numerical values of such dynamic parameters, as orientation relaxation time and ordering, which would offer new technical solutions that would expand the field of practical applications of LC.

The mobility (rotatory diffusion) and ordering of molecules were investigated by the electron spin resonance (ESR) tech¬nique with the help of a spin probe. ESR measurements were carried out in the temperature range of -270C - +700C, which is far beyond LC⟶Crystal transition point. Uniformly oriented samples were obtained by the application of a sufficiently strong magnetic field ~ 3000 G. ESR measurements were carried out on a radio spectrometer РЭ-1301 in a microwave region of 9 GHz. The magnetic parameters we-re measured with an accuracy of ⊠0,4 G. The accuracy of temperature measurements was ±0,1oC. Our analysis of the ESR spectra was based on the well-developed spin relaxation theory [1-3].

It was determined that, depending on the LC system, the rotatory diffusion correlation time (changes in the same way as the rotational anisotropy. In the investigated LC systems in the liquid state, were found. In a frozen LC system, depending on the particular molecular structure of the system's components, the high molecular mobility of was managed to obtain. It has been shown that such high mobility of molecules, extending far beyond the LC⟶Crystal transition point, is caused by the structural features of the components' molecules, which increase system polarity and alter the activation energy for the rotational motion of molecules.

We note that the results on the mobility and ordering in binary systems of NLCs in the solid state were obtained by us for the first time. These findings have both fundamental and practical significance. Currently, NLCs in the solid state are finding practical applications in thermoelectric memory displays, as anisotropic solid optical mediums such as compensators, prisms, optically active plates, etc. Studying the physicochemical properties of such liquid crystalline medium will allow us to improve their operational characteristics.

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