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Investigation of the dielectric parameters of nematic liquid crystals in the boundary layers

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Abstract

This article presents the results of a study of the dielectric properties of thin liquid crystal layer systems. To study the dielectric parameters of nematic liquid crystals in the boundary layers, the frequency and temperature dependences of the real (ε') and imaginary (ε") parts of the dielectric constant were determined. We studied samples that are in macroscopic layers and samples located in flat capillary layers (d ~ 0.1 μm). In both cases, the measurement is performed by the same method, namely, the method of temporary dielectric spectroscopy. The entire procedure for measuring, recording, accumulating and processing data was carried out automatically. In this case, the results of dielectric measurements could be presented both in the frequency and time domains. For measurements, a plane-parallel measuring cell made of brass and titanium electrodes was used.

It should be noted that the surface of a solid body has a strong influence on the phase state of liquids and liquid crystals in the boundary layer. For example, in such a layer, liquid molecules acquire a mesophase ordering. In the case of NLC, the nematic potential increases and, as a result, the temperature of the nematic-isotropic phase transition increases. However, a shift in the bleaching temperature in the NLC mixture studied by us did not appear due to the smallness of the effect.

The substance enclosed in the microspace between the surfaces of the mica has a higher dielectric constant than the corresponding bulk sample. Moreover, such a difference is observed both in the isotropic and in the nematic phases. This can be explained as follows. In a thick layer, a dipole-dipole intermolecular interaction takes place, which reduces the effective dipole moment of the molecules.

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