THE CURRENT PHENOMENON IN THE INDIUM-TIN OXIDE-ALIGNMENT LAYER-LIQUID CRYSTAL STRUCTURE

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At the present day the indium-tin oxide-alignment layer-liquid crystal structures find a wide applications in informational display devices, in adaptive optics and in control devices of optical signal. Field electrooptical effects are commonly used in such sevices but for effective operation conductivity and dielectric permeability of liquid crystal play huge role. Especially, this problem is actual for liquid crystal materials with negative anisotropy of dielectric conductivity when it is necessary to form complex textures stabilized by external electrical field.

This work is connected to investigation of frequency dependencies of conductive value and dielectric conductivity of the indium-tin oxide-alignment layer-liquid crystal structure which allows to find new ways in formation of the electrically stabilized structure of liquid crystal materials for the optoelectronics devices. We have chosed the nematic liquid crystal MBBA and transparent conductive layer of indium-tin oxide (ITO) as a investigation objects. For formation of initial alignment of liquid crystal molecules we have used the polymer layer PI 2555 (plane alignment) and LIC (gomeotropic alignment) and lecetyn. The main feature of the chosen liquid crystal material is the negative dielectric anisotropy and positive anisotropy of refraction coefficient. Under influence of external electrical field the texture, which possesses waveguide properties, can be formed in such liquid crystal material. The main problem for texture formation is the hydrodynamic instability, caused by ions movements in liquid crystal layer. As we know, that the value of changeable ions movement, and also dielectric permeability of liquid crystal material, depend on amplitude and frequency of control pulse [1, 2]. Our investigation allows determining the frequency range of existing of hydrodynamic instability at the amplitude value of control signal of 2-50 V. It is shown, that increasing of frequency of control pulse up to 300 MHz leads to decreasing of dielectric permeability value. The increasing of control pulse frequency allows to get rid of the hydrodynamic instability in liquid crystal layer and obtain the perfect hybrid nematic structure with plane alignment of the central layer.

References

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