Liquid crystal displays and anisotropic materials development in Belarus: present and future

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1. Introduction

Research, development and production of liquid crystal displays and materials in Belarus are presented. The original methodology of the creation of advanced devices and anisotropic materials is considered. The proposed approach of design of new devices, anisotropic materials and ordered nanostructured surfaces and layers is based on numerous data obtained in the last decades in the study of liquid crystals and ordered fluids; on the regularities of the evolutionary development of natural organic compounds; on the use of the anisotropy of the molecules of polyfunctional compounds for the design of new molecular structures (molecular engineering), films, liquid crystals, micelles, membranes, etc. and for the creation of anisotropic ensembles of molecules and biological systems.. [1,2]

2. Anisotropic-based approach for design of structured surfaces, sensors, photonic devices and displays

The results of our investigations have shown that the electrochemical anodization technique of metal or inorganic films on a glass substrate, which provide simultaneously a high optical transparency, good alignment properties and ordering of anisotropic molecules, is one of the promising solutions for the design and production of next generation of displays [2]. Based on these results we propose to combine the design of the nanostructured surfaces and anisotropic materials for the creation of high efficient displays, including chemiluminescent; electroluminescent {EL) porous silicon microdisplays; inorganic EL microdisplays based on Al/porous silicon light emitting Schottky junctions; solar cells, photonic devices and etc.

3. Anisotropic materials

Taking into account that polyfunctional 3,6-disubstituted cyclohex-2-enones, *trans*-2,5-disubstituted cyclohexanones, 3,5-disubstitiuted 2-isoxazolines, 5-substituted cyclohexan-1,3-diones, 1,2-disubstitiuted cyclopropanols and substituted unsaturated epoxyketones can be easily converted to the corresponding liquid crystalline and anisotropic compounds, we proposed to use them as the key intermediates for the preparation of different types of anisotropic substances and materials. Different reaction possibilities for the functional groups and the cyclic fragments allow transformations to be achieved selectively and give a chance of preparing anisotropic compounds and materials with novel combinations of the structural fragments of molecules, which are in their turn useful components for new sensors, photonic devices, displays and other practical applications. Our results demonstrate that the combination of anisotropic and corresponding host LC materials, nanostructured surfaces, the UV curable anisotropic substituted vinylketones and the anisotropic photoalignment materials can provide desirable variations of the properties and parameters of the TN- and VA-LCDs; "shock-free" FLCD's with the bistable memory capability, fast-switching chiral-nematic and smectic displays The cells, which have been prepared using the LC materials and the nanostructured inorganic layers on glass substrate (alignment conditions) have several advantages in comparison with the cells containing commercial LCs and alignment materials and possess switching time less than 1 ms and the viewing angle 170-180°.

4. Conclusion

The presented results demonstrate that the combination of anisotropic materials, nanostructured films and surfaces, which are characterized by the ordered relief structure, opens the new approach of the creation of next generation of high quality displays with improved parameters. It is obvious that the proposed methodology is original and creative, and has a number of distinctive advantages in comparison with the well-known technologies, and can be successfully used for the development of new sensors, photonic devices, displays with a wide range of practical application.

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6. References

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