Instability of the nematic liquid crystal filled with sphere-like magnetic-impurity particles against formation of the modulated structures

A.V. Kleshchonok[a], V.Yu. Reshetnyak[a] and V.A. Tatarenko[b]

[a] *Kyiv National Taras Shevchenko University, Physics department, 64 Vladymirska Str., UA-01601 Kyiv, Ukraine, E–mail: igorresh@svitonline.com*

[b] *G.V. Kurdyumov Institute for Metal Physics, Department of Solid State Theory, N.A.S.U., 36 Academician Vernadsky Blvd., UA-03142 Kyiv, Ukraine, E–mail: tatar@imp.kiev.ua*

In the last decade, much attention has been attracted to Filled Liquid Crystals – highly disperse suspension of impurity particles in nematic liquid carrier. The tested objects are filled nematic liquid crystals-highly-disperse suspension of impurity particles within the nematic liquid carrier. The spatial distribution of rigid-sphere-like magnetic-impurity particles (with radii of 5 μm) within the host nematic liquid crystal is studied. Both the indirect effective interaction between the impurity particles by means of nematic medium and the direct magnetic interaction are considered as being responsible for the formation of (modulated) structures. In the general case, total interaction between the impurity particles includes several contributions-direct Van der Waals-type interaction (at short distances between the particles) and magnetic one as well as indirect interactions (through both the director-field distortions and the density inhomogeneities). The last one depends on temperature, density of nematic host medium and impurities' concentration. Such effective interaction controls the structure formation and properties of a system. Using continuum-mechanics and statistical-thermodynamics approaches, we analyze the necessary thermodynamic conditions for formation of modulated lamellar structures. This condition allows to calculate temperature of homogeneous-distribution stability loss and to estimate period of formed structures. The offered theoretical approach can be used to forecasting other anisotropic and inhomogeneous mesomorphic systems, which can find application by development of integrated-optics facilities to govern the light-beam passing (diffraction gratings of an optical range *etc.*).