RHEOLOGICAL INVESTIGATIONS OF CHOLESTERIC MESOGEN - CARBON NANOTUBE DISPERSIONS

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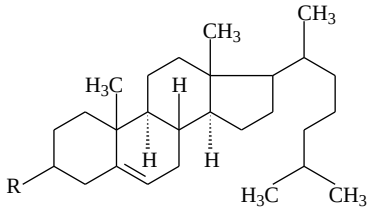
It is known, the flow of mesophase differs from a flow of an isotropic liquid due to occurrence of definite spatial orientation of the molecules depending on their geometry, flow rate, and the mesophase viscosity coefficients [1]. Considering an important role of rheological characteristics of a mesophase in functioning of electrooptical compositions, and to study the influence of intermolecular specific interactions on viscosity of cholesteric liquid crystals (ChLC) and their compositions with multiwall carbon nanotubes (MCNTs), we had been investigated the dynamic viscosity of samples by the method of rotational viscometry. The representatives of homologous series of cholesterol esters were selected as the ChCL-matrices (Fig. 1). The multiwall carbon nanotubes "Taunit-M" (purity > 98%) were used as the active sensitizer (Fig. 2).



I R = $CH_3(CH_2)_{11}COO$- II R = $CH_3(CH_2)_{12}COO$-
III R = $CH_3(CH_2)_7CH{=}CH(CH_2)_7COO$-

Fig. 1. Structure of cholesterol esters I – III.

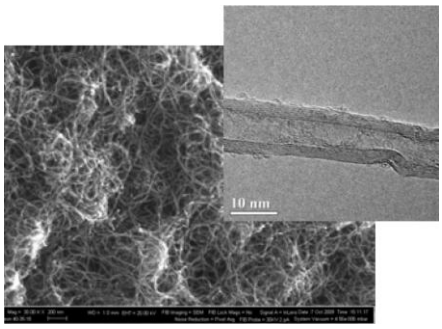


Fig. 2. Microphoto of MCNTs "Taunit-M" [2].

Data on temperature dependence of viscosity became original experimental data for the analysis of rheological behaviour of investigated materials (Fig. 3).

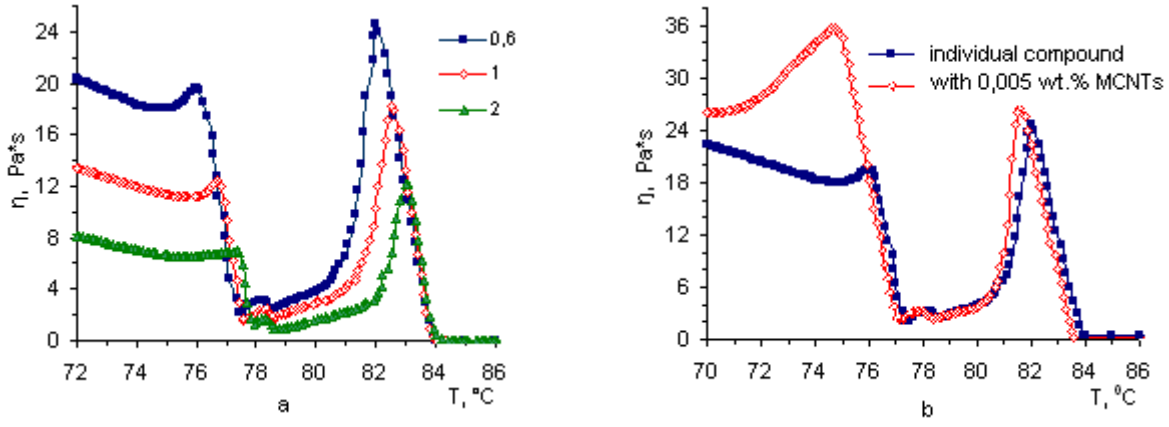


Fig. 3. Temperature dependences of dynamic viscosity on an example of compound II on cooling: a) individual compound at various shear rates, b) in system with 0,005 % MCNTs at shear rate 0,6 sec^{-1}.

Temperature dependences of dynamic viscosity of all investigated compounds have the same type. The bends observed on dependence $\eta = \eta($ (Fig. 3a) correspond to the temperatures of the phase transitions defined by POM and DSC. Within all the temperature range of measurements cholesteric LC show non-Newtonian type of flow behaviour. This fact shows

plastic (or pseudo-plastic) behaviour of a material and allows to apply Kesson model in order to describe the flow [3]. The data obtained for individual compounds, is compared with results of studying of temperature dependence of viscosity of the samples containing MCNTs (Fig. 3b).

[1] *Demus D., Goodby J., Gray G. W., Spiess H. W., Vill V.* Handbook of Liquid Crystals. Wiley-VCH Verlag GmbH, 1998. 2591 p.
[2] http://nanotc.ru
[3] *Schramm G.,* A Practical Approach to Rheology and Rheometry. Gebrueder HAAKE GmbH, Karlsruhe, 1998. 291 p.