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Study of the reorganization of the molecules during smectic A – smectic C phase transition

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4-hexyloxybenzylidene-4'-dodecyloxyaniline (6BA12) belongs to the 4-hexyloxybenzylidene-4'-alkyloxyanilines homologous series. All derivatives of 6BA n ($n=1-12$) homologous series exhibit liquid crystal phases. Arrangement of molecules in phase and number of phases increase with the length of alkyloxy tail [1]. During cooling this substance several liquid crystal phases are observed: nematic (N), smectic A (SmA), smectic C (SmC) and smectic I (SmI).

The aim of this presentation is to describe the dynamic and the structure in each phase which exhibit 6BA12 between 115°C and 25°C. Many complementary methods were used: polarized microscope observation, differential scanning calorimetry (DSC), Fourier transform infrared spectroscopy (FT-IR), X-Ray diffraction (XRD), density functional theory (DFT) calculation and the two dimensional correlation analysis of the IR spectra.

Nature of orientation of molecules in the smectic tilt phases has been an issue of discussion for several years [2]. They attract significant attention because of the application of ferro- and antiferroelectric smectics C* in the fast electrooptic displays and because of the rich variety of different phases with unusual three dimensional structure [3]. Tilting transition are also observed in other soft-matter system including smectic elastomers [4], lyotropic lamellar phases and Langmuir-Blodgett films [5]. We explored the problem of reorganization of molecules distribution for several liquid crystal phase transitions. The main focus is on the SmA-SmC and SmC-SmI transitions found in 6BA12. Two dimensional correlation analysis of the FT-IR spectra is used to check change of the orientation of molecules during phase transitions [6].

References

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