Intra- and intermolecular dynamics in liquid-crystalline substance with ferro- and antiferroelectric phases

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For 1-[3-fluoro-4-(1-methylheptyloxycarbonyl)phenyl]-2-[4'-2,2,3,3,4,4,4-heptafluoro butoxybutoxy)biphenyl-4-yl]ethane (1F7) built of chiral molecules, intra- and intermolecular dynamics is presented. Intermolecular dynamics was studied by dielectric spectroscopy while intramolecular dynamics by nuclear magnetic resonance and infrared spectroscopy. In ferroelectric SmC*, antiferroelectric SmC*$_A$ and highly ordered SmI*$_A$ phases of 1F7 the relaxation processes were detected in frequency range from 0.05 Hz to 3 MHz. Mechanisms of intermolecular dynamics were identified with the help of the bias field [1]. Using NMR technics the following intramolecular motions were detected: rotation of the CH_3 and CF_3 groups and reorientation of the phenyl rings. In liquidcrystalline phases molecular processes connected with rotation molecule around short and long axis were confirmed. Relaxation time T_1, correlation time τ and activation barriers were calculated for individual motions. Infrared spectroscopy method shows rich dynamics in Cr1 and Cr2 crystalline phases [2].

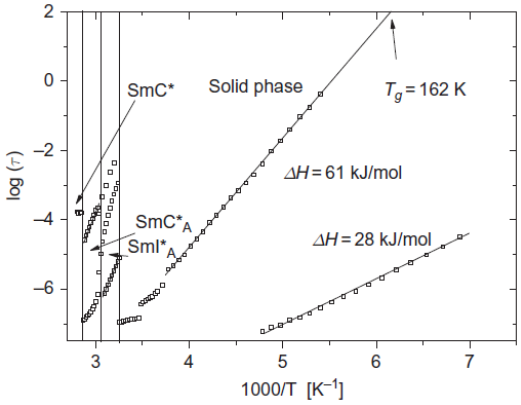

Fig.1. Arrhenius plot for processes observed during slow cooling.

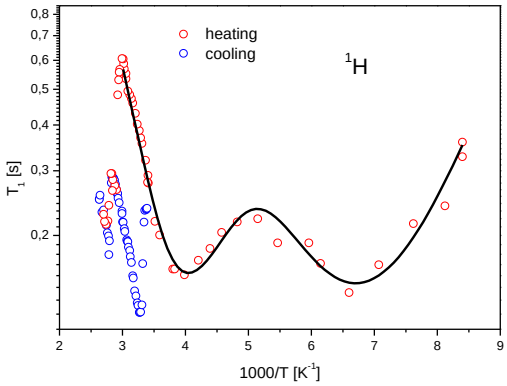

Fig.2. Relaxation time vs 1000/T.

References

[1] Kolek, Ł.; Massalska-Arodź, M.; Paluch, M.; Adrjanowicz, K.; Rozwadowski, T.; Majda, D.; *Liq. Cryst*. 2013, **40**, 1082.

[2] Kolek, Ł.; Massalska-Arodź, M.; Hołderna-Natkaniec, K.; Woźniak-Braszak, A.;, Juszyńska-Gałązka, E.; *Intramolecular dynamics of a liquid crystal with fluorinated molecules (1F7)* (in preparation).