Behavior of ferroelectric, antiferroelectric and ferrielectric smectic phases in the electric field

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We investigated the behavior of ferroelectric, antiferroelectric and ferrielectric smectic phases in the electric field. In contrast to nematics, the smectic materials exhibit the **two thresholds** [1] on application of the electric field, which are registered by measurements of the dielectric susceptibility (red circles in Fig. 1) and of the birefringence (blue triangles in Fig. 1). The smallest and the sharpest thresholds are observed in the biaxial intermediate (ferrielectric) phases.

Interplay between the spontaneous and induced polarizations is found to be responsible for this complex behavior. The lower threshold corresponds to the unwinding process, when the tilt planes in every phase tend to become **perpendicular** to the electric field. On the contrary, the upper threshold corresponds to the formation of bi-domain structure of *Sm-C*, where the tilt planes tend to be oriented **along** or **against** the electric field. This reorientation yields the destruction of antiferroelectric and ferrielectric phases. Theoretical prediction for the two thresholds is presented in Fig. 2, where q_T denotes the fraction of synclinic orderings in every biaxial intermediate phase [2], a is the average molecular breadth, and T^* is the transition temperature into *Sm-A*. All calculations are performed with help of AFLC Phase Diagram Plotter software available at Web-page of the first author.

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[1] A.V. Emelyanenko, E.P. Pozhidaev, N.M. Shtykov, et.al, *J. of SID*, **2008,** *16*, 811.
[2] A.V. Emelyanenko, A. Fukuda, and J.K. Vij, *Phys. Rev. E,* **2006,** *74*, 011705.

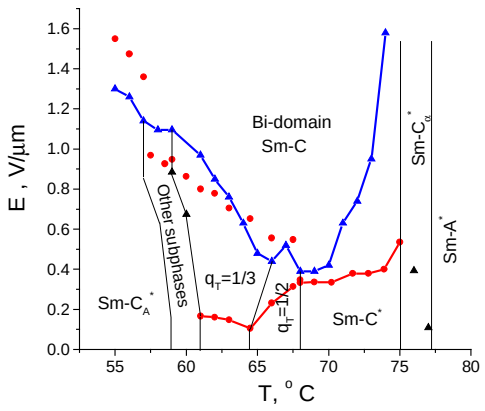

Fig. 1

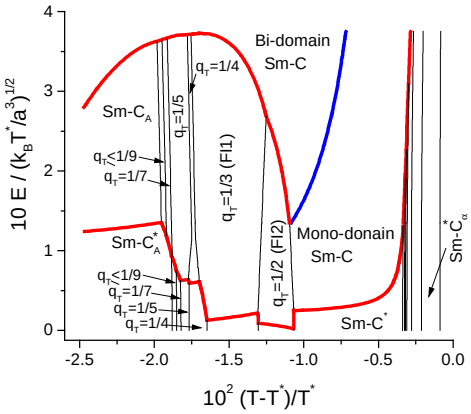

Fig. 2