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Dielectric Spectroscopy of an Antiferroelectric Liquid Crystal for Two Cell Thicknesses

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The dielectric spectroscopy of an antiferroelectric liquid crystal (S)-4-(1-methylheptyloxycarbonyl)phenyl-4′-(6-pentanoyloxyhex-1-oxy)biphenyl-4-carboxylate for its homogeneous anchoring has been carried out for 10 μm and 4 μm cell thicknesses. This study suggests that the dielectric strength of Goldstone mode of the SmC phase is significantly diminished from ∼195 to ∼69, whereas its relaxation frequency is increased from ∼2 kHz to ∼4 kHz from the higher to lower cell thickness. Alternatively, these parameters for the soft mode detected in the SmA* phase and for the two antiferroelectric relaxation modes detected in the SmC^*_A phase do not show any appreciable change with the cell thickness.*

Keywords Antiferroelectric; dielectric strength; Goldstone mode; relaxation frequency; soft mode

1. Introduction

Antiferroelectric order has been known to exist in liquid crystals since more than a decade and is now an intensely studied field of research. The great application potential of antiferroelectric liquid crystals (AFLCs) [1] has especially been demonstrated in sophisticated flat panel display prototypes, which have not yet reached manufacturing, due to the severe intrinsic problem of folds in the smectic layers, which drastically limit the achievable contrast, and which seems impossible to circumvent. This problem has been removed to a large extent by using orthoconic antiferroelectric liquid crystals (OAFLCs) [2]. In general their optical properties make them unique not only among liquid crystals but among electro-optical materials also. The AFLC material (S)-4-(1-methylheptyloxycarbonyl)phenyl-4′-(6-pentanoyloxyhex-1-oxy)biphenyl-4-carboxylate (4H6Bi(S)) belongs to the class of highly tilted AFLCs synthesized by Dabrowski's group from Warsaw [3,4]. The molecular structure of the material is given in the Figure 1.

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