

Flexoelectricity of bent-core nematics

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Flexoelectricity is an important mechano-electric property of liquid crystals (LCs) that provides a reciprocal relation between director distortions and electric polarization¹. While commonly measured flexocoefficients are in the range of a few pC.m⁻¹ for calamitic nematic LCs,¹ recently a giant bend flexocoefficient e_{3x} of the order of tens of nC.m⁻¹ has been measured in a bent-core nematic by studying the direct flexoeffect of the LC sandwiched between flexible electrodes². In addition, this giant value has been reconfirmed by the converse flexoeffect: appearance of a substantial electric-field-induced bending of a LC between the same flexible electrodes³. On the other hand, a recent determination of e_{3x} by the Helfrich method⁵ (involving an optical detection of the electrically-induced director bending of a homeotropic nematic layer), provides for the very same compound a value having just the usual order of magnitude⁴.

Attempting to elucidate such a discrepancy, we have measured e_{3x} by the Helfrich method⁵, and the total flexocoefficient $e_{1z} + e_{3x}$ by the polar surface instability⁶ for a bent core-calamitic twin nematogen: 4-((3-(4-(4-(decyloxy)benzoyloxy)benzoyloxy)phenylimino) methyl)-3-hydroxyphenyl 4-(6-(4'-cyanobiphenyl-4-yloxy)hexyloxy)benzoate (BCCB). In this “sickle” compound, besides curvature electricity, surface polarization due to the CN group makes an important contribution to the total flexocoefficient¹. Nevertheless, the classical order of magnitude for ordinary calamitics (~ 10 pC m⁻¹) is confirmed. We have also determined e_{3x} by the Helfrich method⁵ for a different bent-core compound: 4-cyanoresorcinol bis[4-(4-n-dodecyloxybenzoyloxy)benzoate] (CNRbis12OBB). Here again the value is of the usual order found for calamitics. A cluster model with compensated molecular asymmetry is discussed in order to resolve this discrepancy

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