Anchoring-Mediated Interaction of Edge Dislocations with Bounding Surfaces in Confined Cholesteric Liquid Crystals

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We employ the fluorescent confocal polarizing microscopy to image edge dislocations in cholesteric liquid crystals. Surface anchoring at the bounding plates determines the structure and behavior of

although their glide is hindered by Peierls-Nabarro friction [7].

FCPM of well-equilibrated CLC wedges with one WD plate and one SU plate reveals no bulk dislocations, in accordance with the regular microscopy observations [10]. As thickness of the wedge changes, the number of CLC layers changes by an insertion/removal of a layer near the WD plate rather than by bulk dislocations (Fig. 1). The edge dislocations can be found as transient features of a filling process or after a rapid temperature quench from the isotropic phase. Their Burgers vector is always ; the core is a λ λ pair (Fig. 2). Despite the fact that each dislocation introduces Δ , the neighboring Grandjean zones differ only by Δ . The fit is achieved by a removal of one layer at the WD boundary (Fig. 2). The dislocations slowly glide towards the WD plate [Figs. 2(a)–2(c)] and coalesce with the surface layer [Fig. 2(d)]. Dislocations do not glide as straight lines but via kinks, similarly to the situation in SU samples [7].

In flat cells with both substrates of WD type, the transient dislocations are accompanied by two surface layers (Fig. 3). Importantly, the dislocation profile in this sample is well fitted by the nonlinear Brener-Marchenko elastic theory of an isolated edge dislocation in an *infinite* medium [11,12] [Fig. 3(b)]. The physical implication is that the interaction between the dislocation and the surfaces is close to zero (neither attraction nor repulsion).

In the phenomena described above, the surface tension is irrelevant, and the dislocation-rigid plate interaction is controlled by the anisotropic (anchoring) part of surface energy. As seen in Figs. 1–3, CLC layers are tilted at WD plates; near the SU plates, the surface layers run parallel to the boundaries [7]. When , the dislocation is attracted to the plate and escapes from the CLC slab, as the net result is the decrease of elastic energy. When ! 1, ! 1, the dislocation is pushed into

shows that the critical value p—— does not change much; however, further studies are needed to explore, for example, whether the dislocation can be in