Layer thickness of confined smectic liquid crystals

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The small-angle X-ray scattering (SAXS) technique has been employed in order to study the temperature variations of the average smectic layer thickness *d* (in the Sm*A* phase) of bulk and confined 8CB and 12CB in CPG-matrices samples with various pore diameters (1). It has been found that the layer thickness behavior depends on the liquid crystal (LC) molecular features. In the bulk samples the *d(T)* exhibits qualitatively different behavior for 8CB and 12CB LCs. In 8CB the layer thickness is dominated by the rigid phenyl rings. On decreasing the temperature, the extent of fluctuations of phenyl rings is decreasing, enabling a closer packing of the molecules. As a consequence, the value of *d* decreases respectively. On the contrary, in 12CB the flexible dodecyl carbon tails play also a significant role. On decreasing the temperature, the fluctuations of the flexible tails are suppressed. Thus, their effective length is increasing, resulting in a growth of *d* (1).

In LCs confined to non-treated CPG cavities we observe layer dilation. The mechanisms behind this are the finite-size effects (2) and the surface memory effects (1). Our present results suggest that the latter are dominant (1). The surface memory effects are particularly pronounced for the 8CB samples, where the smectic phase is entered from the nematic phase (1,3). Remarkable differences have been also observed between samples confined in non-treated and treated CPG surfaces (1,4).

References

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