methodology that may also be applicable to other biomaterials.

This study is motivated in part by the recent discovery of liquid crystal phases of ultra-short duplex nano-DNA and RNA oligomers [7]. Nano-length DNA oligomers, with base pair number in the range 6 <

< 20 have been found to exhibit both nematic (N) and uniaxial columnar (C_U) phases in aqueous solution. Such short self-complementary oligomers form double-helical duplex aggregates at room temperature which, by virtue of their hydrophobic ends, further self-assemble end-to-end to form rod-shaped superaggregates that can LC order. Both a nematic phase and a uniaxial columnar phase are found, in which

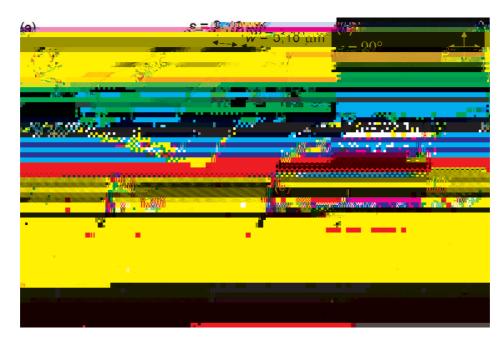


Figure 2. Sample preparation of duplex hydrated nano-DNA columnar LC phase in the confined micro-channels and optical images obtained by depolarised reflected light microscopy (DRLM). (a) LC is filled in the silicon channels with 5 μ m depth and 3 μ m width (or 10 μ m width for the dehydrated sample of Figure 4), and the x-, y- and z-directions are defined. LD is the loading direction of the LC sample. (b–e) Optical images of the confined DNA phase in the confined area $\varphi=90^\circ$, 45°, 30° and 0° rotated sample respectively. Clear alternation of brightness is observed upon rotating the sample, giving information about the molecular orientation in the channel; the two parallel white bars in image (e) indicate channel direction 'y'.

(Figure 2(c)) and the path length is 2 for observation in reflection. We can consider two basic orientations of the C_U phase: with n normal to the plates there is no in-plane birefringence and the image is dark (see Figure S4 in reference [7]); with n parallel to the cell plates, the uniaxial birefringence $\Delta n = n_{||} - n_{\perp}$, where $n_{||}$ is the refractive index for light polarised parallel to n and n_{\perp} is the refractive index for light polarised normal to n, produces a relative phase shift of these modes. The $\sin^2 2\varphi$ term in gives minimum reflectance for $\varphi = 0^{\circ}$, 90° , 180°



Figure 3. FCPM images of aligned duplex hydrated nano-DNA LC in $=3~\mu m$ wide Si channels. (a) 0° polarisation (parallel

[4] Livolant, F.; Levelut, A.M.; Doucet, J.; Benoit, J.P. 1989, , 724–726.