Toward programmed complex mechanical deformations of Liquid Crystal Elastomers-Supplementary information

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Supplementary figures

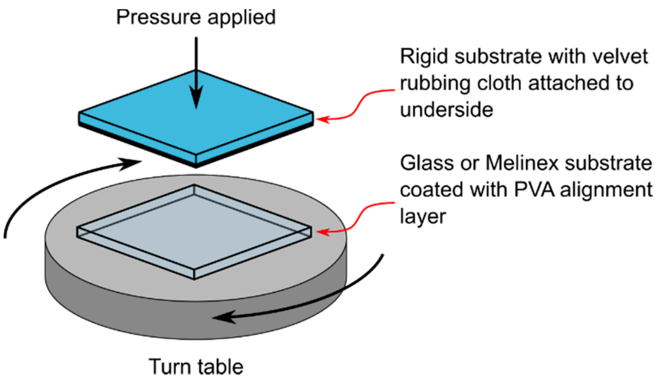

Figure S1 A circular LC alignment geometry was achieved by circularly rubbing the poly(vinyl alcohol)-coated LC cell substrates using a spin coater and velvet cloth.

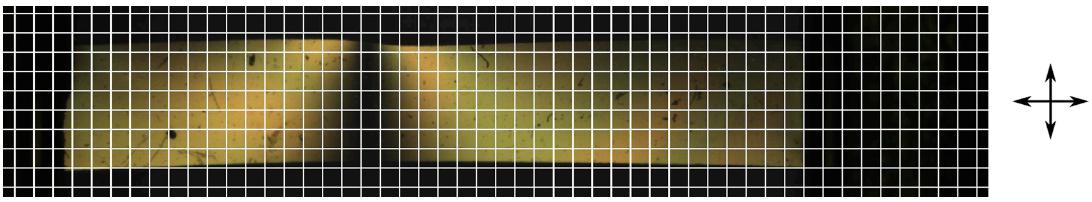

Figure S2 40x40 px grid overlaid onto a polarising microscopy image of the film in the unstrained state. For each frame the director orientation was measured at each vertex of the grid.

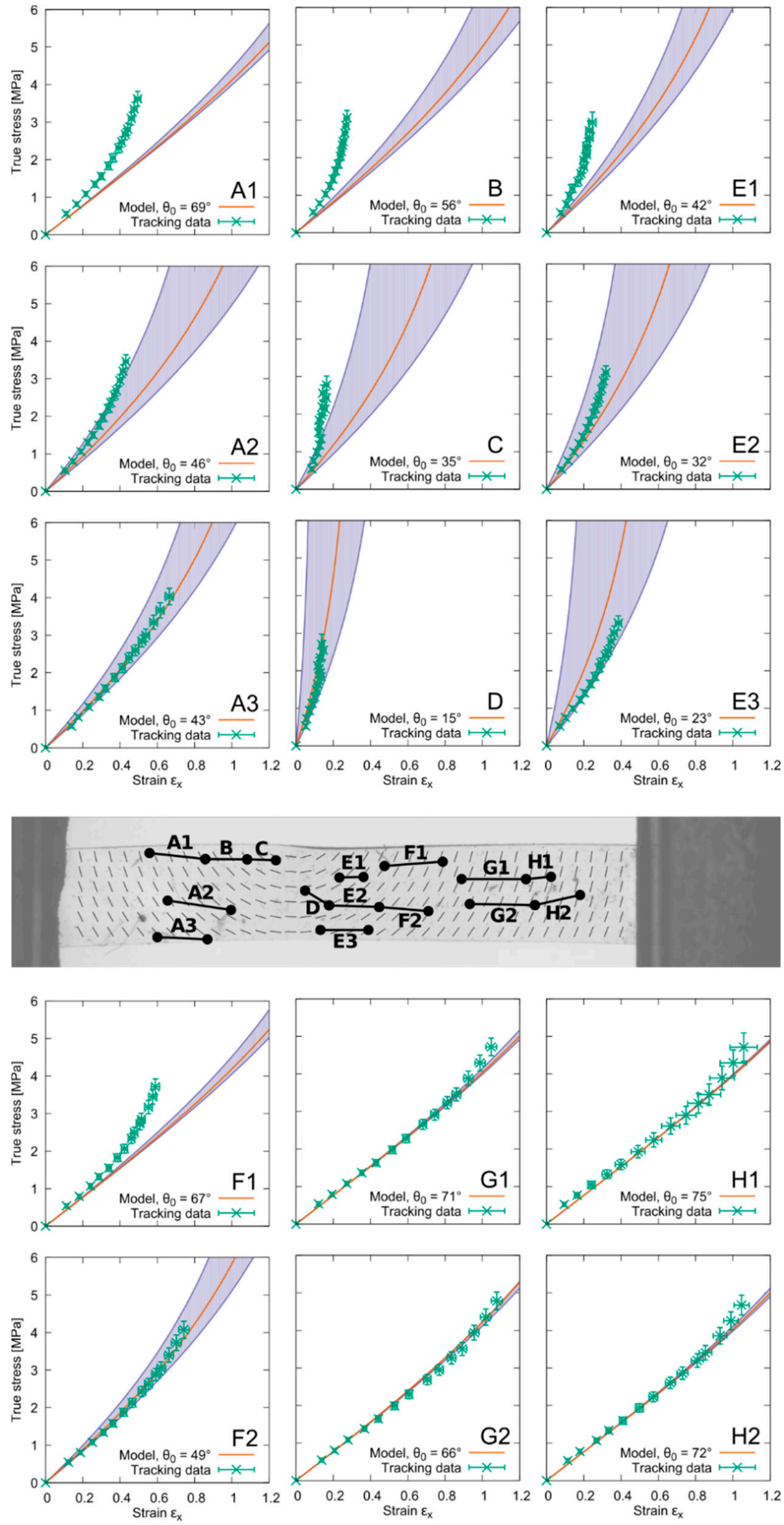

Figure S3 Localised load curves generated using local strains measured by the change in relative separation of tracked particles marked on the photograph. True stress tensile load curves have been generated using the model with initial director angles from: each feature used for tracking (curves bounding shaded regions), and the initial point mid-way between the tracked particles. Data shown was calculated *via* the assumptions and method described below.

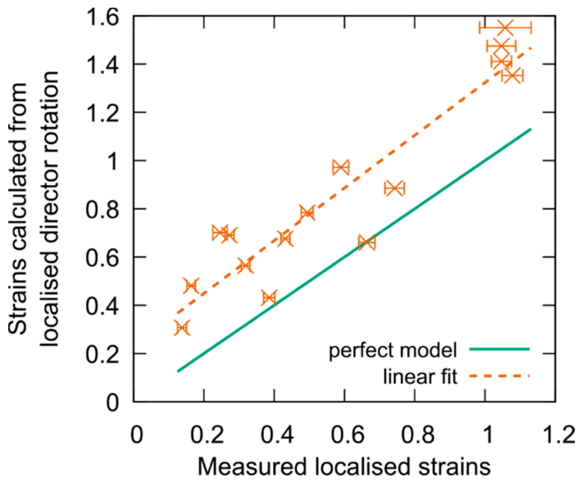

Figure S4 A comparison of the strains measured between particle pairs in Figure XXX and the predicted strains from the initial and change in director orientation at the characteristic point from each pair of particles.

Supplementary methods – generating localised tensile load curves

Localised true stress load curves (**Figure S4**) were calculated using load cell readings and local strains measured using particle pair shown in **Figure S4**. The purpose of these curves is to demonstrate that the assumptions required for such calculations do not hold for present system.

In calculating values for the local true stress, we first assumed we can use an initial cross-sectional area equal to the width x thickness of the sample at the half-way point of the particle pair used to measure local strain. This assumes a uniform stress distribution across a given sample width. The initial thicknesses at the points of interest were calculated from using the linear variation in sample thickness and the halfway point between the features used to measure the local strain. In each case, the initial thickness was assigned an error or ±3 µm. The initial width at all locations was taken as the average cross-sectional width of 2.00 ± 0.03 mm. To account for the changing cross-sectional area with strain, we assumed the localised deformations obeyed the shear-free condition of $\lambda_x\lambda_y\lambda_z = 1$, thus under a deformation of λ_x, the cross-sectional area decreases by a factor $1/\lambda_x$.