Electronic Supplementary Material (ESI) for Nanoscale.

Supplementary Information:

Hybrid Graphene Nematic Liquid Crystal Light Scattering Device

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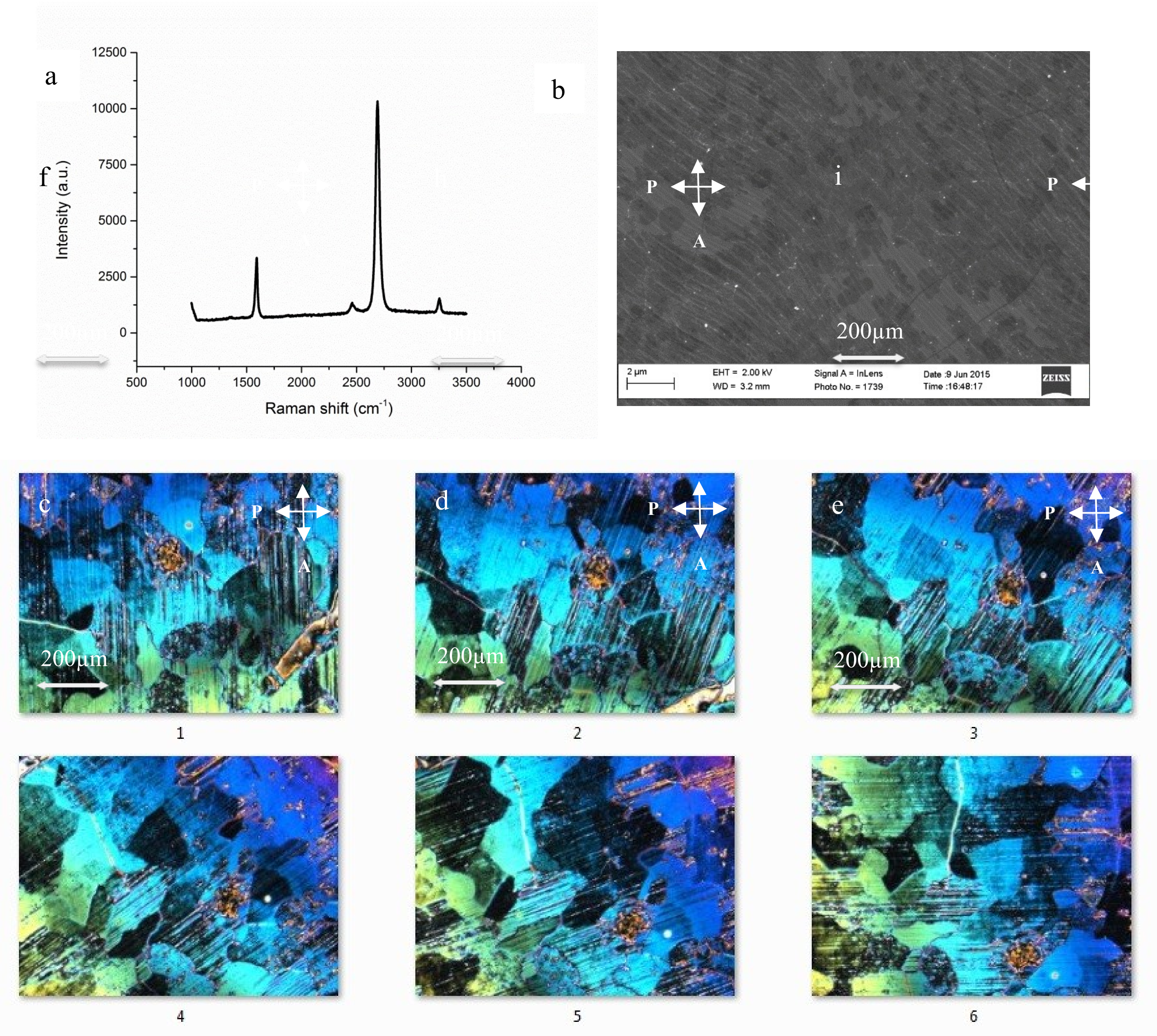


Figure S1 Characterisation of graphene layer after the transfer a) Raman spectrum and b) SEM image of graphene transferred onto the silicon substrate. Optical micrographs of Gr-glass substrate with spin-coated nematic liquid crystal texture on rotation c) 0º degrees and i) 90º degrees under crossed polariser arrangement.

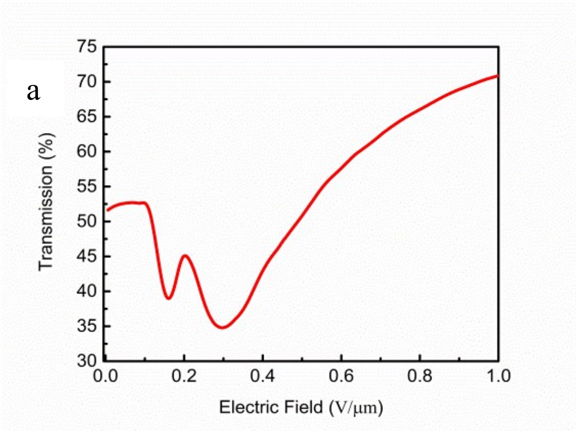
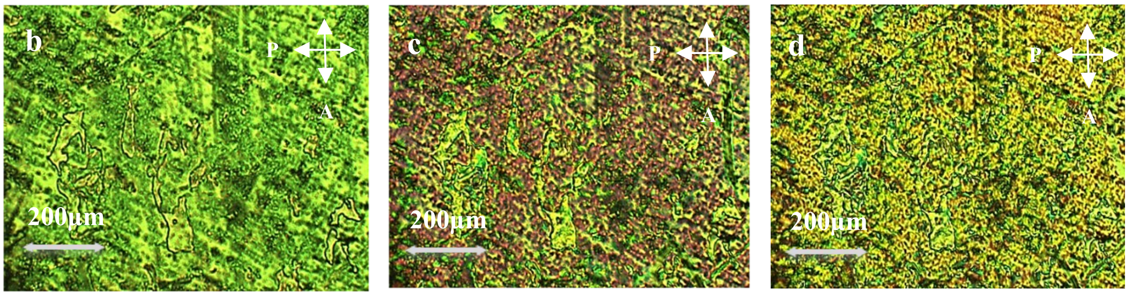


Figure S2: The transmission characteristics oscillations earlier presented in figure 3.

(a) Transmission vs. applied electric field for 10 μm Gr-ITO device filled with nematic LC, (b-d) corresponding POM micrographs. From no field applied (b) and 0.4 V/μm (c) there is a very dramatic change in the observed texture, which corresponds to the detected dips in transmission. This further leads to 0.45 V/μm (d) where the texture is recovered showing rise in transmission.



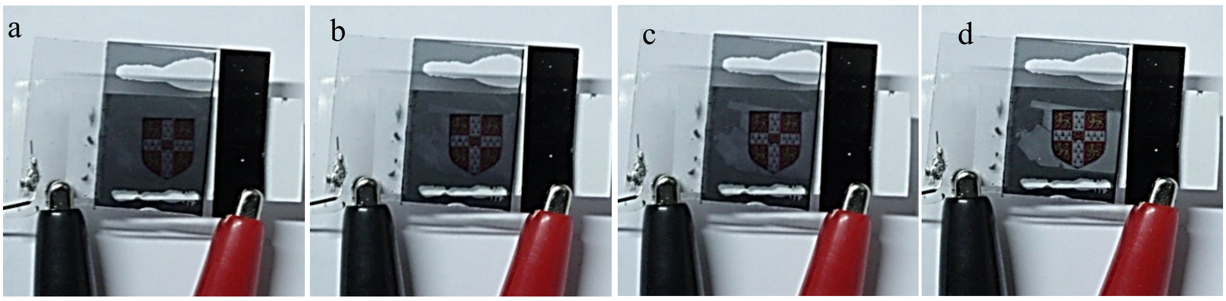


Figure S3 Demonstration of the scattering to clear transition with Gr-ITO switching cell filled with dye doped BL006 nematic LC mixture. Figures (a) to (d) show a gradual change in transmission under applied electric field 0-3 V/μm, 1 kHz.

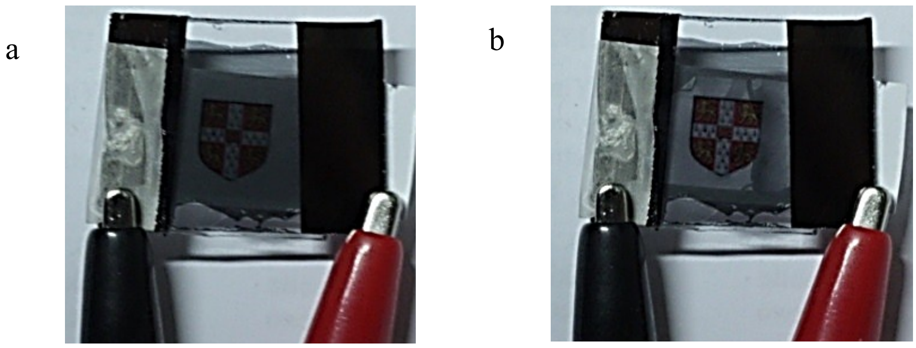


Figure S4 Demonstration of scattering in ambient room lighting for dye doped BL006 nematic LC mixture filled in Gr-Gr cell, (a) off-state, no applied electric field and (b) on-state, 3 V/μm 1 kHz.

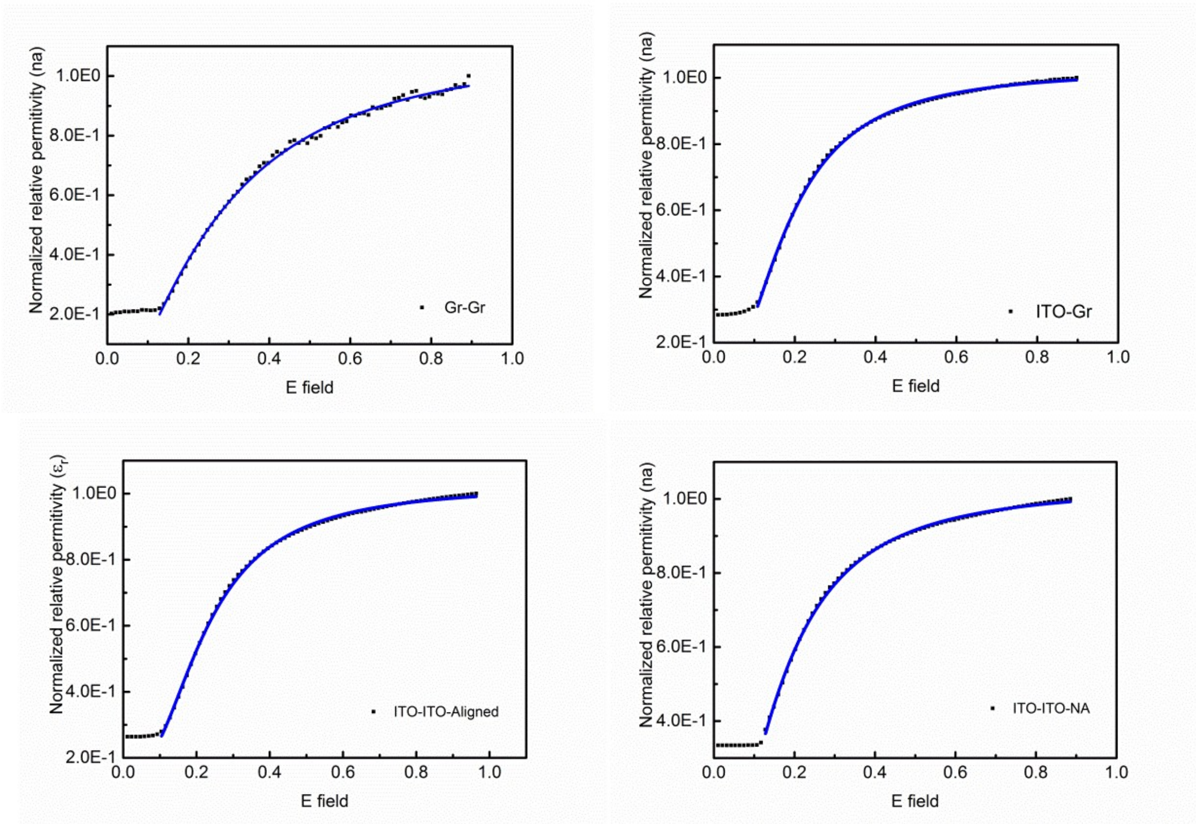


Figure S5 The normalized dielectric permittivity plots for four types of substrate geometries sandwiched in 10µm thickness devices filled with nematic liquid crystal a) Gr-Gr, b)Gr-ITO, c) ITO-ITO with and d)ITO-ITO without alignment layer.

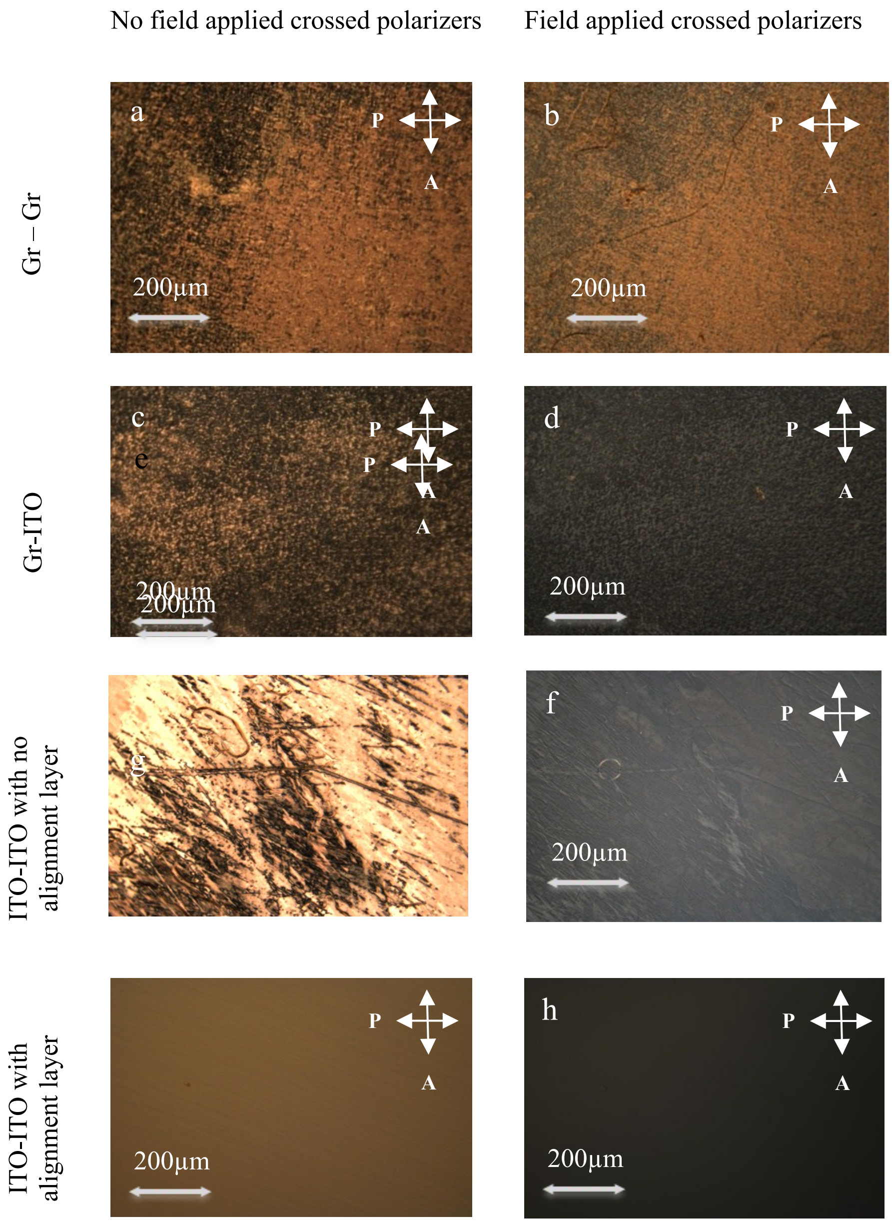


Table S1 Optical micrographs of test cells using different TCM with 10 µm spacer beads filled with nematic BL006 LC. For texture characterization images were taken with crossed polarized light and with and without applied electric field (3V/µm, 1 kHz and scale bars: 200µm, magnification 20x).