

Printable Optical Sensors Based on H-Bonded Supramolecular Cholesteric Liquid Crystal Networks

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Experimental Section

Film preparation: The materials used are purchased from BASF (chiral dopant LC756), Philips (6OBA), Synthon (6OBA-M) and Merck (C6M and C6BP). The liquid crystalline components are mixed with 0.1 wt.% of inhibitor (tert.butyl-hydroquinone, Aldrich) and 0.6 wt.% photoinitiator (Irgacure 369, Ciba). Square 30 x 30 mm glass pieces were used as substrate. After cleaning with ethanol, ultrasonic bath (Branson 2510) and UV-Ozone photoreactor (Ultraviolet PR-100) treatment, the substrates are spincoated with polyimide (JSR grade AL24101) and rubbed with a velvet cloth to induce planar alignment. The solution of CLC in THF is barcoated onto the glass, with both solution and the RK Control coater temperature heated to 55 °C. The remaining THF was evaporated by placing the sample on a hot plate of 80 °C for five minutes. The curing is executed by illumination with a high intensity EXFO lamp for 100 seconds under nitrogen atmosphere.

The inkjet printing films were deposited on rubbed polyimide coated glass or TAC foil at 53 °C platen temperature. The film was placed on a hot plate at of 80 °C for five minutes to allow the remaining THF to evaporate. The curing is executed by illumination with a high intensity EXFO lamp for 100 seconds under nitrogen atmosphere.

Formation of CLC polymer salt: The prepared films were activated by dipping the film into a 0.05 molar KOH solution for about 10 min and subsequently drying at room temperature.

Fabrication of water saturated CLC polymer salt: The CLC polymer salt film was placed in water and after revealing a red color the film was removed and the water on the outside was gently removed with a tissue remaining a red film.

Equipment: UV-Vis spectroscopy was used to determine the SRB position of the original film. UV-Vis measurements were done in Shimadzu UV 3102 PC Spectroscope and Avantes UV-Vis spectrometer with an Avalight-Hal light source and Avaspec-2048 scanner with circularly polarized light. Infrared-spectroscopy was performed with the Varian-3100 FT-IR. Microscopy images were recorded with Leica DM6000D (in reflection without polarizers) equipped with a digital camera (Leica DFC 420C, Leica Microsystems Ltd.) and equipped with a Linkam cooling unit. Inkjet printing was performed using a piezoelectric Dimatix DMP 2800 (Dimatix-Fujifilm Inc., Santa Clara, USA), equipped with a 10 pL cartridge (DMCLCP-11601). The print head contained 16 parallel squared ($8.6 \times 8.6 \mu\text{m}^2$) nozzles with a diameter of $12.1 \mu\text{m}$. The solution was typically printed at 30.0 V, a frequency of 5.0 kHz, and a customized wave form. The substrate holder was set to a temperature of 55 °C and the platen temperature was set to 53 °C for TAC foil and to 55 °C for polyimide coated glass slides.

Figures

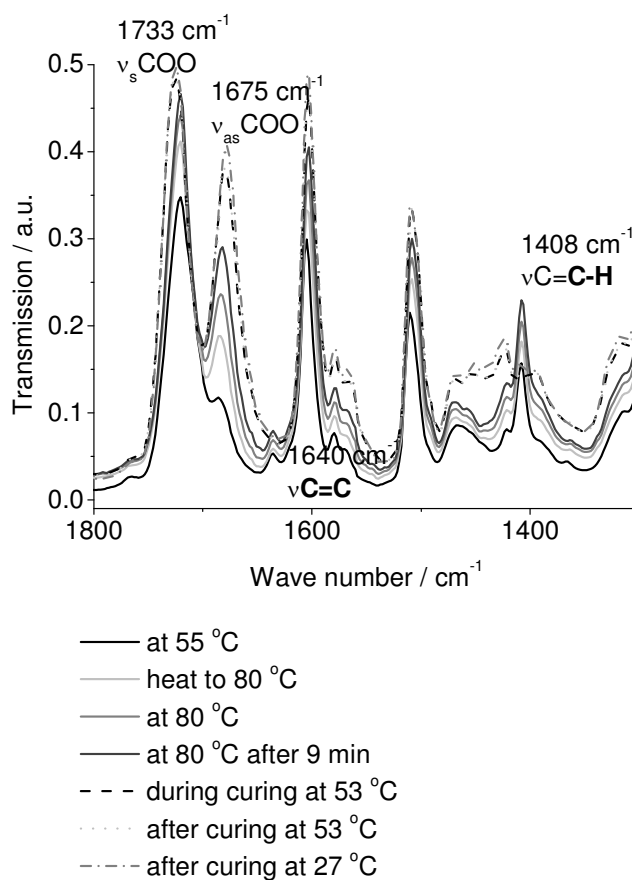


Figure S1. FT-IR spectra of the bar coated CLC film during the different stages of the fabrication process.

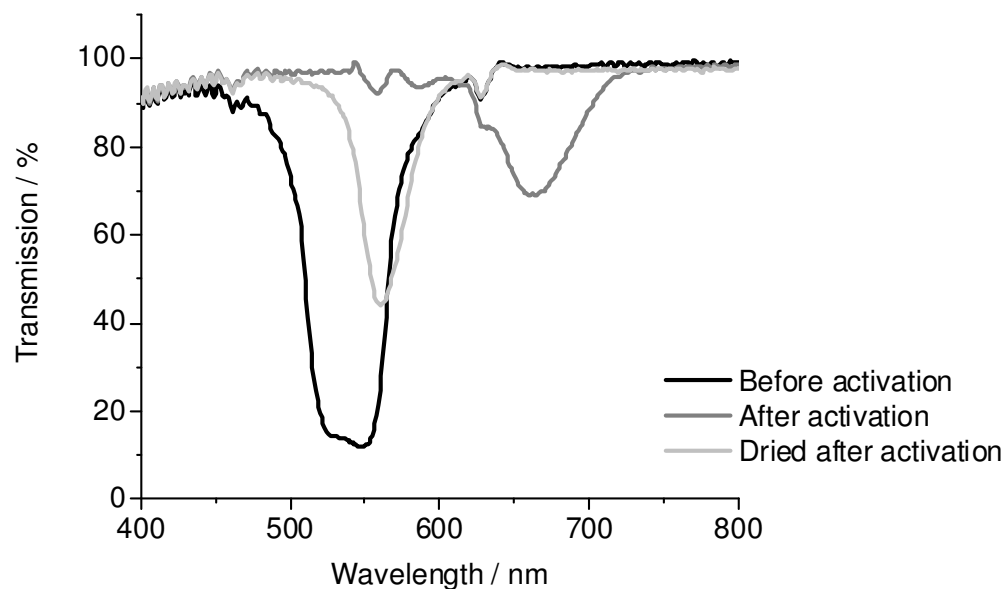


Figure S2. UV-VIS transmission spectra of the CLC polymer film before (black line), directly after (grey line) and dried in air after exposure to a KOH solution (light grey line).

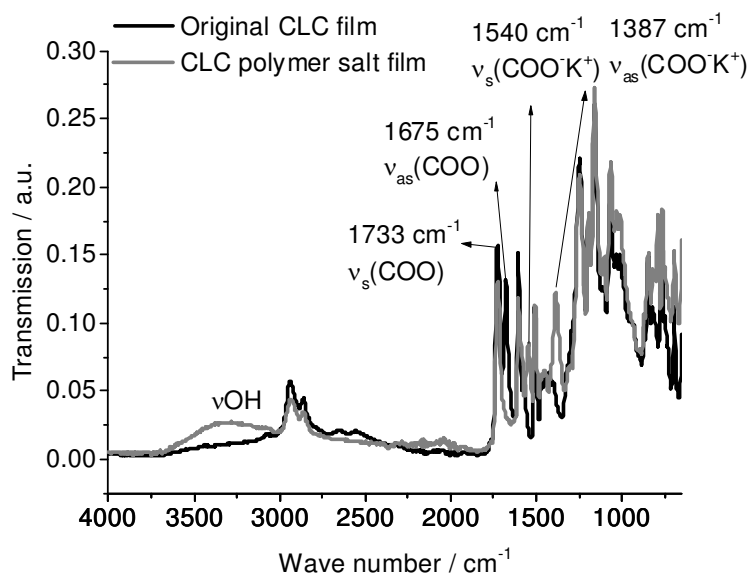


Figure S3. FT-IR spectra of CLC polymer film (black solid line) and after formation of the CLC polymer salt film (grey solid line).

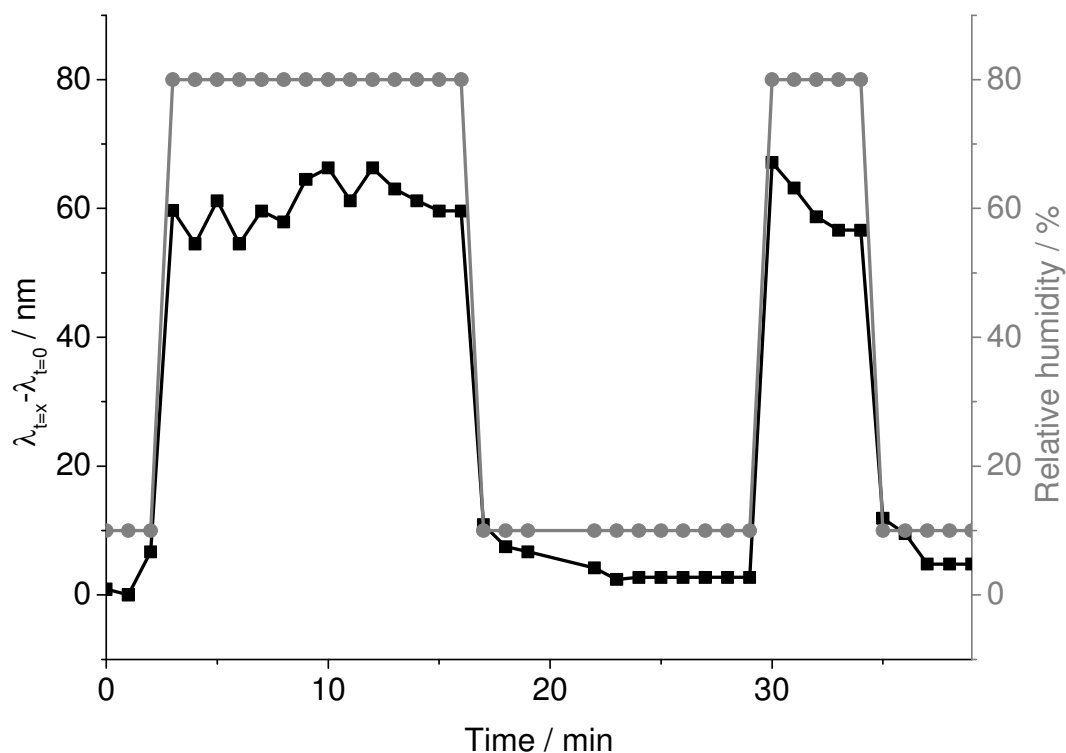


Figure S4. Humidity influence on SRB on the CLC polymer salt film: the relative shift of SRB to the SRB at time 0 versus time is plotted at different RH levels. The higher shift compared to the other humidity experiment is most likely caused by a slightly different preparation protocol.

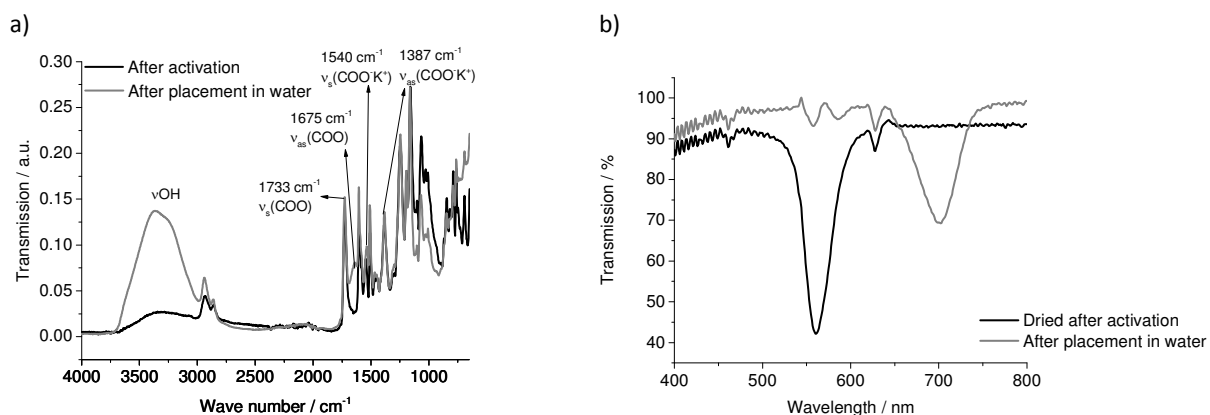


Figure S5. a) FT-IR spectra of the CLC polymer salt film (black line) and after placement in water (grey line); b) UV-VIS spectra of the CLC polymer salt film (black line) and after placement in water (grey line).

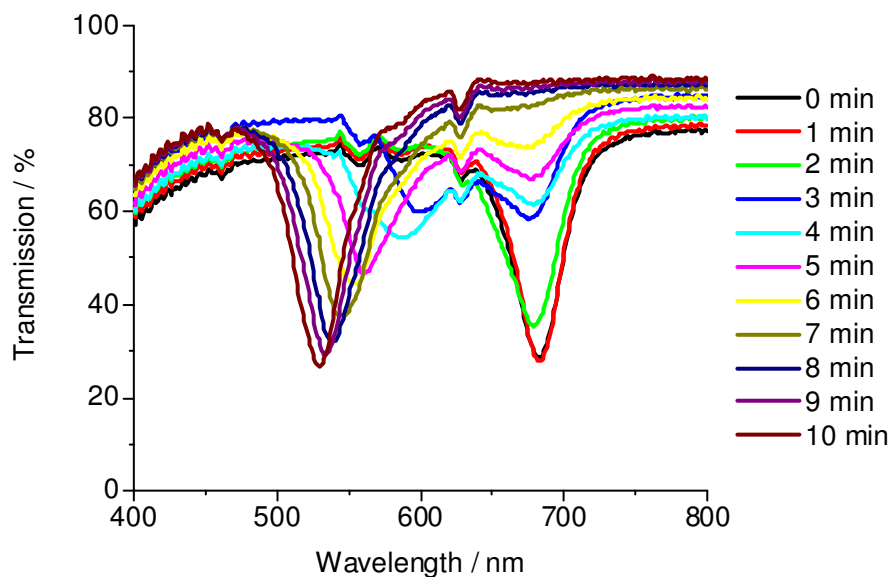


Figure S6. UV-Vis transmission spectra of the water-saturated CLC polymer film at room temperature as function of time.

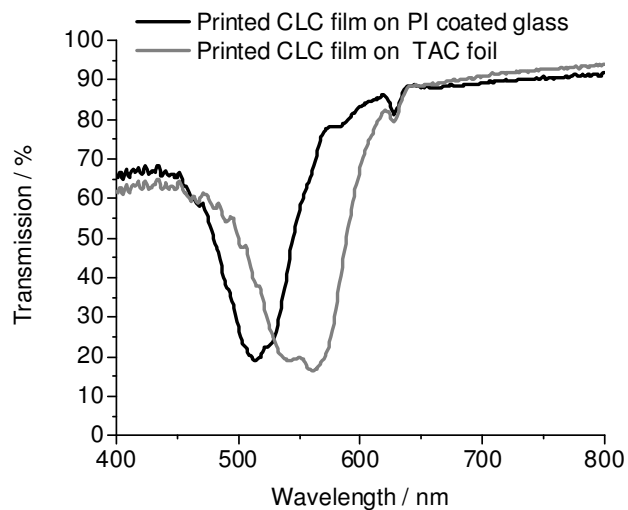


Figure S7. UV-Vis transmission spectra of the CLC polymer films printed on PI coated glass (black line) and on TAC foil (grey line)

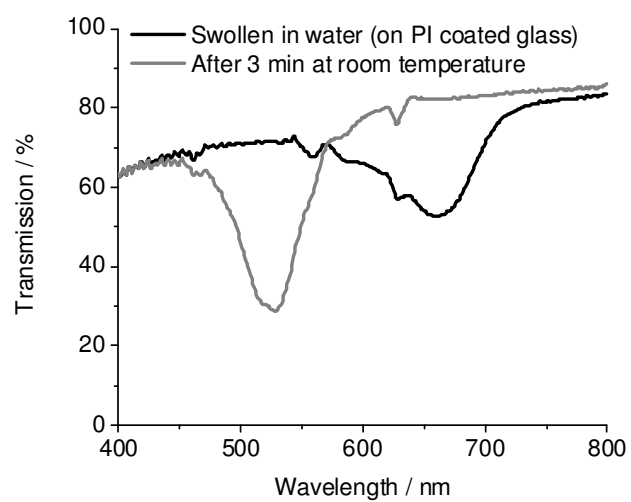


Figure S8. UV-VIS transmission spectra measured at room temperature of a water saturated CLC polymer salt film on PI coated glass fabricated by inkjet printing (black line) and of the same film after 3 min exposed at room temperature (grey line).