SUPPORTING INFORMATION

Rewritable Full Color Photonic Polymer using a Liquid Crystal Ink

Monali Moirangthem,[a] *Anouk F. Scheers*[a] *and Albertus P.H.J. Schenning** [ab]

[a.] Stimuli-responsive Functional Materials & Devices, and Institute for Complex Molecular Systems, Eindhoven University of Technology, P.O. Box 513, 5600 MB Eindhoven, The Netherlands

[b.] SCNU-TUE Joint Laboratory of Device Integrated Responsive Materials (DIRM), South China Normal University, Guangzhou Higher Education Mega Center, 510006, Guangzhou, China

Corresponding author e-mail address: a.p.h.j.schenning@tue.nl

Experimental details

Materials: RM257, RM105, 5CB and E7 were bought from Merck. LC756 was bought from BASF. Irgacure 651 was got from CIBA. Tetrahydrofuran (THF) was obtained from Biosolve.

Functionalization of glass substrates: Methacrylate functionalized and fluorinated alkylsilane functionalized glass substrates were fabricated by spin coating (3000 rpm, 45 s) on UV-ozone (Ultra Violet Products, PR-100, 20 min) treated glass substrates 3-(trimethoxysilyl)propyl methacrylate solution (1 vol. % solution in a 1:1 water–isopropanol mixture) or 1H, 1H, 2H, 2H - perfluorodecyltriethoxysilane solution (1 vol. % solution in ethanol) followed by curing (100 °C, 10 min).

Preparation of responsive CLC polymer coating: For making full color patterns, 1 g of CLC mixture consisting of 11.0 wt % of RM257, 44.0 wt % of RM105, 40.0 wt % of 5CB, 4.0 wt % of LC756, and 1.0 wt % of Irgacure 651 was dissolved in 2 mL THF. 40 μL of this solution was casted on a methacrylate functionalized 3 × 3 cm^2 glass substrate. After the evaporation of solvent at 75 ^oC, a fluorinated alkylsilane coated 3 × 3 cm^2 glass substrate was placed directly on top and on cooling down to room temperature, the glass substrates were sheared along one direction to obtain a red film. It was then followed by photopolymerization by shining UV light (48 mW cm^{-2} intensity in the range 320-390 nm) for 5 min after which the upper glass plate was removed to obtain the polymer coating. The polymer was then washed in THF to get the violet colored CLC polymer coating.

For the rewritability experiments, a CLC mixture with slightly modified compositions was used. This mixture consisted of 15.5 wt % of RM257, 49.0 wt % of RM105, 30.0 wt % of 5CB, 4.5 wt % of LC756, and 1.0 wt % of Irgacure 651 and the pristine CLC polymer was yellow in color while after washing with THF, it turned violet.

Characterization: Photopolymerization was carried out with Omnicure series 2000 EXFO lamp. UV-Visible spectra of the CLC polymer coatings were measured in Perkin Elmer lambda 650 spectrophotometer. Ocean Optics UV-Visible spectrophotometer HR2000+ mounted on a DM2700 M microscope from Leica microsystems was used for recording the transmission spectra of the photonic patterns. The same microscope was used for capturing images with cross polarizers. FT-IR spectra was measured in Varian 670 FT-IR spectrometer with slide-on ATR (Ge). Inkjet printing was done in Dimatix DMP 2800 (Dimatix-Fijifilm Inc., Santa Clara, USA) equipped with 10 pL cartridge (DMC-11610). Height profile measurement was carried out with Veeco Dektak 150 surface profiler. Images of the patterns were taken with Sony Cyber-shot camera.

Patterning by inkjet printing in polymer coating: 10 pL and 1 pL cartridges consisting of 16 nozzles were used for printing. E7 mixture was used as the ink. The cartridge temperature was set at 70 ^{o}C and the printing plate was maintained at 60 ^{o}C. Printing was carried out by using only 3 nozzles with a voltage of 13.0 and 8.0 V for 10 and 1 pL cartridges respectively and frequency 2.0 kHz using standard wave form.

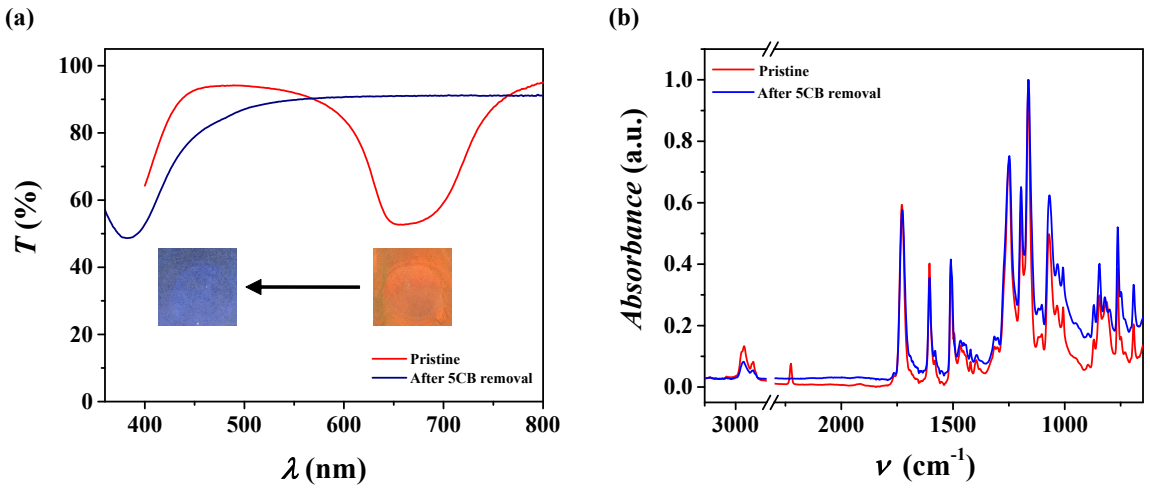

Figure S1. (a) UV-vis transmission spectra and (b) FT-IR spectra of the pristine CLC polymer coating and after removing 5CB. Inset of (a) shows the photographs of the polymer film before and after removing 5CB.

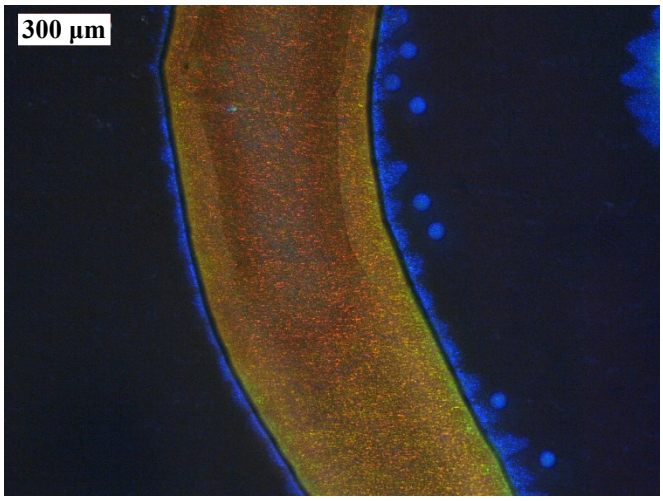

Figure S2. Polarized optical microscopy image of a part of "S" of the photonic pattern shown in **Figure 1.**

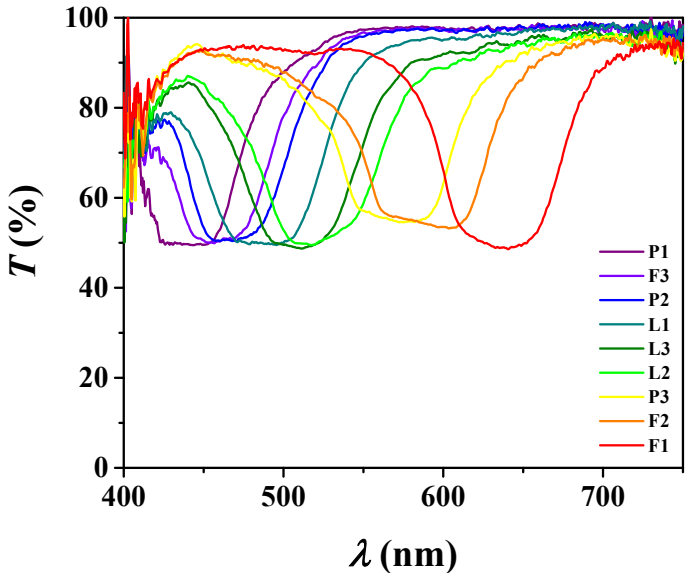

Figure S3. UV-Vis spectra of the different regions of the printed pattern of **Figure 3a** showing full color ranging from violet to red can be obtained.

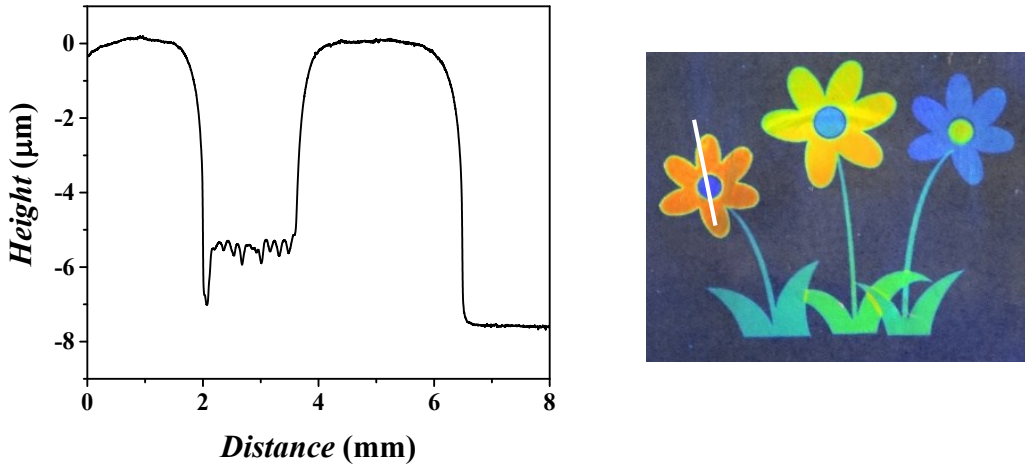

Figure S4. Height profile measured along the white line passing through the red flower petals, violet pistils and much darker violet background.