Supplementary Material (ESI) for *PCCP*

Supporting Information

Formation of Surface Relief Gratings with Homeotropically Oriented Photopolymer from a Photocross-Linkable Organic Monomer

Dongyu Zhao,[a] Zeda Xu,[b] Guojie Wang,[a] Hui Cao,[a] Wenbo Li,[a] Wanli He,[a] Wei Huang,[a] Zhou Yang,[a] and Huai Yang*[a]

[a]*Department of Materials Physics and Chemistry, School of Materials Science and Engineering, University of Science and Technology Beijing, Beijing 100083, P. R. China*

E-mail: yanghuai@mater.ustb.edu.cn

[b] *Department of Physics, Beihang University, Beijing 100083, P. R. China*

Synthetic procedures

n-Propyldiphenylacetypenecarboxylic acid benzyl ester, PDABE

To a solution of benzyl alcohol (1.08 g), 4-(2-(4-propylphenyl)ethynyl)benzoic acid (synthesized in our laboratory, 2.64g) and 4-Dimethylamino-pyridine (DMAP, 0.05 g) in CH_2Cl_2 (120 mL) was added slowly in a solution of DCC (2.06 g) in CH_2Cl_2 (5 mL) at 0□. The mixture was allowed to warm up to room temperature and overnight, then concentrated. The residue was purified by column chromatography (silica gel, dichloromethane) to give PDABE (yield 2.97 g, 83.8 %) as a white solid. PDABE mp: 76-77 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δppm 0.94 (t, J = 7.2 Hz, 3H, -CH_3), 1.57 (m, J = 8.0 Hz, 2H, -$CH_3CH_2CH_2$), 2.61 (t, J = 7.6 Hz, 2H, -$CH_3CH_2CH_2$), 5.38 (s, C_6H_5-CH_2-, 2H), 7.18 (m, J = 8.0 Hz, 2H ， Ar-H), 7.36 (t, J = 6.8 Hz, 5H, Ar-H), 7.46 (t, J = 8.0 Hz, 2H, Ar-H), 7.52 (m, J = 8.4Hz, 2H, Ar-H), 8.05 (d, J = 8.4 Hz, 2H, Ar-H).

n-Propylbiphenylcarboxylic acid cinnamyl ester, PBACE

To a solution of cinnamyl alcohol (1.34 g), 4-Propylbiphenylcarboxylic acid (synthesized in our laboratory, 2.70 g) and DMAP (0.05 g) in CH_2Cl_2 (120 mL) was added slowly in a solution of DCC (2.11 g) in CH_2Cl_2 (5 mL) at 0°C. The mixture was allowed to warm up to room temperature and overnight, then concentrated. The residue was purified by column chromatography (silica gel, dichloromethane) to give PBACE (yield 2.76 g, 77.6 %) as a white solid. ^{1}H-NMR (400 MHz, $CDCl_3$): δppm 0.94 (t, J = 7.6 Hz, 3H, -CH_3), 1.65 (m, J = 7.2 Hz, 2H, -$CH_3CH_2CH_2$), 2.63 (t, J = 7.6

Hz, 2H, -$CH_3CH_2CH_2$), 5.01 (t, J = 5.8 Hz, -$COOCH_2$-, 2H), 6.40 (m, J = 6.4 Hz, Ar-CH=CH-, 1H), 6.75 (d, J = 15.6 Hz, Ar-CH=CH-,1H), .26 (m, J = 6.4 Hz, 5H , Ar-H), 7.43 (t, J = 7.2 Hz, 2H, Ar-H), 7.55 (d, J = 8.0 Hz, 2H, Ar-H), 7.65 (m, J = 8.0 Hz, 2H, Ar-H), 8.13 (d, J = 8.4 Hz, 2H, Ar-H).

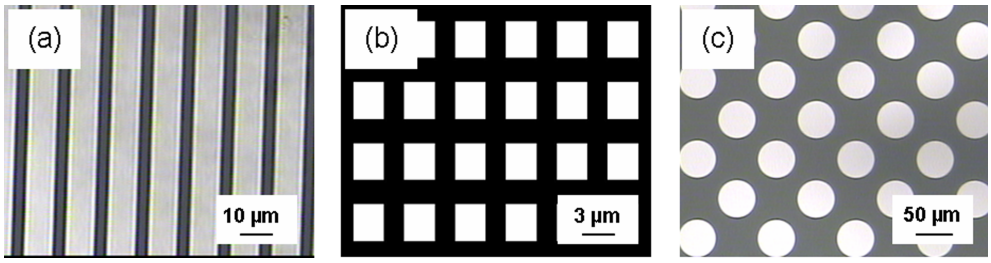

Figure S1. Photographic images of the photomasks used in this study. (a) the striped mask (the exposed width is 10 μm and the shaded width is 5 μm); (b) the grid-type mask (the exposed width is 3 μm and the shaded width is 2 μm) and (c) the circular mask (the exposed diameter is 50 μm and the shaded width is 25 μm).

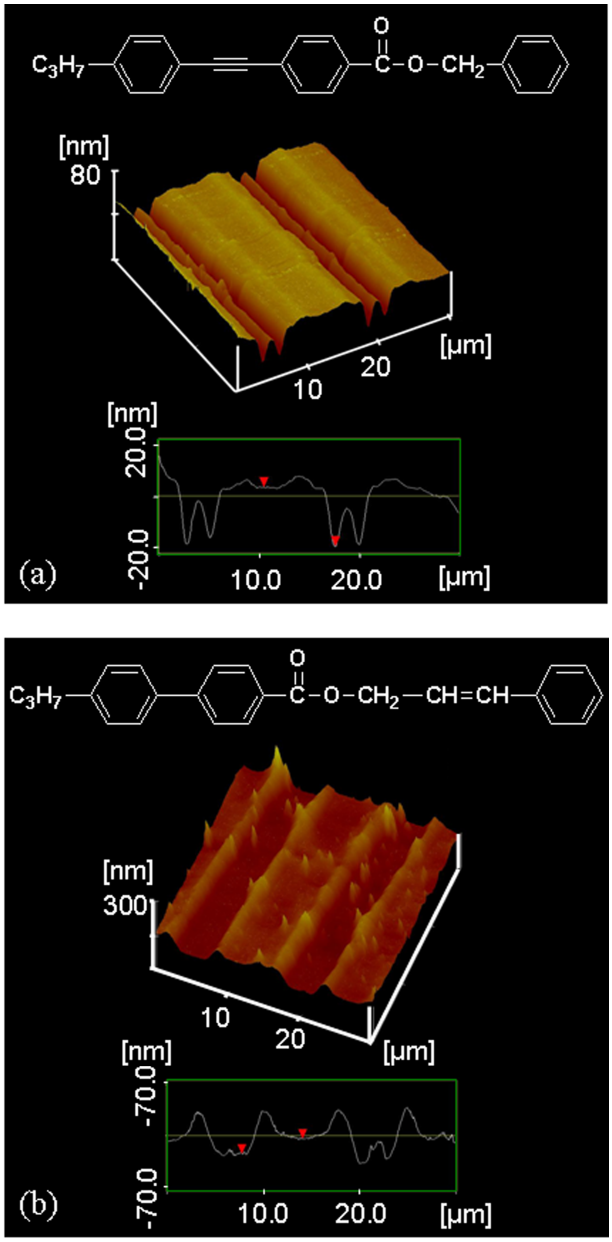

Figure S2. Chemical structures of the monomers PDABE and PBACE and the AFM images of their photoirradiated films under the striped mask. (a) PDABE, irradiated with 365.0 nm UV light (6.5 mW/cm^2, 60.0 s). (b) PBACE, irradiated with 365.0 nm UV light (35.0 mW/cm^2, 60.0 s).

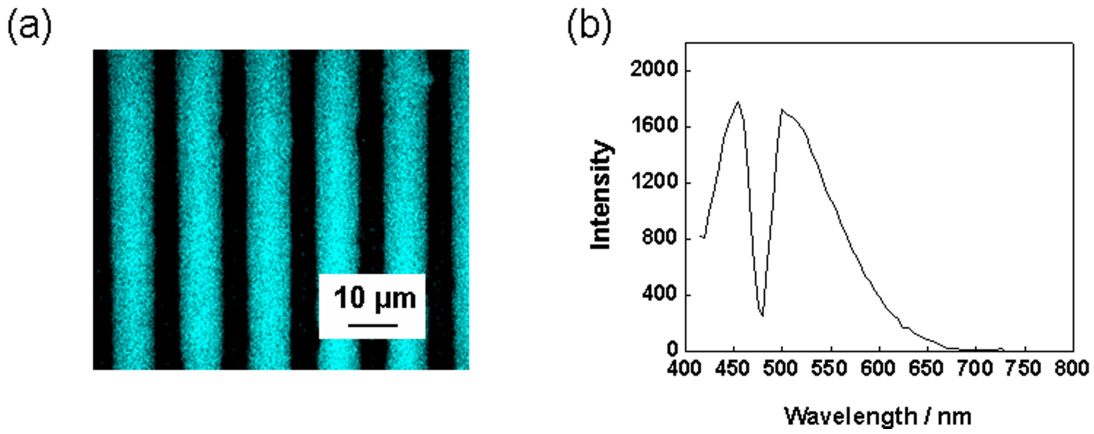

Figure S3. (a) Confocal image of the striped SRG. (b) Fluorescent emission spectra of the photocross-inked polymer of the striped SRG excited at 405 nm.