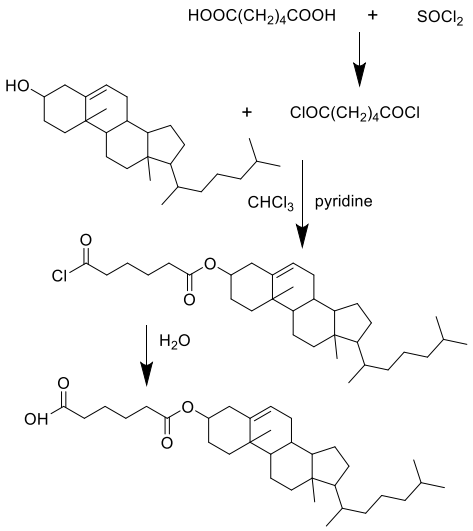
Supporting Information

Synthesis and Characterization of biodegradable liquid crystal elastomer with the property of shape recovery

Mingyao Xu, Yuehua Cong and Baoyan Zhang*

SI-1: Synthesis of liquid crystal (LC) molecule

Cholesterol (77.4g, 0.2mol) dissolved in dry chloroform (140ml) and dry pyridine (20ml) was added to a round bottom flask equipped with a condenser and thermometer. Then adipoyl chloride (91.5g, 0.5mol) was added dropwise to the flask. The reaction mixture was refluxed 5-6 hours. The chloroform was distilled off under reduced pressure. The residue was poured into water at 45°C, washed by hot water to neutral PH. The precipitate was isolated by filtration and washed with acetone, recrystallized in acetone and dried in a vacuum oven to obtain a white powder, Cholest-5-en-3-ol (3β)-, 3-(hydrogen pentanedioate). Yield: 83.2%.



Scheme S1. Schematic of synthesis of the LC molecular.

Then put M1 (15.45g, 0.03mol) in a round bottom flask equipped with an absorption apparatus to absorb hydrogen chloride, then 30mL $SOCl_2$ was dropwise added in. The mixture was stired at room temperature for 0.5h, then stired at 60°C for 4h. The excess thionyl chloride was distilled off under reduced pressure. Yellow powder was obtained.

SI-2:Characterisation of the LC molecule(M1)

DSC curves of M1 are shown in Figure S1. The melting point is at 131°C and clearing point at 142°C. When M1 is cooled down, a crystallisation point was found. The optical texture of M1 was determined by POM with a heating stage. Photographs of M1 are shown in Figure S2. A typical cholesteric Oily streak texture appeared at 131°C (Figure S2a), when M1 was heated to 142°C (Figure S2b), an isotropic phase appeared. However, when M1 was cooled from 142°C to 86°C, Droplet texture was displayed (Figure S2c).When the temperature was below 86°C, M1 was crystalline (Figure S2d).

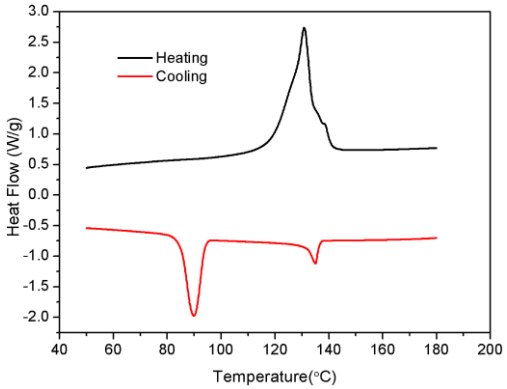


Figure S1. DSC curve of M1.

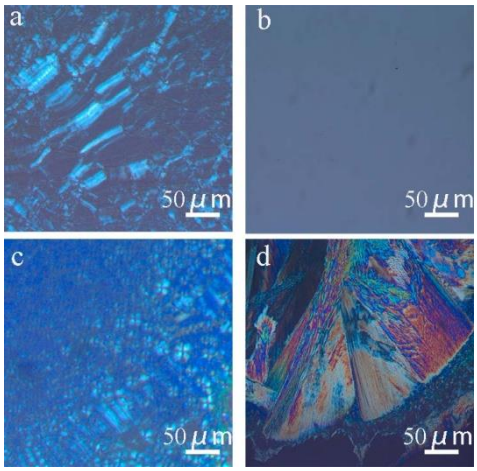
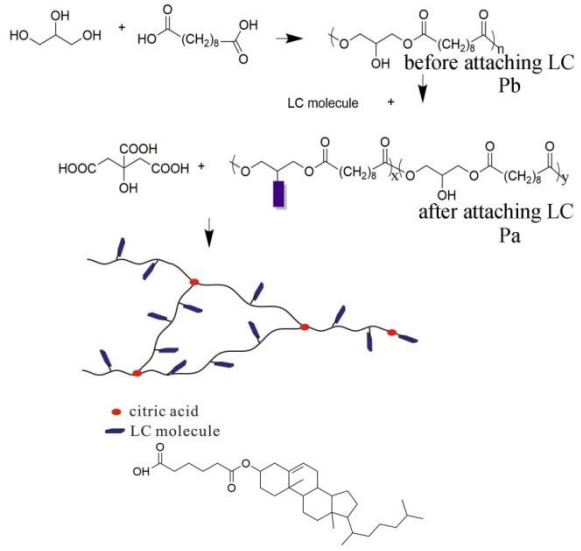


Figure S2. The POM texture of M1, (a) heating to 133°C, (b) heating to 142°C, (c) cooling to 123°C, (d)cooling to 80°C.

SI-3: FTIR spectroscopy

To characterize the structure of the outcome, FTIR spectroscopy is texted. From Scheme S2, we can see the process of the reaction. IR of Pb (KBr, cm^{-1}): 2953, 2877 (-CH_3, -CH_2-, -CH-), 3466 – 2500 (-OH in carboxylic acid), 1749,1690 (C=O), 1266 (secondary alcohol, -OH). IR

of Pa (KBr, cm^{-1}): 2953, 2852 (-CH_3, -CH_2-, -CH-), 3470–2433 (-OH in carboxylic acid), 1720,1697(C=O), 1171 (C-O-C)). The absorption peak at 1266 cm^{-1} turned weak after attaching LC, which was due to the LC reacted with the secondary alcohol.(Figure S3)



Scheme S2. The synthetic route of the polymer.

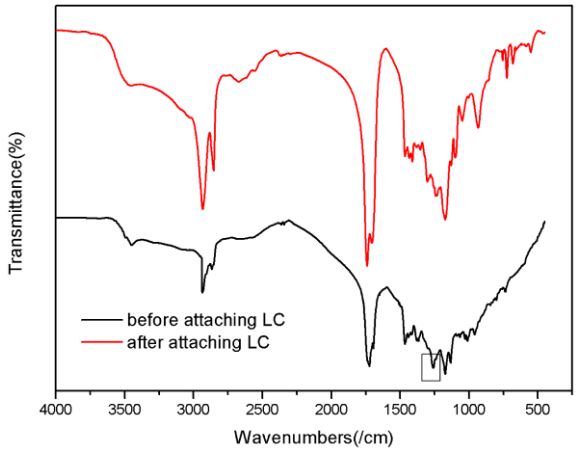


Figure S3. FTIR spectroscopy of polymer before and after attaching LC molecule.

SI-4: The process of the BLCE recovering to the original shape,when the sample was put on the heating stage at 120°C, which is recorded in Video S1.