Electronic Supplementary Information (ESI)

Reversible White-Light Actuation of Carbon Nanotube Incorporated Liquid Crystalline Elastomer Nanocomposites

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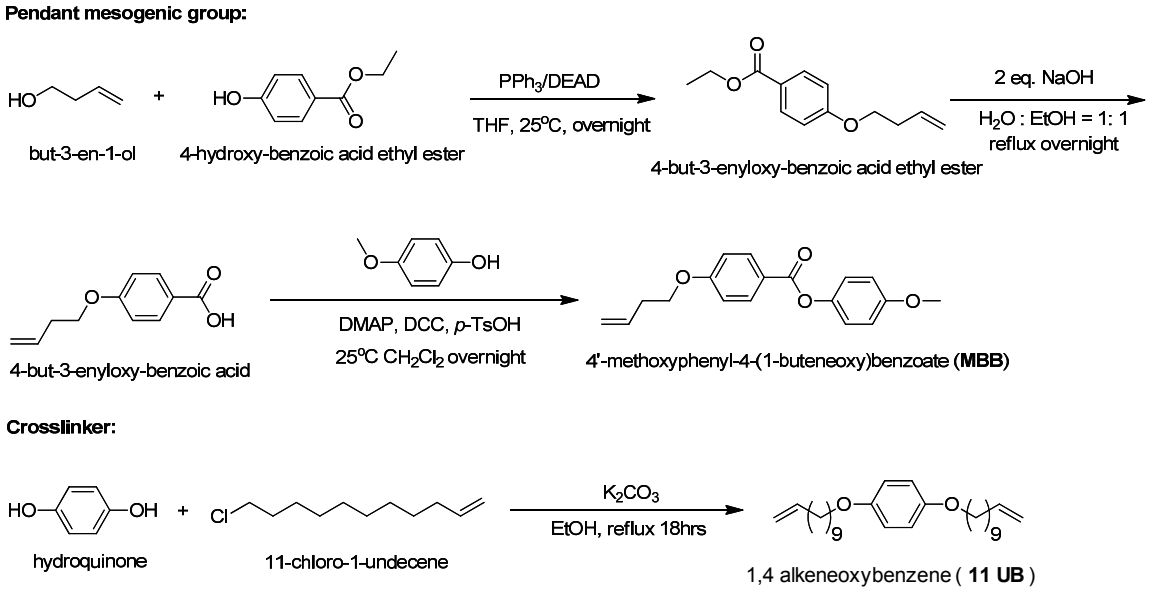
Included in this ESI: 1) the synthesis route of the mesogen and the crosslinker; 2) a discussion on the fabrication of LCE nanocomposites; 3) a video showing the response of the films under white light.

1) The synthesis route of the mesogen and the crosslinker:



Scheme S1. Synthesis route of the pedant mesogenic group and crosslinker.

2) A discussion on the fabrication process of the SWCNT-LCE nanocomposite:

The synthesis procedure was through a two-stage crosslinking process coupled with a drawing

process. In previous works, the first stage of crosslinking was generally implemented by centrifugation and heating processes to get a partly crosslinked and unaligned elastomer film. A uniaxial stress was then applied to the film after the first crosslinking stage to produce and maintain the nematic domain alignment. Then after the second crosslinking stage, which was heating the stressed film, the nematic LCE was obtained. However, the CNTs filled in the solution of reaction mixture tend to precipitate and aggregate during the centrifugation process, leading to poor dispersion of the nanotubes in LCE matrices. We tried to fabricate SWCNT-LCE composite films based on the process described above. However, the SWCNTs in the resulting films were often seriously aggregated. Therefore, if we were to use to such fabrication method, the controlled SWCNT content in the nematic LCE matrix must be very low to suppress the aggregation phenomenon. In these experiments, we found that in order to realize effective distribution of SWCNTs in the LCE matrix, the controlled maximum SWCNT loading level in the nematic side-chain polysiloxane LCE should generally be below 0.01 wt%. Thus in the work described in the manuscript, in order to prevent SWCNTs from precipitating during centrifugation, the generally used centrifugation and heating processes for the first crosslinking stage was substituted by molded casting and heating. As a result, the SWCNT-LCE samples with high SWCNT contents were prepared.

3) A video of photo-actuating SWCNT-LCE nanocomposite:

The supplementary video shows that the blank LCE does not respond under the irradiation of the white light, while in contrast, SWCNT-LCE nanocomposite (0.3 wt % of SWCNT content) responds rapidly to and is reversibly deformed under the stimulus of the white light. Each film is loaded with a weight of approximately 8 g.