New Materials 3: 10:55 - 11:30 a.m.

Photomobile Polymer Materials
- From Nano to Macro-

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Liquid-crystalline elastomers (LCEs) are attractive materials because of unique properties of liquid crystals (LCs)and elastomers. LCEs exhibit reversible and large contraction along the alignment direction of mesogens when they are heated to induce their order-disorder phase transition. This phenomenon was first predicted by de Gennes [1] and experimentally confirmed by Finkelmann et al. [2]. A large deformation can be generated in LCEs, such as reversible contraction and expansion, and even bending, by incorporating photochromic molecules, such as an azobenzene, with the aid of photochemical reactions of these chromophores [3,4]. Moreover, the laminated films were fabricated by thermal compression bonding of an LCE and a polymer film with an adhesion layer. We have successfully developed new photomechanical devices, including the first light-driven plastic motor [5].Figure 1 shows a unidirectional motion, an inchworm walk, of the LCE laminated film with asymmetric end shapes. The film moves forward upon alternate irradiation with UV and visible light at room temperature. Next, we prepared a rolled-up film by laminating with LCE layers at two places (Figure 2). The azobenzene mesogens were aligned along the long axis of the film. Sequential and flexible motion of the film has been observed by irradiation with UV and visible light. Large and rapid-responsive motions with the LCE laminated materials are successfully induced by photo irradiation, which leads to novel three-dimensional movements such as an inchworm walk and a flexible robotic arm motion[6]. These results show a high possibility of numerous applications based on LCE composites that can convert light energy directly into mechanical work and move without any batteries or electric wires.

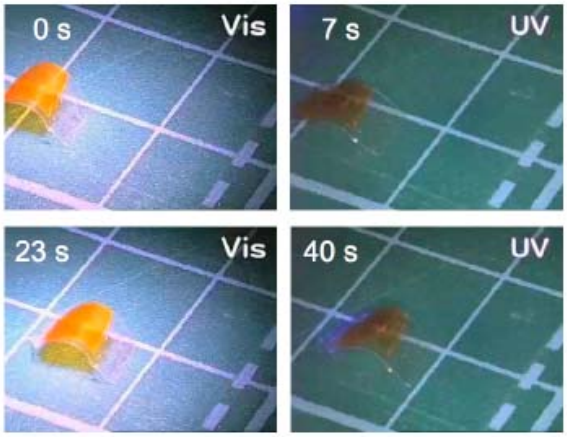

Figure 1. An inchworm walk of the LCE laminated film by alternate irradiation with UV and visible light.

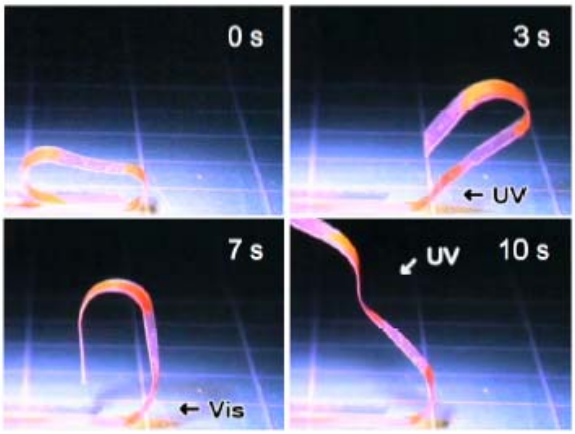

Figure 2. Robotic arm motion of the LCE laminated film by photoirradiation.

References

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