ACS Appl Mater Interfaces. 2016 Oct 19;8(41):28040-28046. doi: 10.1021/acsami.6b09144. Epub 2016 Oct 4.

Initiatorless Photopolymerization of Liquid Crystal Monomers

Kyung Min Lee [1 2], Taylor H Ware [1 2 3], Vincent P Tondiglia [1 2], Matthew K McBride [4], Xinpeng Zhang [4], Christopher N Bowman [4], Timothy J White [1]

Affiliations

Affiliations

1 Materials and Manufacturing Directorate, Air Force Research Laboratory , Wright-Patterson Air Force Base, Ohio 45433-7750, United States.
2 Azimuth Corporation, 4027 Colonel Glenn Hwy, Beavercreek, Ohio 45431, United States.
3 Department of Bioengineering, The University of Texas at Dallas , Richardson, Texas 75080, United States.
4 Chemical and Biological Engineering, University of Colorado , Boulder, Colorado 80309, United States.

PMID: 27636826 DOI: 10.1021/acsami.6b09144

Abstract

Liquid crystal monomers are widely employed in industry to prepare optical compensating films as well as extend or enhance the properties of certain display modes. Because of the thermotropic nature of liquid crystalline materials, polymerization of liquid crystalline monomers (sometimes referred to as reactive mesogens) is often initiated by radical photoinitiation (photopolymerization) of (meth)acrylate functional groups. Here, we report on the initiatorless photopolymerization of commercially available liquid crystalline monomers upon exposure to 365 nm UV light. Initiatorless polymerization is employed to prepare thin films as well as polymer stabilizing networks in mixtures with low-molar-mass liquid crystals. EPR and FTIR confirm radical generation upon exposure to 365 nm light and conversion of the acrylate functional groups. A potential mechanism is proposed, informed by control experiments that indicate that the monomers undergo a type II Norrish mechanism. The initiatorless polymerization of the liquid crystalline monomers yield liquid crystalline polymer networks with mechanical properties that can be equal to those prepared with conventional radical photoinitiators. We demonstrate that initiatorless polymerization of display modes significantly increases the voltage holding ratio, which could result in a reduction in drive voltages in flat-panel televisions and hand-held devices, extending battery life and reducing power consumption.

Keywords: displays; liquid crystal polymers; liquid crystals; photoinitiator; photopolymerization.

Related information

MedGen

LinkOut – more resources

Full Text Sources

American Chemical Society

Other Literature Sources

The Lens - Patent Citations
scite Smart Citations