

**Phase Diagram and Photopolymerization Kinetics of  
Multifunctional acrylates/ nematic liquid crystal (E7)/ Multiwall  
carbon nanotube (MWNT) Blends**

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Abstract: A binary miscibility phase diagram of mixtures of multifunctional acrylates/ nematic liquid crystal (LC) has been established using optical microscopy and differential scanning calorimetry. The observed phase diagram is of an upper critical solution temperature (UCST) type, overlapped with the nematic-isotropic transition of the liquid crystal. Photopolymerization was carried out on various regions of the phase diagrams of the multifunctional acrylate/LC system by means of Photo-DSC and real time-IR techniques. Upon UV irradiation, the coexistence curve moves up asymmetrically towards the side of LC rich regions that pushes the initial reaction temperature from the single phase into a two-phase region. Phase separation followed by nematic ordering was observed during the course of photopolymerization. This study has been extended to multifunctional acrylate/liquid crystal/multi wall carbon nanotube (MWNT) system in order to investigate the effect of MWNT on the phase diagram. It was found that the nematic-isotropic phase transition temperature is depressed with increasing MWNT content ranging from %0.01 to %0.1. The rate constants for propagation ( $k_p$ ), and termination ( $k_t$ ), reactions were determined as a function of light intensity, temperature, LC content and monomer conversion. The significance of these observed constants on the morphology development is discussed. Supported by NSF and AFOSR/WPAF.

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