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Spatial temperature mapping in polymer nanocomposites due to ultrafast photothermal heating of gold nanorods[1] SOMSUBHRA MAITY, COLIN CURTIS, WEI-CHEN WU, CHAO XU, JOSEPH TRACY, KENAN GUNDOGDU, JASON BOCHINSKI, LAURA CLARKE, NC State University — In pulsed laser irradiance, extremely high peak powers (low average powers) can be attained due to short bursts of energy. This property can be exploited for photothermal heating of polymers using gold nanorods in which the incident radiation can be efficiently converted into heat in short pulses. This leads to extreme localization of heat energy which does not affect the global polymer temperature significantly. In this work, we describe the effect of using pulsed laser to generate photothermal heat within polymer matrices doped with gold nanorods, and novel optical techniques to determine the corresponding temperature distribution. The rotation of the nanorods are studied to monitor the temperature of the polymer melt immediately surrounding the nanorods and the polarized fluorescence of probe molecules* are used to determine the temperatures of concentric volumes of polymer far away from the nanorods. The experimental techniques discussed provide simple tools to monitor the ensemble behavior of the nanorods and map the temperature distribution due to pulsed heating. The pulsed photothermal effect enables nanoscale thermal manipulations without altering the bulk temperature or morphology of the polymer.
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