Journal of Physical Chemistry C 2017 vol.121 N5, pages 3007-3012

Photoinduced Heating of Freestanding Azo-Polymer Thin Films Monitored by Scanning Thermal Microscopy

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Abstract

© 2017 American Chemical Society. Despite numerous attempts to capture a temperature rise in azobenzene-functionalized polymer thin films exposed to laser irradiation, so far no attention has been paid to direct temperature measurements. Here, we characterize a photoinduced heating of freestanding thin films using nanoscale resolution scanning thermal microscopy. The polymer films under study are composed of epoxy-based oligomers with chemically attached nitroazobenzene chromophores. A temperature change of 1.7 K only is observed when an 800 nm thick film is subject to resonant 532 nm illumination with a modest intensity of 25 mW/cm 2 . A freestanding and glass substrate supported 20 nm azo-polymer films exhibit an anomalous depression of the glass transition temperature by approximately 80 and 70 K, respectively, that is probed with thermally assisted atomic force microscopy. Our results show that the photoinduced heating can negatively affect an ordered state of the azo dyes within the polymer ultrathin film (< 100 nm) at room temperature.

http://dx.doi.org/10.1021/acs.jpcc.6b12658

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