Photothermal Detection of Nanoscopic Liquid Crystalline Nematic-to-Isotropic Phase Transition

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Various techniques have been established to image nonfluorescent nanoparticles with optical far-field microscopy, we implore one of these techniques, photothermal heterodyne imaging, to detect the nematic-to-isotropic phase transition of 5CB at the nanoscale. The technique involves heating the nanoparticle with a modulated resonant laser that creates an index of refraction profile that diffracts a nonresonant probing laser to create a measurable signal. Along with an index of refraction profile, the heating beam creates a temperature profile that is maximum at the nanoparticle surface and drops quickly as the energy is dissipated into the liquid crystal. At a high enough power, the liquid crystal surrounding the nanoparticle transitions to the isotropic phase, causing a shift in the slope of the signal as a function of power allowing this transition to be detected. Interestingly, due to the strong index of refraction dependence of the signal measured by the PHI technique and the large index of refraction variation during the liquid crystalline phase change, we find a signal to noise enhancement of 6-fold.

Notes