

Isotropic-to-nematic phase transition in a liquid-crystal droplet

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Abstract

In this paper, we focus on the isotropic-to-nematic phase transition in a liquid-crystal droplet. We present the results of an experiment to measure the growth of the nematic phase within an isotropic phase liquid-crystal droplet. Experimentally, we observe two primary phase transition regimes. At short time scales, our experimental results ($R(t) \sim t^{0.51}$) show good agreement with a Stefan-type model of the evolution of the nematic phase within the isotropic phase of a liquid crystal. As time progresses, the growth of the nematic phase is restricted by increased confinement of the droplet boundary. During this stage of growth, the nematic phase grows at a slower rate of $R(t) \sim t^{0.31}$. The slower growth at later stages might be due to a variety of factors such as confinement-induced latent heat reduction; a change of defect strength during its evolution; or interactions between the defect and the interface between the liquid crystal and oil or between adjacent defects. The presence of two growth regimes is also consistent with the molecular simulations of Bradac et al. [22] who identify an early stage domain regime and a late stage confinement regime. For the domain and confinement regimes, Bradac et al. [22] obtain growth exponents of 0.49 ± 0.05 and 0.25 ± 0.05 . These are remarkably close to the values 0.51 and 0.31 observed in our experiments.