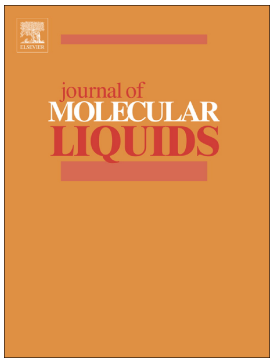

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Spontaneous Striped Pattern Formation in Thin Chiral Nematic Liquid Crystal Layers

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Abstract

Periodic modulations in chiral nematic liquid crystals (CLCs) are used in several optical and photonic devices. A remarkable way of fabricating and controlling such patterns is in a thin wetting layer that grows as temperature is decreased. Here, we study this stripe formation process experimentally and by means of Monte Carlo simulations. We report on samples of CLCs that present, after the wetting transition, a stripe/fringe formation occurring either through a nucleation process or homogeneously across the cell. **These patterns depend on** the ratio of the pitch to thickness of the layer, elastic anisotropy, and anchoring strength. Although such process is well documented for CLCs under applied field, we show here that similar textural transitions occur in thin layers mediated by the weak anchoring at the CLC-isotropic interface; it happens for values of pitch to thickness ratio much smaller than the ones reported in field driven situation. The Monte Carlo method takes action in simulating the experimentally observed textures by using a pairwise additive potential model for CLCs. A qualitative comparison with the experimental phenomena is possible to be made in which both the stripes formation and its behavior agree with the experiments.

Keywords: Stripes pattern formation, wetting transition, Monte Carlo simulation.

1. Introduction

Spatially repeated arrangements frequently occur in nature. Such orderly outcomes are formed in consequence of one or more driving forces, yielding beautiful and, more important, functional patterns in self-organized systems [1]. Snow flakes, body segmentation in animals, sand dunes, complex organization of cell fates, the circumpolar hexagonal storm in Saturn [2], Belousov-Zhabotinsky chemical reaction [3] and Rayleigh-Bénard convection [4] patterns are just a few examples of pattern formation. In many cases, replicating a naturally occurring pattern in a synthetic system is key for understanding the physics involved in a determined system [5]. Due to the multifaceted structures and phenomena liquid crystals (LCs) might

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