Instability patterns in thin nematic films: stripes versus squares

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ABSTRACT

Recent experiments [1] demonstrated that thin nematic films, spread on liquid substrates, exhibit a long-wavelength periodically deformed state as stripes, squares, chevrons up to the thickness of 20 nm. The formation of these instability patterns can be attributed to the response of the system to the antagonistic boundary conditions. Although being extensively studied in the last two decades [2], these new observations cannot be explained completely by the existing theories. To get a theoretical insight on the experimental findings, we consider the onset of stripe and square instabilities in ultrathin nematic films within the continuum theory of liquid crystals [3]. In the linear approximation, we find analytical expressions for the critical thickness as well as for the critical wavenumber and discuss the role of the surface-like terms entering the free energy.

REFERENCES

[1] U. Delabre, C. Richard, G. Guéna, J. Meunier, and A.-M. Cazabat *Nematic Pancakes Revisited* , Langmuir **24**, 3998–4006, 2008; U. Delabre, C. Richard, and A.-M. Cazabat *Thin Nematic Films on Liquid Substrates*, J. Phys. Chem. B **113**, 3647–3652, 2009.

[2] O. D. Lavrentovich and V. M. Pergamenshchik *Stripe Domain Phase of a Thin Nematic Film and the K_{13} Divergence Term*, Phys. Rev. Lett. **73**, 979–982, 1994; A. Sparavigna, O. D. Lavrentovich and A. Strigazzi *Periodic stripe domains and hybrid-alignment regime in nematic liquid crystals: Threshold analysis*, Phys. Rev. E **249**, 1344–1352, 1994.

[3] O. V. Manyuhina, A.-M. Cazabat, and M. Ben Amar *Instability patterns in ultrathin nematic lms: Comparison between theory and experiment*, Europhys. Lett. **92**, 16005, 2010.