

Title: Nematic wetting and filling of crenellated surfaces

Author(s): Silvestre, N. M.^{1,2}; Eskandari, Z.²; **Patricio, P.**^{2,3}; Romero-Enrique, J. M.⁴; Telo da Gama, M. M.^{1,2}

Source: Physical Review E

Volume: 86 **Issue:** 1

Article Number: 011703 **DOI:** 10.1103/PhysRevE.86.011703

Part: Part 1 **Published:** Jul 9 2012

Abstract: We investigate nematic wetting and filling transitions of crenellated surfaces (rectangular gratings) by numerical minimization of the Landau-de Gennes free energy as a function of the anchoring strength, for a wide range of the surface geometrical parameters: depth, width, and separation of the crenels. We have found a rich phase behavior that depends in detail on the combination of the surface parameters. By comparison to simple fluids, which undergo a continuous filling or unbending transition, where the surface changes from a dry to a filled state, followed by a wetting or unbinding transition, where the thickness of the adsorbed fluid becomes macroscopic and the interface unbinds from the surface, nematics at crenellated surfaces reveal an intriguingly rich behavior: in shallow crenels only wetting is observed, while in deep crenels, only filling transitions occur; for intermediate surface geometrical parameters, a new class of filled states is found, characterized by bent isotropic-nematic interfaces, which persist for surfaces structured on large scales, compared to the nematic correlation length. The global phase diagram displays two wet and four filled states, all separated by first-order transitions. For crenels in the intermediate regime re-entrant filling transitions driven by the anchoring strength are observed.

Document Type: Article

Language: English

KeyWords Plus: Liquid-Crystal Alignment; Phase-Transition; Substrate; Adsorption; Geometry; Layer

Reprint Address: Silvestre, NM (reprint author), Univ Lisbon, Dept Fis, Fac Ciencias, Ave Prof Gama Pinto 2, P-1649003 Lisbon, Portugal.

Addresses:

1. Univ Lisbon, Dept Fis, Fac Ciencias, P-1649003 Lisbon, Portugal
2. Univ Lisbon, Ctr Fis Teor & Computac, P-1649003 Lisbon, Portugal
- 3. Inst Super Engn Lisboa, P-1959007 Lisbon, Portugal**
4. Univ Seville, Dept Fis Atom Mol & Nucl, Area Fis Teor, E-41080 Seville, Spain

E-mail Address: nunos@cii.fc.ul.pt

Publisher: Amer Physical Soc

Address Publisher: One Physics Ellipse, College, MD 20740-3844 USA

IDS Number: 973CL

ISSN: 1539-3755