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Using chemically patterns with different anchoring behavior to control the orientation of nematic liquid crystal XIAO LI, JULIO ARMAS PEREZ, JOSE ADRIAN MARTINEZ-GONZALEZ, HELOU XIE, JUAN DE PABLO, PAUL NEALEY, University of Chicago — We present experimental and theoretical study of nematic liquid crystal (5CB) confined to a thin cell between homeotropic anchoring top surface and chemically patterned planar/homeotropic anchoring bottom substrates. The chemically patterned substrate with different dimensions and $\sim$ 4 nm depth topography induce the 5CB to align as the pattern direction as non-degenerate behavior, until the width of the straight line pattern is too wide to confine the 5CB to one direction and back to degenerate behavior. By changing the width of the straight line pattern, a brightness change of the intensity is shown by their corresponding crossed polarizer images. This change is mainly due to a discontinuity of the average angle between the molecules and the surface in function of line width, which is in excellent agreement with the Landan-de Gennes theory when the balance between the elastic deformation in the bulk and orientation of molecules close to the surface is simulated for different pattern dimensions. An elastic free energy transition is also observed from the numerical analysis when the strong planar anchoring for presented experiments is changed to weak. This 3D confinement by chemically patterns and small depth topography offers a new way to generate any geometry pattern controllable non-degenerate orientation, achieving switchable optical properties.

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