Orientational transitions in nematic liquid crystals in contact with patterned substrates: A Monte Carlo Study

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In recent years there has been much interest in the alignment of nematic liquid crystals with micro-patterned surfaces to construct bistable devices. It was observed that liquid crystals confined with both geometrically and chemically patterned substrates has technological relevance and exhibit very rich behaviour. Recently continuum theory predictions showed transitions in the director structures in the nematic region with the variation in anchoring angle, width of the cell, etc., [1-4]. We have performed non-Boltzmann Monte Carlo studies [5] to investigate the nature of these structural transitions by constructing free energy profiles which in turn showed rich structures. We observed that the phase difference between the chemical and geometrical patterns of the substrate brings about qualitative changes in the symmetry of the director structure and also in the effective anchoring angle at the patterned substrate. Fluctuations in uniaxial and biaxial order parameters are observed to persist till very low temperatures.

References

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