Phase diagrams of a biaxial liquid crystal with dipolar particles.

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Abstract

We employ a lattice-gas extension of a theoretical liquid crystal model with discrete orientation states to study the phase behavior of a statistical model which contains biaxial nematogenic units and dipolar particles in the context of the mean-field theory. The phase behavior of the system is investigated in terms of the strength of isotropic interaction between anisotropic objects, the strength of the interaction between objects of different nature, as well as the degree of biaxiality and the concentration of nematogenic units. We obtain phase diagrams with isotropic phases and stable biaxial and uniaxial nematic structures, various phase coexistences, many types of critical and multicritical behaviors, such as ordinary vapor-liquid critical points, critical end points, and Landau-like multicritical points. We present a perturbative calculation to study the effects produced in the nematic phases when doping a nematogen with small amounts of dipolar particles. Our results widen the possibilities of relating the phenomenological coefficients of the Landau–de Gennes expansion to microscopic parameters, allowing an improved interpretation of theoretical fittings to experimental data.

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