Abstract

We study the ordering in dipolar and quadrupolar colloids driven by an appropriate external field, which is low structured at zero field strength. This study consists of analyzing the predictions involved by the one body probability density function, as function of the strength of the field, which is the solution of the equilibrium Smoluchowski equation, without hydrodynamic interactions. Because of the symmetry of the dipole and quadrupole, for the former an axial nematic-like phase is predicted, whereas for the latter a biaxial nematic-like phase is predicted. In the study we consider different fields, for the dipole only the orientation of the field is changed, whereas for the quadrupole the gradient of the field is also changed. The alignment of the multipolar colloids for high values in field is independent of the different fields studied in both moments, but their alignment for low values depends on the field features. The change in curvature of the one body probability density functions for the moments analyzed is predicted in field strength values with a different meaning. For the quadrupole moment an anomalous perpendicular alignment of the particles is predicted, which does not occur for the dipole moment. Our results are described as a generalized point of view in the Landau-de Gennes theory for the nematic isotropic phase transition driven by an external field.

Keywords

Multipolar colloid, nematics, orientational distribution.