Advanced Modelling of Lyotropic Liquid Crystals by Small Angle X-Ray Scattering

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The micelles of a lyotropic liquid crystal present long-distance orientational order sensitive to concentrations of amphiphilic molecules, alcohols, ions and to the temperature of the sample. Under specific combination of these parameters, a biaxial nematic phase may emerge between calamitic and discotic phases. Also, by the inclusion of small fractions of ferrofluids, the use of external magnetic fields can promote the orientation of the groups of micelles in the system [1,2]. Small-Angle X-ray scattering experiments is a very useful probe to investigate structural features on this system since it can be used directly in the solution system. However, since one has the micelles combined in different types of supramolecular arrangements, the analysis of the scattering data is not trivial, and demands the development of advanced modelling tools. In this work we present a recent model [3] very useful to investigate the micellar structure by the use of SAXS experiments. As will be shown, the micelles are modelled as core-shell ellipsoidal particles forming planar layers, which pills up as lamellar structures. From the fitting of the full scattering curve (Figure 1) one can obtains detailed structural parameters. This model was successfully applied for the investigation of the effect of chiral molecules in lyotropic cholesteric calamitic phases [3] but it is a very versatile approach and can be used in a number of systems composed by liquid crystals.

Figure 1. SAXS results. (a) 2D SAXS data for NC phase. (b) Vertical and horizontal cuts (symbols) with theoretical model fits (Solid lines).


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