Wednesday 9 September, Session 4, 11:55 – 12:15

Disk-shaped bicelles in block copolymer/homopolymer blends

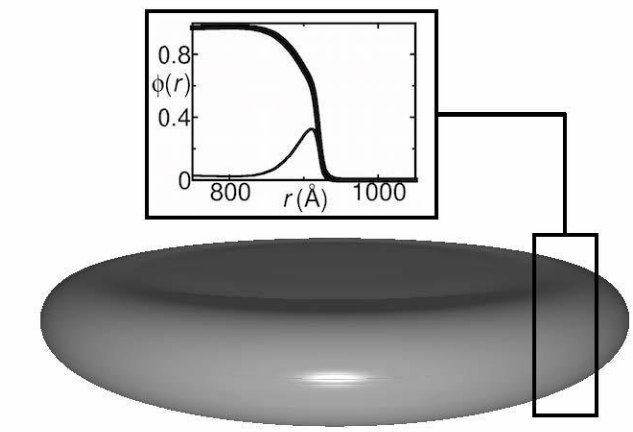
M J Greenall

Aberystwyth University, UK

Mixtures of micelle-forming and lamella-forming amphiphiles in solution can form disk-shaped bilayers known as bicelles [1]. These structures are widely used in biophysical experiments as model membranes. However, it is not clear if and under what conditions they are thermodynamically stable, and making detailed comparisons between theory or simulations and experiments on aqueous systems proves difficult. Here, following an approach that has been successfully applied to the study of micelle formation, we take a step towards bridging this gap, and perform self-consistent field theory (SCFT) calculations on bicelle formation in a blend of two types of diblock copolymer with homopolymer.

We find that, if the segregation between the different repeat units is strong and the hydrophilic block of the micelle former is large, the free energy of the bicelle can drop below those of the competing micelle and bilayer structures. This region of parameter space is found to correspond to a PDMS-PS/PDMS blend at experimentally accessible temperatures. We also find that the centre of each disk is mainly composed of lamella former, while its thicker rim has a higher concentration of micelle former. Finally, we show that the presence of the micelle former is necessary for the bicelle to be stable with respect to further aggregation.

To conclude, we discuss how the presence of bicelles and other structures might affect the rheological properties of the blend.



A disk-shaped bicelle found in SCFT calculations. The inset shows the segregation of the two hydrophobic groups at the rim of the bicelle core.

[1] U. H. Dürr, R. Soong and A. Ramamoorthy, Prog. Nucl. Mag. Res. Sp. 69 1-22 (2013)