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Low Temperature Mixed Lipid Phase: Understanding Bicelle Formation. P.D. Butler[1], D. Singh[1,2], L. Porcar[1,3], U. Perez-Salas[4], W.A. Hamilton[5], G. Lynn[5], [1]National Institute of Standards and Technology, Gaithersburg, MD, [2]Johns Hopkins Univ., Baltimore, MD, [3]Univ. of Maryland, College Park, MD, [4]UC Irvine, Irvine CA, [5]Oak Ridge National Laboratory, Oak Ridge, TN.

Systems consisting of mixtures of a long and a short-tail lipid have recently shown promise in membrane protein crystallization and have been used for some time as an alignable media for use in NMR protein structure determination. However, the phase diagram of these lipid mixtures remains poorly understood. In particular, much of the literature posits the existence of bicelles, or discotic micelles, as the agents of the useful properties. Recent work however suggests that such structure only exist below the melting transition temperature of the long tail lipid, with a transition to a lamellar phase at higher temperature. A detailed understanding of the phase behavior is crucial to adapting these systems for more general applications. In this work, we report on a systematic study at the lowest temperature isotropic fluid like phase. Using a series of small angle neutron scattering (SANS) experiments with hydrogentaed and deuterated lipids, we show direct evidence of the discoidal morphology with the two lipids being segregated in different parts of the disk and show that a model which properly accounts for the geometric packing as well as the thermodynamic nature of the system, hitherto ignored, quantitatively predicts the sizes of the disks. At higher temperature, but still well below the chain melting temperature, the system clearly becomes much more complicated and we see evidence of mixing of the two lipids.