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Topological Relaxation of a Shear-induced Lamellar Phase to Sponge Equilibrium and the Energetics of Membrane Fusion. W.A. Hamilton¹, L. Porcar², P.D. Butler^{1,2}, G.G. Warr³, ¹Oak Ridge National Laboratory, Oak Ridge TN 37831, ²National Inst. of Standards & Technology, NCNR, Gaithersburg, MD 20899 USA, ³Univ. of Sydney, Sydney, Australia.

We report measurements of the relaxation of shear-induced L_2 lamellar states to their isotropic L_3 sponge equilibrium phases in a surfactant membrane system. This is expected to be an activated process since (re)formation of the connecting handles characterizing the sponge topology when adjacent membrane sheets are brought into contact by diffusive motion will involve energetically unfavorable intermediate structures. Confirming this analysis, a sample series of constant intrinsic membrane properties exhibit an Arrhenius relationship between the structural relaxation from time resolved small angle neutron scattering (SANS) and the membrane contact time obtained from dynamic light scattering (DLS). From these two measurements we may extract an activation energy for topological handle creation.