

Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Thermo-adjustable mechanical properties of polymer, lipid-based complex fluids MILLICENT FIRESTONE, SUNGWON LEE, Argonne National Laboratory — Combined rheology (oscillatory and steady shear) and SAXS studies reveal details on the temperature-dependent, reversible mechanical properties of nonionic polymer, lipid-based complex fluids. Compositions prepared by introduction of the polymer as either a lipid conjugate or a triblock copolymer form an elastic gel as the temperature is increased to 18 C. The network is produced from PEO chain entanglement and physical crosslinks confined within the intervening aqueous layers of a multilamellar structured lyotropic mesophase. Although the complex fluids are weak gels, tuning of the gel strength can be achieved by temperature adjustment. The sol state formed at reduced temperature arises as a consequence of the well-solvated PEO chains adopting a non-interacting, conformational state. Complex fluids prepared with the triblock copolymers exhibit greater tunability in viscoelasticity than those containing the PEGylated-lipid conjugate because of the temperature-dependent water solubility of the central PPO block. The water solubility of PPO at reduced temperatures results in the polymer being expelled from the self-assembled amphiphilic bilayer, causing collapse of the swollen lamellar structure and loss of the PEO network. At elevated temperatures, the triblock reinserts into the bilayer producing an elastic gel. These studies identify macromolecular architectures for the facile preparation of dynamic soft materials possessing a range of mechanical properties that can be tuned by modest temperature control.

Millicent Firestone
Argonne National Laboratory

Date submitted: 15 Nov 2011

Electronic form version 1.4