Mechanical Properties of Peo/ Ppo/ Pluronic Interfaces

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We are studying the effect of surfactant on interface-driven motion in fluid/fluid systems using model systems composed of polyethylene glycol (PEG), polypropylene glycol (PPG), and Pluronic (PEG-PPG-PEG) triblock copolymer surfactants. Here we report on some unexpected observations of the mechanical properties of such PEG/PPG interfaces with Pluronic adsorbed on them.

Experiments were performed in a Spinning Drop Tensiometer in which a drop of PPG suspended in a matrix of PEG was spun at high speed and drawn into an elongated cylinder. A subsequent decrease in rotational speed is expected to allow the drop to retract into a sphere; indeed this was observed for surfactant-free systems. Addition of small amounts of Pluronic produced unusual behavior: the drops did not retract completely, but instead retained elongated, non-shperical shapes at the end of the retraction. This suggests that the Pluronic surfactant gives the interfaces a weak yield stress that can resist the capillary pressure driving retraction. Remarkably, this apparent yield stress occurs even at low surfactant concentrations that do not reduce the interfacial tension significantly. Similar effects are seen for a variety of Pluronic and Pluronic-R (PPG-PEG-PPG) triblocks.

Preheating the system to temperatures above 50C seems to erase this apparent yield stress altogether, suggesting that some crystallizable component in the Pluronic is responsible. Notably, the effect is seen even in liquid Pluronics that are not crystalline in their bulk state.