
Contribution ID: **138** Type: **Invited Talk**

# Complex thermodynamics, structure and dynamics of mixed surfactant "frenemies" on highly curved interfaces

Tanvi Sheth, Andrea Perez, Nairiti Sinha, David Zhao, Glenn Fredrickson, M. Scott Shell and Matthew E. Helgeson
Department of Chemical Engineering, UC Santa Barbara

Surfactant mixtures and blends are ubiquitous in industrial practice –yet little is understood about the molecular interactions they experience at fluid interfaces, and how these interactions control interfacial properties. In this talk, we report on the incredible complexity that mixed surfactants can exhibit, and our attempts to use neutrons to understand their interfacial thermodynamics, structure and mechanics to design and stabilize complex emulsion systems. We focus on relatively simple mixtures of surfactant "frenemies"–co-surfactants with homologous chemistry but dissimilar spontaneous curvature. Placing such mixtures on oil-water interfaces with nanoscale curvature (i.e., microemulsions and nanoemulsions) leads to complex vesicular structures, whose phase behavior can be readily tuned through the different spontaneous curvatures of the co-surfactant pair. Using contrast-variation neutron scattering, we demonstrate that the appearance of these structures correlates with interfacial demixing of the co-surfactants. Using a combination of experiments, theory and simulation, we provide a molecular explanation for this behavior, and use it to construct a model for the interfacial thermodynamics that simultaneously predicts the occurrence of demixing and the observed emulsion morphology phase behavior. Finally, we use neutron spin echo to show that these systems exhibit highly non-trivial interfacial mechanics, opening new frontier questions and opportunities to explore how nonideal mixing/demixing and nanoscale curvature can be used to control the mechanics of mixed surfactant interfaces.

## Topical Area

Soft matter: polymers, and complex fluids

**Author:** HELGESON, Matthew (UC Santa Barbara)

**Presenter:** HELGESON, Matthew (UC Santa Barbara)