Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Modeling of Stable Emulsions using a Diffuse Interface Model with a Surfactant Phase and Interfacial Viscosity SEAN COLBERT-KELLY, TREVOR KELLER, GEOFFREY MCFADDEN, FREDERICK PHELAN JR., NIST - Natl Inst of Stds Tech — An outstanding problem in emulsion science is modeling of binary emulsions stabilized by surfactants. The presence of surfactants alters the interfacial tension and interfacial viscosity between the two phases leading to greater emulsion stability and fine control over drop size. The surfactants are very low in overall composition, but have a dominant effect at the interface which makes the modeling problem challenging. In this study we formulate a diffuse interface model to investigate binary emulsions with a ternary surfactant component. First, we compare a number of models for the Gibbs free energy for binary systems stabilized by a surfactant phase, including a Langmuir isotherm model and a modified ternary Ginzburg-Landau formulation. The properties of these various models are compared by means of phase diagrams to derive a model that best represents the phase behavior. Then, we examine a number of models for concentration dependent interfacial viscosity. This is accomplished by studying the effects of these different models on emulsion stability looking at growth rates and growth to stable drop size. Finally, we compare droplet dynamics in some simple flow fields, looking at the effect of the models on drop size distributions.

Sean Colbert-Kelly
NIST - Natl Inst of Stds
Tech

Date submitted: 11 Nov 2016 Electronic form version 1.4