Transport of Macromolecular Species to Fluid-Fluid Interfaces and the Impact on Materials Processing and Engineering

Lynn M. Walker
Department of Chemical Engineering
Carnegie Mellon University
Pittsburgh PA

Systems involving deformable interfaces between immiscible fluids offer a significant challenge for materials design and processing. Static interfacial/surface tension is often the only parameter considered in the design of systems with fluid-fluid interfaces. In foams, emulsions, blends, sprays, electrocoalescence, droplet-based microfluidic devices, and many other applications, the dynamic nature of surface active species and deformation of interfaces requires a more detailed characterization of the interfacial transport, dynamic interfacial properties and interfacial structure. Macroscopic properties and the ability to tune and control phenomena requires an improved understanding of the time-dependent properties of the interfacial tension and interfacial mechanics. To connect to processing of interfacially-dominated materials, an understanding of the relationship between external fields and transport of surface active species is vital. We have developed tools and approaches to quantify the impact of surface active species on interfacial behavior with and without external fields. Simple surfactants at interfaces make evident the need to characterize timescales in the adsorption problem. Macromolecular species demonstrate the detailed impact of surfactant structure on transport and adsorbed layers. Polymer-grafted nanoparticles, polymer-surfactant aggregates and proteins show the ability to bridge between macromolecular and particulate (Pickering) laden interfaces. This talk will provide the motivation to use microscale interfaces for efficient analysis of complex interfacial phenomena and how that relates to the material properties of interface-dominated materials.

Biography

Lynn M. Walker is a Professor of Chemical Engineering and both Chemistry (by courtesy) and Materials Science & Engineering (by courtesy) at Carnegie Mellon University. She holds a B.S. degree from the University of New Hampshire and a Ph.D. from the University of Delaware, both in chemical engineering. She was an NSF International Postdoctoral Fellow at the Katholieke Universiteit in Leuven, Belgium before joining CMU in 1997. She has held visiting faculty positions at the Polymer IRC in Leeds, UK, and in Chemical Engineering at UCSB, and held the Piercy Visiting Professorship at the University of Minnesota. Her research focuses on quantifying the coupling between flow behavior and flow-induced microstructure in complex fluids. Current research focuses in two directions; quantifying the influence of flow on self-assembled nanostructures and controlling transport to complex fluid-fluid interfaces. She has twice been recognized for teaching by receiving the Kun Li Award for Excellence in Education from the Department of Chemical Engineering at CMU, is the 2016 recipient of the Lazarus Award for Mentoring from CMU and the 2015 WIC Mentorship Excellence Award from AIChE. She is Editor-in-Chief of *Rheologica Acta* and serves on the editorial boards of the *Journal of Rheology, Journal of Non-Newtonian Fluid Mechanics,* and *Langmuir.* She is a member of the E&PS technical advisory board at Dow Chemical, and a fellow of both AIChE and the Society of Rheology.