Experiments on Drop Coalescence

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Drop collisions and coalescence in mixtures of oil- and water-based fluids are investigated with the goals of understanding the underlying dynamics and of eventually developing accurate predictive models for applications related to transport, mixing, and separation of petroleum, chemical, and waste streams. Drops coalescing at interfaces and colliding drop pairs are examined as canonical cases. Laser induced fluorescence and refractive index matching are employed to obtain clear images of interface locations and interior volumes. Planar and tomographic PIV methods are used to examine real-time flow sequences. In the drop/interface case, coalescence occurs not upon collision, but after buoyancy-driven film thinning. The effects of neighboring drops and particles on the film rupture and drop collapse will be discussed. In the case of colliding drop pairs, coalescence occurs after significant deformation and vortex-driven induction. The effects of parametric variations will be discussed.

Bio Ellen Longmire received an A.B. in physics (1982) from Princeton University and M.S. (1985) and Ph.D. (1991) degrees in mechanical engineering from Stanford University. Prior to receiving her Ph.D., she worked as an engineer at Hauni-Werke Koerber & Co in Germany and at Honeywell and SAIC in the U.S. Since 1990, Longmire has taught and directed research in the Department of Aerospace Engineering and Mechanics at the University of Minnesota where she currently holds the rank of Professor. She uses experimentation and analysis to answer fundamental questions in fluid dynamics that affect aerospace, industrial, biomedical, and environmental applications. Recently, her work has focused on single- and multi-phase turbulent flows, liquid/liquid mixtures with surface tension, microscale flows, and biomedical flows. She serves as Associate Editor of Experiments in Fluids and Physics of Fluids, and is a Fellow of the American Physical Society.