Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Investigation of drop coalescence using tomographic PIV[1] CECILIA ORTIZ-DUENAS, JUNGYONG KIM, ELLEN LONGMIRE, Department of Aerospace Engineering and Mechanics, University of Minnesota — High-speed tomographic PIV was used to obtain evolving volumetric velocity fields of the coalescence of single drops and two side-by-side drops through liquid/liquid interfaces. Reynolds numbers ($Re=\rho_s U_\sigma D/\mu_s$) based on surface tension velocity ($U_\sigma=D/t_\sigma$) and surrounding ambient fluid were 8-10, and the viscosity ratio between the fluid drop and surrounding fluid was 0.14. The coalescence process investigated is driven by gravity and thus the initial drops are non-spherical and the interface is deformed by the drops. Previously, Mohamed-Kassim & Longmire (2004) showed that under these conditions, the film rupture typically occurs off-axis, and therefore the flow is three-dimensional. For a single drop, volumetric velocity vector fields are used to characterize the asymmetric film rupture occurring for $0<t/t_\sigma<0.1$ and the subsequent symmetric development of the velocity and vorticity fields for $0.1<t/t_\sigma<1.6$. It is shown that even though the film rupture occurs off-axis, the capillary waves and the collapse of the drop into a vortex ring are relatively axisymmetric. For two side-by-side drops, the first drop to coalesce ruptures off-axis on the side closest to the second drop. The volumetric velocity and vorticity fields indicate an asymmetric collapse of the drop for $0.1<t/t_\sigma<1.6$ due to the deformation of the interface by the second drop while the capillary waves are axisymmetric.

[1]Supported by NSF CTS-0320327.

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Date submitted: 06 Aug 2008 Electronic form version 1.4