Drop deformation and breakup in polystyrene/high-density polyethylene blends under oscillatory shear flow

Author(s): Sirivat, A (Sirivat, Anuvat)[1]; Patako, S (Patako, Sakchai)[1]; Niamlang, S (Niamlang, Sumonman)[2]; Lerdwijitjarud, W(Lerdwijitjarud, Wanchai)[3]

Source: PHYSICS OF FLUIDS **Volume:** 23 **Issue:** 1 **Article Number:** 013104 **DOI:** 10.1063/1.3541967 **Published:** JAN 2011

Abstract: Drop deformation and breakup in polystyrene/high-density polyethylene viscoelastic melt blends were investigated under the effects of viscosity ratio, the time scale ratio, and droplet elasticity under oscillatory shear flow using an optical flow cell. The deformation was studied in terms of deformation parameters, Def*=a*-c/a*+c, where a* and c are the apparent drop principal axes and the minor axes of the droplets as measured from the time series of images. Amplitudes of deformation parameters are defined as the difference between the maximum and minimum values divided by two. The amplitudes increase linearly at small capillary number and nonlinearly at large capillary number, where the capillary is defined as the ratio between the matrix viscous force and the interfacial tension force. The deformation amplitude parameters decrease with increasing viscosity ratio, time scale ratio, and elasticity at any fixed capillary number. Drop breakup patterns observed are the nonsymmetric one-end tearing pattern for the system with a lower viscosity ratio and the two-end stretching and twisting for the system with a higher viscosity ratio. The critical capillary number increases with viscosity ratio but varies slightly with the time scale ratio. (C) 2011 American Institute of Physics. [doi:10.1063/1.3541967]

Addresses:

1. Chulalongkorn Univ, Conduct & Electroact Polymers Res Unit, Petr & Petrochem Coll, Bangkok 10330, Thailand
2. Rajamangala Univ Technol Thanyaburi, Fac Engn, Dept Mat & Met Engn, Phatumthani 12110, Thailand
3. Silpakorn Univ, Fac Engn & Ind Technol, Dept Mat Sci & Engn, Nakhon Pathom 73000, Thailand