Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Study of the behavior of rising bubbles in a Boger-type fluid J.R. VELEZ-CORDERO, D. SAMANO, R. ZENIT, Universidad Nacional Autonoma de Mexico — Particle aggregation is a common phenomenon observed in viscoelastic multiphase flows. In this work a new effect has been observed to occur in monodispersed bubbly flows in a Boger-type fluid. It was found that the dispersion of bubble changes dramatically depending on the bubble size: if the diameter of the bubbles is small, large vertical clusters are formed; on the other hand, the bubble assembly rises in a dispersed manner if the bubble size is increased. To understand the condition for which agglomeration occurs two additional experiments were conducted: the interaction of two side-by-side bubble chains was analyzed; and, the unsteady behavior of the first normal stress difference was studied in a rheometric flow. These analyses suggest that there is a process of accumulation of elastic stress; when the accumulated elastic stress surpasses the viscous repulsive stress, aggregation can occur even at supercritical speeds. Interestingly, the two bubble diameters tested in the bubbly flow experiments are above and below the critical diameter for which the velocity of an isolated bubble becomes discontinuous, the so-called bubble velocity discontinuity. This suggests that the bubble dispersion improvement could result from the modification of the gas-liquid interface.

Roberto Zenit
Universidad Nacional Autonoma de Mexico

Date submitted: 05 Aug 2011 Electronic form version 1.4