Surfactant effect on the multiscale structure of bubbly flows

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Abstract:
Small amounts of surfactant can drastically change bubble behavior. For example, a bubble in aqueous surfactant solution rises much slower than one in purified water. This phenomenon is explained by the so-called Marangoni effect caused by a nonuniform concentration distribution of surfactant along the bubble surface. In other words, a tangential shear stress appears on the bubble surface due to the surface tension variation caused by the surface concentration distribution, which results in the reduction of the rising velocity of the bubble. More interestingly, this Marangoni effect influences not only the rising velocity, but also the lateral migration in the presence of mean shear. Furthermore, these phenomena influence the multiscale nature of bubbly flows and cause a drastic change in the bubbly flow structure as shown in Fig.1. In this talk, related to these interesting multiscale structures, bubble clustering phenomena in upward bubbly channel flows are discussed with the emphasis on the detail description of a single bubble behavior influenced by the surfactant adsorption/desorption kinetics on the bubble surface.

Reference:

Fig. 1  Multiscale structure of bubbly flows in aqueous surfactant solution