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Influence of surfactant conditions on the structure of an upward bubbly channel flow TOSHIYUKI OGASAWARA, SHU TAKAGI, YOICHIRO MATSUMOTO, Dept. of Mechanical Engineering, The University of Tokyo — We investigated an upward bubbly channel flow and the effects of surfactant on its flow structure experimentally. 3-Pentanol and Triton X-100 are used as surfactants. By the addition of small amount of surfactant, bubble coalescences are prevented and mono-dispersed 1mm spherical bubbles are obtained. Under all of our experimental conditions, the added surfactants do not influence the single-phase turbulence. On the other hand, small amount of surfactant drastically changes the whole flow structure of bubbly flow. On the low concentration of 3-Pentanol (21-63ppm), bubbles strongly migrate towards the wall and these highly accumulated bubbles on the wall form crescent-like shaped horizontal bubble clusters of 10-40mm length. However, in 3-Pentanol solution of higher concentration ($\sim$168ppm) or in the 2ppm Triton X-100 solution, the tendency of the lateral migration of bubbles is weaken and the bubbles are distributed uniformly in the channel. In the surfactant solution, the slip velocity on the bubble surface retards and the bubble rising velocity decreases (Marangoni effect). The change of boundary condition on the bubble surface affects not only drag force but shear-induced lift force. It is indicated that this change of shear-induced lift force greatly relates to the lateral migration of bubbles and the disaggregation of the bubble clusters. We also measured the turbulent properties using LDV and discuss the flow structure.

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