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**Improvement for efficiency of frictional drag reduction by repetitive bubble injection** YUJI TAsAKA, YUICHI MURAI, HYUN-JIN PARK, YUKIHIRO TOHGE, Hokkaido University — Repetitive bubble injection was examined for promoting frictional drag reduction by bubbles based on idea of “resource allocation” and voidage waves formed in a horizontal bubbly channel. Gain factor, which is defined as the ratio of degree of the drag reduction by the mean void fraction of bubbles,  $\alpha$ , showed dramatic improvement on the efficiency of the drag reduction in comparison with continuous bubble injection at the same  $\alpha$ . This improvement is prominent at small void fractions at which the continuous bubble injections enhance the frictional drag. Simultaneous recording of advecting bubbles with measurements of shear stress profiles at the channel wall indicated that preceding large bubbles provide great drag reduction and following small, low concentration bubbles don’t affect the frictional drag. Namely the bubbles as a limited resource are efficiently used for the drag reduction in the repetitive bubble injection.

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