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Frictional Drag Reduction by Bubbles in Taylor-Couette Flow YUICHI MURAI, Hokkaido University, HIROSHI OIWA, Japan Atomic Energy Agency, YASUSHI TAKEDA, Hokkaido University — Frictional drag reduction provided with small bubbles is investigated experimentally using a Couette-Taylor flow system, i.e. shear flow between concentric cylinders. Torque and bubble behavior are measured up to Re=4500 when air bubbles are injected constantly and rise through the cells. Silicone oil is used for avoiding uncertain interfacial property of bubbles as well as for keeping nearly mono-sized bubbles. We assess the effect of drag reduction with two types of evaluation factors, i.e. sensitivity and power gain. The sensitivity exceeds unity at Re<2000, proving that the drag is reduced more than the drop of mixture density. This originates from accumulation of bubbles into the rotating inner cylinder, which is little affected by turbulence. The power gain, which is defined by drag reduction power per bubble injection power, takes the highest value of O(10) at higher Re numbers around 2500. The image processing measurement finds this reason to be disappearance of azimuthal waves when the organized bubbles distribution transits from toroidal to spiral modes. Moreover, the axial spacing of bubble clouds expands during the transition, enforcing the reduction of momentum exchange.

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