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Mode transition in bubbly Taylor-Couette flow KOJI YOSHIDA, YUJI TASAKA, YUICHI MURAI, YASUSHI TAKEDA, Hokkaido Univ. — The frictional drag acting on cylindrical surfaces in Taylor-Couette flow is significantly reduced by injection of small bubbles. This results in delayed mode transitions from the original scenario in pure fluid. In our study, the relationship between the drag reduction and the change of vortical structure is successfully measured by particle tracking velocimetry. In this system, three major patterns of bubble distribution are observed depending on Re numbers and gas flow rate; i.e., uniform, toroidal, and spiral modes. We found that the power gain of the drag reduction gets largest when the toroidal and the spiral modes coexist. Furthermore, Taylor vortex bifurcates and a pair of vortices coalesces when the flow switches between these two modes in time. Through this experiment, we can grasp how the bubbles affect the vortices to restrict the momentum exchange in the shear layer during the two-way interaction between two phases. This will yield to new universal understanding of drag reduction by means of small amount of bubbles.

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