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Bubble Trapping in Two-Phase Wakes from Upward Adiabatic Liquid-Gas Flow Around a Cylinder DOHWAN KIM, MATTHEW RAU, The Pennsylvania State University — The two-phase wakes that form downstream of a cylinder in crossflow with a liquid-gas mixture contain complex distributions of single-phase and concentrated bubbly flow. We conducted a high-speed visualization experiment to characterize these wakes using a water-air mixture and liquid Reynolds numbers (Re) ranging from 100 to 3,000, based on a cylinder diameter of 9.5 mm, and air superficial velocities ranging from 0.061 to 0.614 m/s. By introducing a low concentration of isopropyl alcohol into the water, we altered the surface tension of the solution to create mean air bubble diameters of 4, 1, and 0.5 mm. We calculated the mean bubble diameter and bubble velocity using image processing methods and Particle Tracking Velocimetry (PTV). The mean shadow fraction and time-averaged PTV results showed that the single-phase wake region decreased in size with increasing Re. The same results suggested that bubbles were trapped in the wake as Re exceeded 2,000; however, bubble Stokes numbers did not consistently predict the trapping phenomenon. Instead, the lift-to-drag ratio, which compares a ratio of inertial to buoyancy forces and a ratio of trapping velocities, consistently predicted the occurrence of bubble trapping throughout the experimental parameter ranges.

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