Experimental study on breakup of a single bubble in a stirred tank: Effect of gas density and liquid properties

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Abstract

Bubble breakup plays an important role in gas-liquid flows, but detailed studies are still scarce. In this work, the breakup behavior of a single bubble in a stirred tank was experimentally studied with a high-speed camera, focusing on the effect of gas density, liquid properties, agitation speed and mother bubble size. The bubble breakup time, breakup probability, breakup rate and daughter bubble size distribution were determined. The internal flow phenomenon inside a deformed bubble was studied in detail, which accounted for the effect of gas density or operating pressure. The results showed that with increasing gas density, agitation speed, mother bubble size and decreasing surface tension, the bubble breakup rate and probability of equal-size distribution significantly increased. With increasing liquid viscosity, the bubble breakup rate decreased especially in the high viscosity range. An M-shaped daughter bubble size distribution was observed, which was consistent with our previous bubble breakup model.

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