Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

An experimental study on the unsteady characteristics of a bubble plume[1] HYUNSEOK KIM, Seoul Natl Univ, HYUNGMIN PARK, Seoul National University — Despite increasing importance of the unsteady flow characteristics to understand bubble plume dynamics, most of the previous studies have mainly focused on averaged parameters and 1D integral plume model. In the present study, we measured velocities for both gas and liquid phases at high volume flow rate and high volume void fraction (>5%) using laser doppler anemometry and digital image processing, and investigated the turbulence characteristics of bubble plume. We considered two types of bubble plume: regular bubble plume and irregularly pulsating bubble plume (same volume flow rate with regular bubble plume but shows more dynamic motion). In the conventional 1D plume model, bubble plume motion was treated as being only determined by gas flow rate. However, we found that at small injection area, bubble plume shows more irregular and dynamic motion and it determines the induced liquid flow. With more irregular bubble plume motion (higher fluctuation velocities of gas phase), liquid flow shows a slower development and higher turbulence kinetic energy. Also, we examined two important spatial length scales, radius of bubble plume and induced liquid plume. While mean and root-mean-squared velocities were scaled by induced liquid plume radius, integral time scale and tendency of velocity spectra described readily by scaling with bubble plume radius.

[1]Supported by NRF grant (2017M2A8A4018482, 2020R1A2C22014510) of Korea government.

Hyunseok Kim
Seoul Natl Univ

Date submitted: 12 Aug 2020 Electronic form version 1.4