Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

A numerical study on the effect of the bubble diameter on the mass transfer in bubbly plumes XIAOBO GONG, SHU TAKAGI, Department of Mechanical Engineering, The University of Tokyo, HUAXIONG HUANG, Department of Mathematics and Statistics, York University, YOICHIRO MATSUMOTO, Department of Mechanical Engineering, The University of Tokyo — A numerical simulation has been conducted for studying the effect of bubble diameter on the mass transfer efficiency and the concentration distribution of the dissolved gas in a bubbly plume. The numerical method for describing the bubbly plume with mass transfer was developed in an Euler-Lagrange way. The Navier-Stokes equation was adopted for the movement of the liquid phase. The motion of bubbles was tracked individually. The interaction between the liquid and bubbles were considered with a two-way coupling method. The model for the correlation of the dissolution and diffusion of the gas and the translational motions of bubbles with mass loss was introduced. The oxygen bubble plume in a quasi two dimensional rectangular water tank was simulated and studied. The numerical results show that the mass transfer efficiency non-linearly deceases with the increase of bubble diameter. Optimal bubble diameter exists for the mass transfer with a given tank size. The bubble diameter distribution of a certain range does not clearly affect the mean mass transfer efficiency. However, the mixing of different sizes of bubbles improves the uniformity of the concentration distribution in the flow field.

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Date submitted: 03 Aug 2005 Electronic form version 1.4