Estimation of Gas Holdup in Three-Phase Fluidized Bed Containing Small or Low Density Particles [16pt/Centering/Boldface]

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A mechanistic model based on the drift line created by a spherical bubble passing through a liquid is developed to predict the gas holdup in gas-liquid-solid three-phase fluidized beds containing small or low-density particles. In the model development, the drift line calculated from stream function for the three-dimensional case is used to predict the mean liquid rise path in the bubble street. The gas holdup can be estimated from the mean bubble rise velocity obtained by the sum of the following: the single bubble rise velocity, the mean liquid velocity calculated from the mean liquid path, the gas velocity in the bubble street, and the liquid velocity. Agreement between the calculated and measured values of gas holdup is fairly good using the correction factor. Also agreement of the calculated values of gas holdup with the measurements in the bubble column is good using a constant correction factor of around 0.7. [9pt/Boldface]

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Introduction [10pt/Boldface]

[10pt] Gas-liquid-solid fluidized bed systems have been widely applied to many biotechnological processes such as fermentation and aerobic wastewater treatment in which very small particles and/or light particles whose densities are very close to those of the liquid media are contained. Previously, however, most research was concerned with three-phase fluidized beds of glass beads, alumina particles, etc., of which the densities were more than 2500 kg/m3 (Muroyama and Fan, 1984). One of the most important is the gas holdup necessary to predict the interfacial area. Bhatia and Epstein (1974) developed the generalized wake model. To estimate the gas holdup using this model requires two unknown parameters which are quitedifficult to obtain experimentally: the ratio of the solids holdup in thewake to that in the liquid-solid fluidized bed region and the ratio of the wake volume to the bubble volume for a multibubbles system. In calculations using the wake model, a potential difficulty exists in the estimation of the gas holdup for the model. Therefore, many empirical correlations for the gas holdup were proposed and the effect of particle size on the gas holdup was described (Muroyama and Fan, 1984).

In the present study, apart from the generalized wake model, we will propose a model based on the drift line created by a bubble passing through a liquid; we call it the drift line model. From the drift line model, the mean bubble rise velocity can be calculated. Concerning this mean bubble rise

velocity, a new approach for the calculation of the gas holdup is demonstrated for the study of the hydrodynamic characteristics of gas-liquid-solid fluidized bed systems containing small or low density particles.

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1. Theoretical Model [10pt/Boldface]

1.1 Mean liquid rise path created by a bubble passing through a liquid [10pt]

As shown in Fig. 1 (Joshi and Shah, 1981), in a bubble column, the upward liquid flow at the center of the column and the downward flow near the wall, namely the liquid circulation flow, can be found.

※　英語所属記載上の注意点

岡山理科大学の所属が複数続く場合には、大学名及び住所の部分は、最後の所属にのみ記載して下さい。例えば、応用数学科と修士課程応用数学専攻の所属を続けて書く場合には、以下のようになります。

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