The 29th International Symposium on Chemical Engineering, December 2-3, 2016,
Sheraton Grande Ocean Resort, Miyazaki, Japan

Effects of increase in volume of fluidizing gas on the bubble behavior of a bubbling fluidized bed

Hidekazu Miyata, Takami Kai, Tsutomu Nakazato

Abstract

The correlation of bubble size in fluidized beds has been actively studied to estimate the contact interface area in the past. However, these correlations are not adequately applied in the design of reactors [1]. One of the reasons is that all the correlations ignore the change in mole number, although many industrially useful reactions are accompanied with mole number change [2]. In this study, the water vapor evaporation method is used to expand the fluidizing gas volume. The effect of gas volume increase on the bubble behavior was examined base on the experimental data by distinguishing this effect from the change in gas and particle properties [3]. Assuming that the bubble eruption at the bed surface is a dominant factor of the pressure fluctuation, it is considered that the frequency of the pressure fluctuation represents the frequency of the bubble eruption and the deviation of the fluctuation reflects the bubble size. For this reason, the frequency and deviation of the pressure drop fluctuation were analyzed.

Fig. 1 shows the results of the wavelet transform of pressure fluctuations under the conditions of increase in gas volume and constant gas volume. Fig. 1 (a) and (b) were the results when the gas velocity was constant. The superficail gas velocity, U_G, was 4 cm/s for the former and 9 cm/s for the later. Although the intensity of the power of higher frequency decreased with increasing gas velocity, the wide distribution of the frequency intensity is observed in both the spectrum. Therefore, it is considered that the bubble size distribution shifted to the larger size. On the other hand, the intensity of the frequency larger than 7 Hz was hardly observed when gas volume increased as shown in Fig.1 (c). This is considered that the small bubbles disappeared.

When the gas volume increase was gradual, bubble size distribution was had equilibrium distribution. On the other hand, when the gas volume increase was rapid, the rate of bubble coalescence was higher than that of bubble splitting. Consequently, bubble size distribution shifted to larger size than equilibrium distribution at that gas velocity.

Reference

[1] Levenspiel, O., *Ind. Eng. Chem. Res.*, **47**, 273–277 (2008).
[2] Kai, T., J. Horinouch, T. Takahashi, *J. Chem. Eng. Japan*, **42**, s137–s141 (2009).
[3] Kai, T., S. Furusaki, *J. Chem. Eng. Japan*, **19**, 67–71 (1986).

Department of Chemical Engineering, Kagoshima University,
Kagoshima 890-0065, Japan

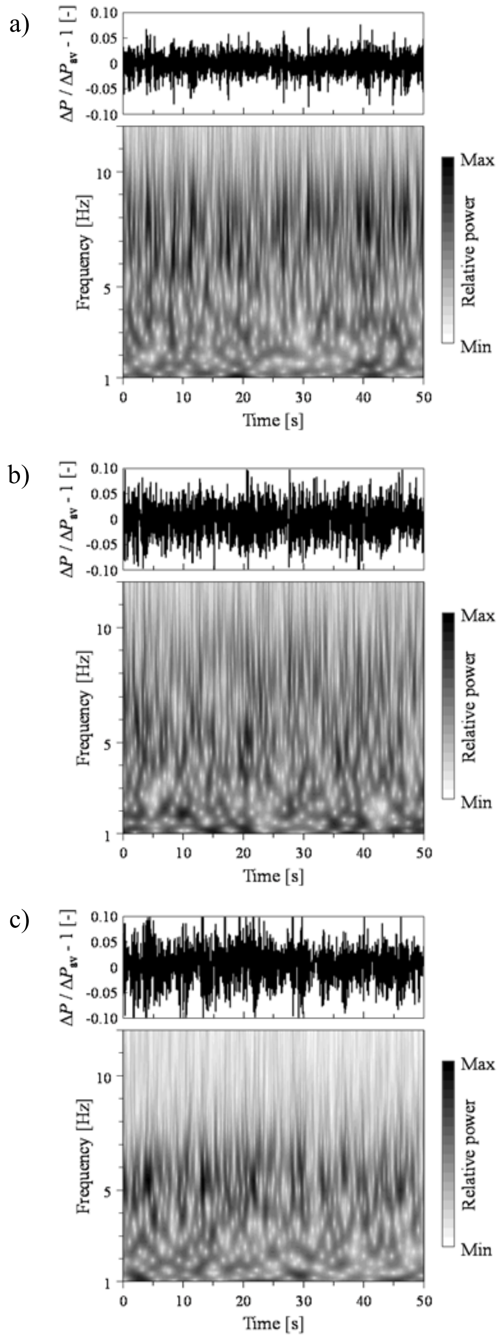

Fig. 1 Wavelet transform of pressure fluctuation signals: (a) U_G = 4.0 cm/s; (b) U_G = 9.0 cm/s; (c) U_{Gin} = 4.1 cm/s, U_{Gout} = 8.8 cm/s.