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Heat Transfer between Gas and Particle in Fluidized-Bed

Masaru KOBAYASHI*

There are two methods to predict the numerical value of coefficient of heat transfer between gas and particles in fluidized bed, namely the steady state method and unsteady state heating method. The coefficient varies with the particular experimental method used in its determination. On this research, with the unsteady state method the out-let gas temperature recovery time is measured.

While many works have been done on the subject of heat transfer using both of these methods in recent years, the experimental values reported do not coincide with each other. Especially the values differ markedly for the two methods.

The present research was carried out using the unsteady state heating method. This research aims to 1) determine the proper value of heat transfer coefficient, 2) investigate the basic mechanism of heat transport phenomena in fluidized bed, 3) find the correlation between the two methods. In this study a new equation for calculating the heat transfer coefficient is formulated, assuming that the mechanism of transport phenomena is basically identical for the two experimental methods.

The followings are the conclusions drawn from the present research; 1) the marked difference between the experimental values of the coefficient for the two methods can be explained. 2) a short zone above a distributor controls the heat transport phenomena. 3) the heat transfer depends on the time factor of fluidized bed. 4) the lines obtained on a log-log diagram having Nu on Y-axis and Re on X-axis using particle diameters as parameter are parallel to each other. 5) the effect of the shape of distributor on heat transfer is very slight.

As to the behavior of fluidization, several works have been done only on an upper part of fluidized beds, but not on the bottom part, especially not on a short zone above the distributor which controls the heat transport phenomena. In this investigation the pressure fluctuation in this zone was measured. In all previous works reported by other works only the average sizes and their rising velocities have been predicted between two observing points. However it is possible to estimate the bubble size and its velocity at any point using the pressure gradient. By this way the behavior of zone near the distributor can be observed. It is observed that the bubbles on a plate with many holes are not formed in spherical shape at the outbreak.

*小　林　　勝