CHAPTER I
INTRODUCTION

Fluidization is an operation by which fine solids are transformed into a fluid-like state through contact with a gas or liquid. Intense solid mixing and good gas-solid contacting create an isothermal system having good mass transfer. The fluidization is an ideal operation for chemical reactions, drying, mixing and heat transfer. Although fluidized beds are used in various industrial operations, the gas-solid contact in fluidization is not well understood. Since many properties of fluidized beds are related directly to the presence of bubbles, the study of the flow pattern for describing the contact between gas and solids in the fluidized bed is practically important. The accurate prediction of the bubble characteristics such as the rise velocity of a single bubble, the bubble size and the bubble frequency, is necessary for the design of a fluidized bed.

One of the most characteristic phenomena of fluidized beds is the formation of gas bubbles. Many properties of the fluidized beds are strongly influenced by the size distribution and the time for generating the bubbles in the fluidized bed. Therefore, it is important to understand the mechanism of the bubbles generated at the distributor in a fluidized bed. Some studies of bubbles in the industrial equipment use a transparent two-dimensional fluidized bed to generate the bubbles at an orifice submerged in the solids. When gas is blown through an orifice in the incipient fluidization, bubbles form and rise to the upper surface of the bed. To describe the properties of bubbles, the bubble properties in the fluidized bed are compared to the bubbles in an inviscid liquid of zero surface tension because the solids are in the fluidized state. The rise velocities of single bubbles in liquid of infinite extent are used as a basis for the rise velocities in the fluidized bed. The sizes of the bubbles from the experiment are used for calculating the time for bubble generation from the mass and momentum balances. The bubbles generating time and the bubble sizes at the different gas flow rates are used to design the distributor. The rise velocities of a single bubble and a continuous swarm of small bubbles are used to determine the time that the gas in the bubbles contacts the solids in the fluidized bed.

In this thesis, the research is focused on an aggregative fluidized bed, which is considerable importance in the industrial catalytic reactors. The rise velocity and the volume of the bubble are investigated in a two-dimensional bed located between two narrow transparent plates. The movement of the bubbles is recorded by a video camera to display the size and velocity of the bubbles. The movement of the gas in the fluidized bed is expressed by the gas streamlines that are computed by the finite element method using FORTRAN PowerStation 4.0 programming language.