Particle Ejection Velocity Distribution from 2D Bubbling Fluidized Bed

by
D. Santana*, S. Nauri, A. Lecuona, J. Nogueira

Universidad Carlos III de Madrid
Área de Ingeniería Térmica
Avda. de la Universidad 30, 28911 Leganés, Madrid, Spain
*Corresponding author: dsantana@ing.uc3m.es

ABSTRACT

One of the most important problems of fluidized beds is the entrainment and/or elutriation of particles. Entrainment and elutriation are technical terms used interchangeably to describe the loss of inert particles and/or fuel in a fluidized bed system. Normally, entrainment is the carryover of large ejected particles by the gas flow field, and eventually, the particles will fall back to the bed surface because of their high terminal velocities. Elutriation is normally used to describe the fractional carryover of finer particles when the bed particles size distribution is wide.

A two-dimensional non-reacting fluidized bed 1m wide was constructed with the aim to measure the origin of particles ejected and the initial particle velocity distribution in a freely fluidized bed with fine and coarse sand particles. The bubble ejection mechanism was observed taking into account not only the origin of particles ejected but also the initial particle velocity distributions as well as the effect of other neighboring exploding bubbles. Images for different bubble eruption mechanism were selected, both isolated and affected by other exploding bubbles.

A high resolution and highly accurate PIV technique, named Local Field Correction Particle Image Velocimetry (LFC-PIV), has been used to obtain the initial particle velocity distribution from high speed video recorded digital images, using cross correlation. As we will comment later, the initial particle velocity spatial distribution at the bed open surface is crucial for the accurate prediction of the particle trajectory in the freeboard and to determine the maximum height attained by the ejected particles. It is believed that the initial particle velocity direction has a distribution with respect to the vertical direction.