Kaliyaperumal, Sureshkumar, MESc, “Fluidization of nano and submicron powders under mechanical and acoustic vibration”, The University of Western Ontario, September 2004 (co-supervisor: L. Briens and S. Rohani).

Abstract

The fluidization characteristics of very fine powders (nano and sub-micron powders) were studied in a two different fluidized beds namely a vibro-fluidized bed and a sound assisted fluidized bed. It was found that by adopting both methods, the quality of fluidization was increased significantly. A comprehensive experimental finding of each method was discussed.

The fluidity of nano and sub-micron powders was studied in a vibro-fluidized bed. The effect of frequency, amplitude of vibration and the corresponding changes in fluidization characteristics such as minimum fluidization velocity, bed pressure drop, bed expansion, and agglomerate size were extensively tested. It was found that vibration increases bed pressure drop, bed expansion and minimized the minimum fluidization velocity. The size of the agglomerates was found to be reduced by increasing the intensity of vibration. In general, for nano particles a more homogenous fluidization at a relatively lower gas velocity was achieved by using vibration. For sub-micron powders the quality of fluidization was increased, however they cannot be fluidized completely by using vibration.

The effects of sound on fluidization behaviour of nano and sub-micron powders were extensively investigated with respect to minimum fluidization velocity, bed pressure drops and bed expansion. In general, sound vibration leads to a decrease in minimum fluidization velocity, an increase in bed pressure drop and bed expansion. Varying the sound pressure level leads to dramatic changes in quality of fluidization. However, at least a minimum sound pressure level of 110dB is necessary to initiate the fluidization. The resonance frequency is found to be at 120hz where the fluidization quality is the best. Additionally in this work, a novel technique was used to find the apparent minimum fluidization velocity from pressure drops signals.