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Experimental study on the characteristic mixing time of solids and its link with the lateral dispersion coefficient in bubbling fluidized beds

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Abstract

An experimental relation between the characteristic mixing time of solids and the lateral dispersion coefficient in a bubbling fluidized bed is established in this work. To do that, experiments were carried out in a pseudo-2D fluidized bed using glass beads as bed material. The glass beads have the same density and diameter but half of them are painted in black to make them distinguishable. At the beginning of each experiment, the particles were placed in a completely lateral segregated state and then the fluidizing air was suddenly injected while images were recorded. The images were processed to obtain the mixing index evolution with time. Two different regions where differentiated in the evolution of the lateral mixing with time: a region dominated by convective mixing and a region governed by diffusive mixing. Both the start-up time and the total solids mixing time were characterized. The total solids mixing time was found to have a potential relation with the excess gas velocity and it was found to be independent of the particle size. This total solids mixing time was compared to the residence time of the bubbles in the bed and it was showed that the axial solids mixing is two orders of magnitude faster than the lateral solids mixing. This result justifies the use of the 1D Fickian-type diffusion equation to fit the experimental data of the mixing index obtaining the values of the lateral dispersion coefficient. Finally, the experimental values of the total solids mixing time were com-

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