SIMULATION OF FUEL PARTICLES MOTION IN A 2D FLUIDIZED BED USING A HYBRID-MODEL CONSIDERING WALL FRICTION

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The mixing of fuel particles is a key issue on the performance of fluidized bed reactors. In this work, the motion of a non-reactive fuel particle in a 2D bubbling fluidized bed at ambient conditions is simulated employing a hybrid-model. The hybrid-model, implemented in the code MFIX, simulates the dense and gas phases using a Two-Fluid Model (TFM) while the fuel particles are modeled using a Discrete Element Method (DEM). The importance of the present hybrid-model is that the interaction of the continuum phases with the fuel particles behavior is fully coupled.

In a previous study, Hernández-Jiménez et al. (1) compared the fuel particles motion obtained from the simulation with experimental results measured in a cold 2D fluidized bed by Soria-Verdugo et al. (2, 3). The simulation results related to the location of the fuel particle in the bed were similar to the experimental data (Figure-1). Nevertheless, some discrepancies were found in important parameters such as the circulation time of the fuel particles. These discrepancies were associated to the overprediction of the simulated solids velocity. In the present work, in order to improve the accuracy of the simulated fuel particle motion in a bubbling fluidized bed, a friction term accounting for the effect of the walls of the bed on the continuum solid phase is introduced in the hybrid-model, as proposed by Hernández-Jiménez et al. (4). According to the results, prediction of the fuel circulation time is clearly improved when the friction term is included in the simulation (Figure-2).

REFERENCES

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FIGURES AND TABLES OF THE ABSTRACT

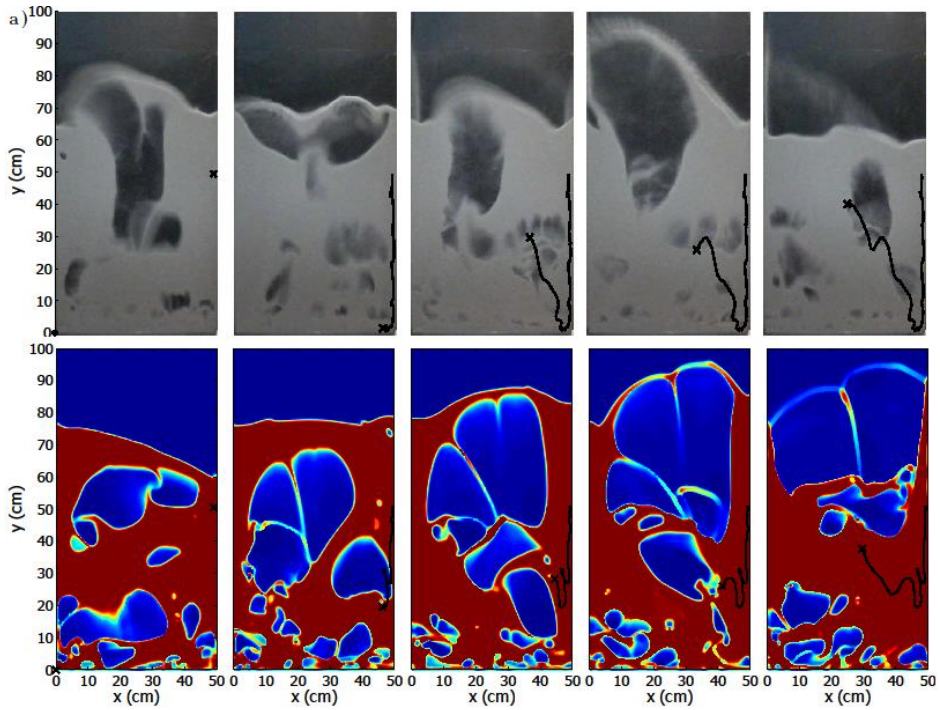

Figure-1. Path followed by a fuel particle in a 2-D fluidized bed obtained experimentally (upper row) and simulated with the hybrid-model (lower row). The path followed by the fuel particle in its sinking and rising process in a 2D fluidized bed showed qualitative good agreement between the experimental data and the simulation results.

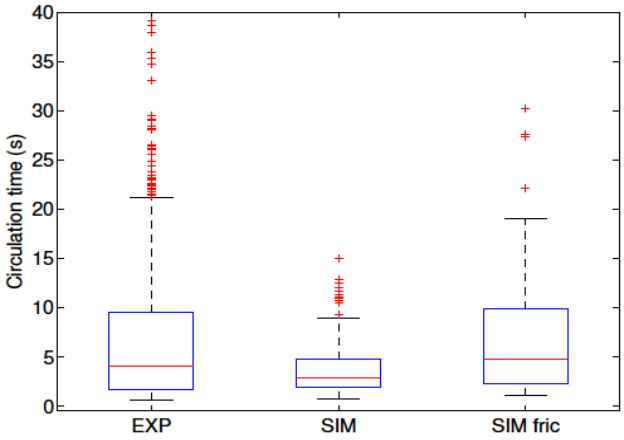

Figure-2. Box plot of the circulation time of fuel particles for the experimental data (EXP) and the simulation results neglecting (SIM) and considering the friction model (SIM fric). As can be seen, the friction model improves considerably the simulation results.