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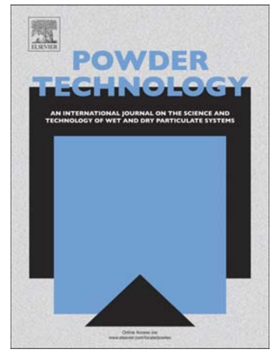

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Hydromechanical Simulation of a Bubbling Fluidized Bed Using an Extended Bubble-based EMMS Model

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Abstract: The meso-scale structure has an obvious influence on gas-solid two phase flow in a bubbling fluidized bed and subsequently affects its heat and mass transfer performance. To accurately simulate the hydromechanical behavior in the bubbling fluidized bed, the influence of the meso-scale structure on gas-solid flow must be reasonably described. In this work, the pressure-drop balance equation is introduced into an original bubble-based energy-minimization multi-scale (EMMS) model to establish a new gas-solid drag model. Compared with previous studies in which the heterogeneous drag force was artificially set at less than the conventional Wen & Yu drag force, a novel solving strategy is proposed to explain this phenomenon that will give a general method to determine the relationship between heterogeneous and conventional drag forces. Moreover, the dynamic evolution processes of the emulsion phase and bubble phase with the increase of the overall voidage (ε_g) are clearly revealed by the model solution. Eventually, the present drag model is integrated into a computational fluid dynamics (CFD) solver by user defined functions (UDFs) to simulate the hydromechanical behavior of a bubbling fluidized bed with Geldart A particles. The simulation results give higher accuracy with respect to the reported experimental data