

Mathematical modelling of wet fluidization

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The presence of liquids in particle suspension is a feature of many industrial fluidization processes, for example, oil-wet catalyst are undesirably produced in high temperature FCC units, solutions are sprayed into fluidized bed for particle coating, and liquid tar is produced in biomass thermal conversion. In a slightly wet and dense suspension, the liquid bridges between particles result in the reduction of interparticle friction (lubrication) by switching the frictional contacts to fluid shear resistance, while collisional contacts dissipate energy in the liquid bridges and particles.

This work will present experimental evidence on the critical effects of liquid presence on the hydrodynamics of a dense bubbling fluidized bed reactor. A new constitutive equation for the particle stress tensor that allows for the descriptions of the interaction between slightly wet particles will be discussed.