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The Role of Cohesive Forces on the Fluidization Behavior of Fine Powders

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Gas-fluidized beds are suspensions of particles in an upward gas flow. They display three main regimes of behavior: bubbling, fluidlike, and solidlike. At large gas velocities there is a continuous bubbling process in which the bed looses memory of previous states. If the gas velocity is decreased below a critical value bubbles disappear and the bed acts as a low viscosity liquid. Due to interparticle attractive forces, particles aggregate and aggregates interact hydrodynamically with the gas. By means of settling experiments we characterize aggregates. Optical probe measurements reveal the existence of mesoscale pseudoturbulent structures, responsible for an enhanced effective diffusion process, and short-lived voids. As the gas velocity is decreased there comes a point at which aggregates are brought together to a loose packing structure and the bed gets a solidlike appearance. The extension of the fluidlike regime decreases as particle size is increased and shrinks to zero when the particle weight is comparable to the interparticle attractive force.

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