EFFECT OF PRESSURE AND GAS VELOCITY ON RESIDENCE TIME OF PARTICLES SUSCEPTIBLE TO ENTRAINMENT IN GAS-SOLID FLUIDIZED BEDS

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In relation to pressurized fluidization processes such as oxyfuel coal combustion, understanding the influence of pressure on bed hydrodynamics and in turn their effect on parameters including feed residence time and entrainment rate is essential. The main focus of the work presented here was to evaluate the impact of pressure and gas velocity on particle elutriation rates and residence times. Experiments were conducted under cold flow conditions in a pilot-scale pressurized fluidized bed with an inner diameter of 0.15 m. The bed material was relatively large glass beads (0.8 to 1.2 mm in diameter) while the feed material was simulated with smaller glass beads (37 to 106 micron in diameter), susceptible to entrainment. Operating pressures and fluidization velocities tested were between atmospheric and 1200 kPa(a) and 0.4 and 1.1 m/s, respectively. Preliminary experiments carried out in batch mode resulted in particle elutriation rates increasing with fluidization velocity in a power law relationship. To simulate coal combustors, experiments were then conducted in a continuous mode where the finer material was continuously fed to the fluidized bed of large particles over a desired period of time, without recycling of fines. This work thus presents particle entrainment results for both batch and continuous operations.