Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Power dissipation and fluidization in a vibrated/stirred granular flow JAMES GILCHRIST, KENNETH FORD, HUGO CARAM, Department of Chemical Engineering, Lehigh University — We investigate flow of powders within a model high shear granulation process. High shear granulators typically produce flow by sweeping a pitched bladed under a granular bed at high rotation rates, providing both fluidization from upward lift from fast moving blades and flow in a circular motion. In our experimental setup, we partially decouple the fluidization and circulation by independently vibrating and stirring a deep granular bed. Without stirring, vibration begins to fluidize the bed when the Froude number, $Fr > 1$. By attaching an accelerometer to the vessel, we measure the resulting time of flight. The deep granular bed primarily behaves as a solid mass at moderate Fr, and we compare the accelerometer data to a simple model of a bouncing mass on a spring. The stirring mechanism allows measurement of the power required to maintain a constant rotation rate. Without vibration, the power draw is linearly related to the rotation rate. At high Fr, the power requirements for stirring the fluidized bed decrease dramatically. At intermediate Fr, we observe a transition between dense granular flow and fluidized granular behavior with increased vibration and stirring by monitoring the power requirements for stirring. This transition marks the boundary between dense granular flow and fluidized granular flow, and suggests the degree to which stirring influences bulk fluidization.

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Date submitted: 07 Aug 2006 Electronic form version 1.4