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Title - The Study of Magnetically Assisted Fluidization in Microgravity and Variable Gravity: Simulation and Experiment

Abstract. Fluidized bed reactors provide an ideal solution for mass transfer limited chemical reactions such as oxidation of solid wastes. Conventional fluidized beds require a constant gravitational restoring force to counterbalance fluid dynamic forces. In the Magnetically Assisted Gasification (MAG) process currently under development, the use of magnetic fields and susceptible media provide the basis for fluidized bed combustion and gasification reactions under a variety of gravitational environments, including microgravity. Magnetic forces are created in the interaction between a magnetic field and fluidization particles containing ferromagnetic material. The fields are conveniently oriented in the direction of or in opposition to other major forces acting on fluidization particles, including: buoyancy, gravity and drag. By manipulation of the intensity of the magnetic field, a simulated gravitational restoring force can be provided under a range of gravity conditions. In this paper we present a complex theoretical fluid-dynamic model describing behavior of the Magnetically Assisted Fluidized Bed (MAFB) in non-homogenous magnetic and fluid flow fields. Fluid (water) and particulate phases (custom made ferromagnetic beads) are represented as two interacting continua. The numerical solution of the model is fitted to the experimental laboratory data obtained at 1g. Currently we are preparing a demonstration experiment to be performed on-board the KC135A at gravity conditions ranging from 0g to 2g. The results of these tests will also be discussed.