FLUIDIZATION OF NANOPARTICLES

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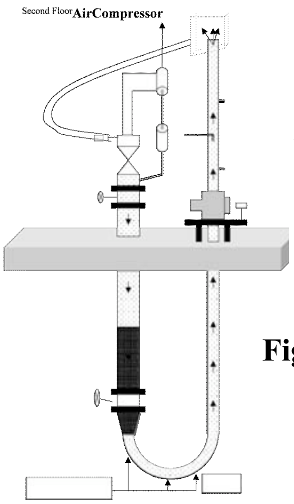

Fig.1

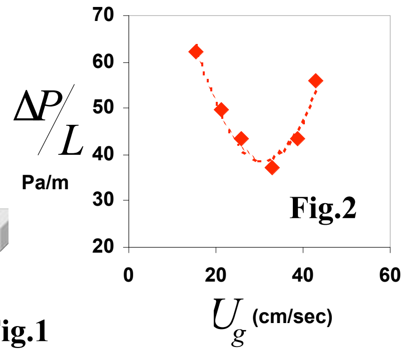

Fig.2

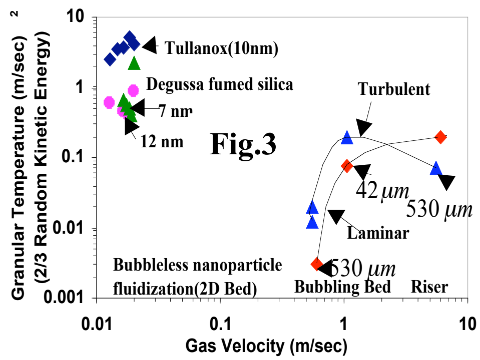

Fig.3

Nanoparticles have unique flow properties that make them useful for numerous applications. We demonstrated that they can be fluidized in our two story Circulating Fluidized Bed (CFB), shown in Fig 1, with a typical pressure drop versus gas velocity curve, depicted in Fig2. Risers filled with catalyst nanoparticles have a very low pressure drop and hence require little work for pumping but have a high surface area needed for reactions. Previously (***Jung&Gidaspow, 2002***) we had demonstrated that silica nanoparticles can be fluidized without bubbles. This property eliminates the major disadvantage of fluidized beds, formation of large bubbles that causes gas-bypassing and hence poor reaction. Fig3 provides a theoretical explanation for this phenomenon. It shows the measurement of granular temperature of 3 silica nanoparticles obtained from a particle momentum balance to that of ordinary particles measured with a kinetic theory based particle image velocity meter (***Gidaspow, et al 2004***) There are no bubbles because it satisfies the bubble formation criterion given by ***Gidaspow(1994)***. Random particle oscillation velocity ($\sqrt{Granular Temperature}$) >> Minimum Fluidization Velocity.

References

1.Jonghwun Jung and Dimitri Gidaspow, Fluidization of nano-size particles, Journal of Nanoparticle Research, 483-497,2002.

2. Gidaspow D., 1994. Multiphase Flow and Fluidization: Continuum and Kinetic Theory Descriptions. Academic Press New York, NY.

3. Dimitri Gidaspow, Jonghwun Jung and Raj.K.Singh, Hydrodynamics of Fluidization Using Kinetic Theory.An Emerging Paradigm, 2002 Flour-Daniel Lecture, Powder Technology (2004), in press.