

Comparison of Particles Charge Distribution within a Pilot-scale Gas-solid Fluidized Bed Operated at Atmospheric versus High Pressure

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Abstract— In any gas-solid fluidized bed generation of electrostatic charges is inevitable where the degree of charging varies depending on the properties of surfaces in contact and operating conditions of the system. Negative effects of fluidized bed electrification including reactor wall fouling is observed in commercial processes such as those of gas-phase ethylene polymerization. Research is currently underway to better understand the underlying mechanisms of electrostatic charge generation in gas-solid fluidized beds with a goal of assisting the commercial operations such as those of petrochemical. In this work the effect of fluidization operating pressure was investigated in a pilot plant high-pressure gas-solid fluidization facility. Experiments were conducted at two pressures of 0 and 2500 kPa (gauge), allowing the comparison of the extent of bed electrification and wall fouling at a lower pressure with that at a high pressure similar to the commercial polyethylene reactors. The electrostatic charge distribution was determined within the fluidized bed for particles within the bulk of the bed and those adhered to the reactor wall. Moreover, the degree of fluidization column wall fouling was qualitatively evaluated. The results showed that the magnitude of particles forming a layer on the column wall was higher at 2500 kPa and the layer comprised of two layers of predominantly positively and negatively charged particles.