Study of the Effect of the Mixture of Two Distinct Sizes of a Polyethylene Resins on the Degree of Fluidized Bed Reactor Electrification and Wall Fouling

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***Abstract*— In gas-solid fluidized bed reactors used in polyolefin industry, such as those used for polyethylene production, the generation of electrostatic charge due to the repeated particles contacts and separation is almost unavoidable. In such processes, accumulation of electrostatic charge causes a layer of particles to adhere to the reactor wall, a problem known as "sheeting". Sheeting results in frequent reactor shutdowns for clean-up and in turn significant economic loss. The overall focus of this research is to better understand the underlying mechanisms of charge generation in gas-solid fluidized beds to ultimately be able to find means to reduce or eliminate the problem of sheeting. The specific of objectives of this project is to determine the effect of particle size on the degree of bed electrification and reactor fouling. It is anticipated that the finer particles generate a greater degree of charge-per-mass and thus contribute significantly to the adhesion of particles to the reactor. Thus, the experimental program involves the fluidization of polyethylene particles received directly from commercial reactors (i.e., having a wide size distribution of 20-1500 micron), as well as mono-sized large particles (600-700 micron) and binary mixture of small (200-300 micron and 300-425 micron) and large particles. Experiments are carried out in a 3D fluidization column, 0.156 m in diameter and 4.5 m in height, under atmospheric conditions. For all conditions, the charge, mass and size distribution of particles fouled on the reactor wall as well as the layer thickness are measured and compared. The electrostatic charge measurement is conduced online by means of Faraday Cup technique. With the binary mixture, the mass fraction of the small particles was varied from 5% to 20%. It was found that the particles layer formed on the reactor wall mainly consisted of the smaller particles as the fraction of small particles was increased. Although the extent of wall fouling declined as the amount of the smaller particles decreased, but the net specific charge of these particles increased. In addition, comparison of results for the two types of the binary mixtures showed that the net specific charge of the wall coating formed with the smaller particles (212-300 micron) was higher than that of 300-425 micron particles.**