# An Euler-Euler CFD Model for Gas-Solid Fluidized Beds Incorporating Electrostatic Charging due to Particle-Wall Collisions

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***Abstract*—Gas-solid fluidized beds are employed in a variety of industrial applications including polymerization, fluid catalytic cracking, mixing, coating, drying, etc. One application of gas-solid fluidized beds is the catalytic polymerization of ethylene gas to produce polyethylene. An operational challenge faced in such a process is the generation of electrostatic charge, which is an inherent and unavoidable issue in this field. This electrostatic charge generation can result in the accumulation of particles on the reactor wall, which melt and fuse together due to the highly exothermic reaction. Consequently, these polymer "sheets" can break off and block the inlet into the reactor, forcing a reactor shutdown for clean-up. Charging in fluidized beds occur due to triboelectrification via particle-particle and particle-wall contacts. Extensive experimental investigations have been performed to understand the charging mechanisms within such systems. Simulation and modelling of electrostatic charging in fluidized beds, however, has received limited attention. To simulate electrostatic effects in an industrial-scale gas-solid fluidized bed, the present work implements an Euler-Euler multi-fluid and electrostatic model. This Computational Fluid Dynamic (CFD) model uses particle charge-to-mass ratio (q/m) as an input for the simulation. The model incorporates a charge generation component to capture the electrostatic charging of dielectric particles due to particle-wall collisions. The major contribution of the present work consists in the formulation of the wall-boundary condition to describe charge generation due to particle-wall interactions.**