MECHANISM OF PARTICLE BUILD-UP ON GAS-SOLID FLUIDIZATION COLUMN WALL DUE TO ELECTROSTATIC CHARGE GENERATION

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Particle build-up on gas-solid fluidization column wall due to electrostatic charging causes significant economic loss in industrial processes such as gas-phase ethylene polymerization to produce polyethylene. It is well acknowledged that in fluidization process electrostatic charges are generated as a result of continuous particle-particle and particle-vessel wall contacts. However, the mechanism of charged particles attraction and adhesion to the fluidization column wall is still under investigation. This work proposes a mechanism for particles coating the column wall by experimentally investigating the extent of particles wall fouling, the fouled particles net specific charge density with an online Faraday cup (1) as well as particles charge distribution with a charged particle separator apparatus (2). The experiments were carried out in a pilot plant gas-solid fluidization system consisting of a 0.15 m in diameter metallic column. Two types of linear low-density polyethylene resins (20-1500 μm) directly received from commercial reactors were fluidized in bubbling flow regime. Experimental results showed that the layer built-up on the column wall contained both positively and negatively charged particles. The wall coating mechanism proposed indicates that particles migration towards the metallic column wall is due to image and electrostatic forces. The image forces are generated by particle-wall contacts causing induction charging on the column wall, in turn attracting the oppositely charged particles towards the wall. Conversely, particle-particle contacts within the bed generate bipolarly charged particles, which depending on their polarity some will be attracted towards the oppositely charged particles fouled on the column wall due to electrostatic forces.

REFERENCES

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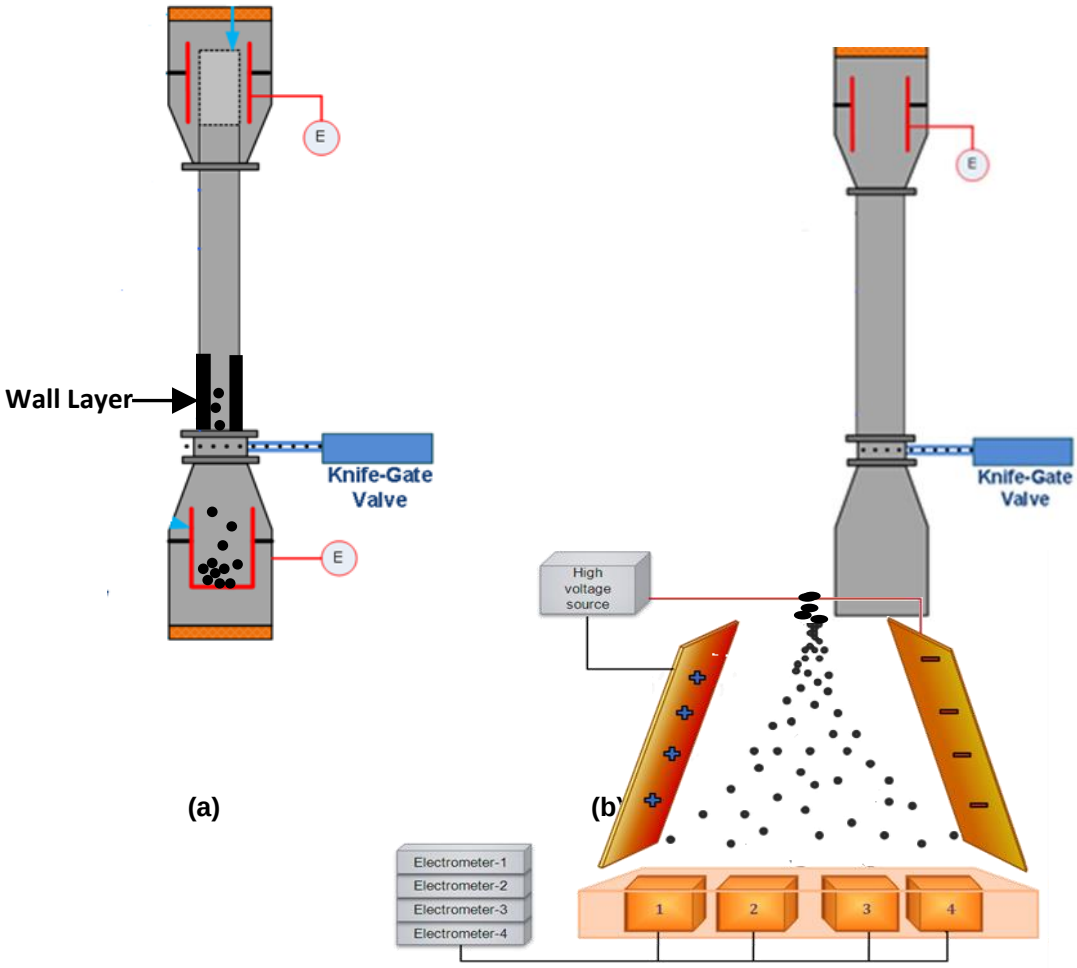

Figure 1. Schematics of fluidization system with (a) the online Faraday cup technique; and (b) charged particle separator apparatus.

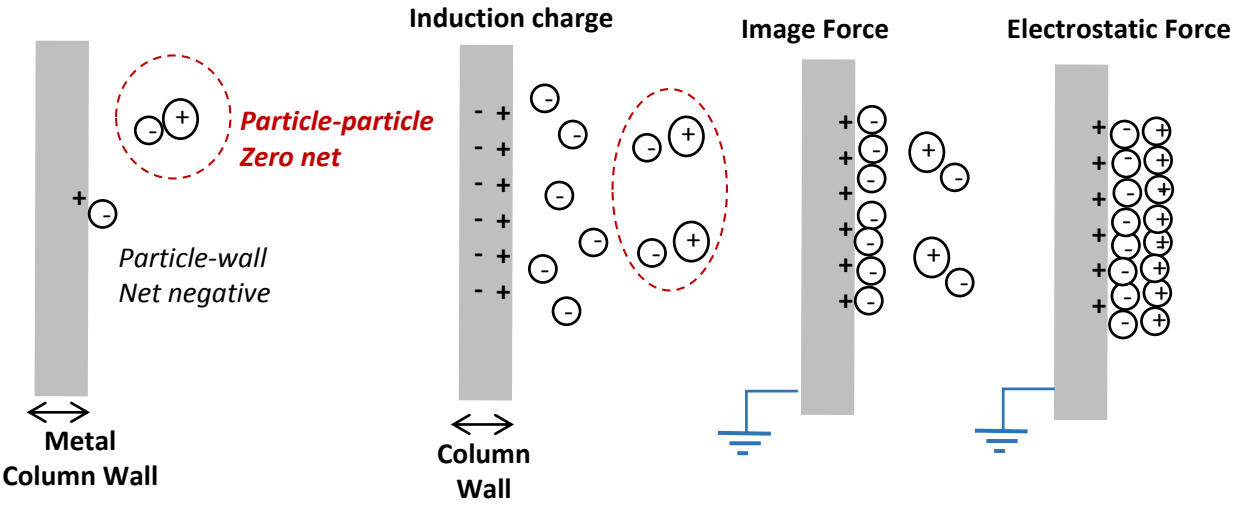

Figure 2. Wall coating formation mechanism.