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Particle Capture by a Conducting Cylinder in an Electrostatic Field using a Discrete Element Method[1] GUANQING LIU, SHUIQING LI, Tsinghua University, JEFFREY MARSHALL, University of Vermont — Particle capture by a conducting cylinder is studied with a discrete element method (DEM) developed for particle transport with electrostatic effects. A charged cylinder is placed in a uniform electric field. Uncharged particles are advected toward the cylinder by air flow. Electric field generation by the cylinder is resolved by a boundary element method (BEM), which accounts for effect of polarized particles on the cylinder induced surface charge. Conventional BEM exhibits errors when near-surface particles are smaller than BEM panels. An algorithm using approximate particle images and local panel subdivision is introduced to improve computational accuracy. Particle-particle electrostatic interaction is accelerated using a fast multipole expansion method. The simulation shows that particles captured by the cylinder form straight chains oriented nearly perpendicular to the cylinder surface. Varying the cylinder voltage with fixed uniform electric field strength leads to different particle deposition characteristics. Particles deposit on only one side of the cylinder at low voltages, but at higher voltages particles deposit all over the cylinder. Predicted particle capture efficiency compares well with experimental data.

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