Particle Aggregation and Deposition in a Micro-nozzle Flow[1]

JOHN MOUSEL, University of Iowa, JEFFREY MARSHALL, University of Vermont — A discrete-element model for adhesive particulate flows is applied to study particle transport in a micro-nozzle flows. A soft-sphere particle collision model, modified for adhesive forces, is combined with a level-set method to efficiently transport the particles on a Cartesian mesh. Of particular interest is examination of the ability of van der Waals force to cause particle to adhere to the nozzle wall and to each other, forming aggregates both freely transported by the nozzle flow and attached to the nozzle wall. The study examines the physical processes by which particle aggregates attached to the wall interact with those transported by the flow. The percentage of particles captured by the nozzle walls is evaluated as a function of adhesion parameter, particle size, particle concentration, and nozzle contraction ratio and contraction rate. Of particular interest are conditions leading to formation of a particle bridge blocking the nozzle.

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