437a Simulation of Particle Movement in a Pan Coating Device Using Discrete Element Modeling and Its Comparison with Video-Imaging Experiments

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A new MATLAB™-based DEM (discrete element method) code was developed to study the movement of particles in a pan coating device. The code was developed as a stand-alone program and provides simulation, visualization (GUI interface), and post-processing statistical analysis of particle motion. The results obtained from DEM simulations were compared to experimental observations. Experimental data was obtained by installing a CCD camera inside a model of a pan coating device. Machine vision was used to track the motion of a white tracer particle in a bed of black particles. This was done in a 58 cm diameter pan with 9 mm spherical polystyrene balls. The parameters compared with the simulations are dynamic angle of repose and particle velocities in the x- and y-directions in the cascading layer. The effects of pan loading and pan speed on particle motion are compared and discussed. Good agreement was obtained between the DEM simulation and experimental results. The dynamic angle was found to increase with increasing pan speed and pan loading. The average cascading velocity was found to increase linearly with pan speed for both DEM and experiments. The particles in the cascading layer were found to reach their maximum velocity at locations close to the mid-point of the cascading surface. The study shows that DEM can be used effectively to capture the particle motion inside a rotating pan. Ongoing work is focused on developing a similar DEM code for tablet-shaped particles.