300a Multidimensional Modeling of Granulation

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The use of granules is very widespread, with diverse applications ranging from fertilizers and detergents to foods and pharmaceuticals, where a composition of several materials in one piece is often beneficial. In addition to composition, there are other granule properties, for example the size, shape, and porosity, which are important in achieving the desired effect of the product, such as the controlled release of the active component of a drug.

In the current work, a multidimensional agglomeration model is used to describe binder dispersion and granule growth in an experimental binder agglomeration process. In this process, a liquid binder containing a blue tracer was added to a dry particle feedstock, and the size and coating level of the granules was measured at different stages of the process. The process model includes coagulation, compaction and fragmentation of the particles. Each granule is described by the three independent variables solid content, binder content and surface area. The model equations are solved by a constant number Direct Simulation Monte Carlo (DSMC) approach. In the simulations the stochastic particles, which represent the real particle ensemble, undergo model events with probabilities and time steps depending on the event rates. Comparisons of simulations and experimental results show that the model has the capability to predict the evolution of the particle properties during the granulation process using relatively simple rate expressions. The implications of different rate processes for binder dispersion, coagulation, compaction and fragmentation are discussed.