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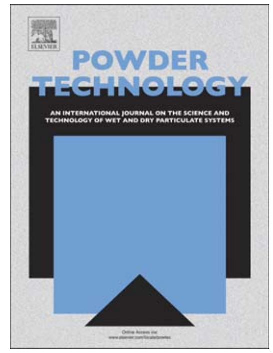

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Particle design via spherical agglomeration: A critical review of controlling parameters, rate processes and modelling

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Abstract

Particle design via spherical agglomeration is a size enlargement technique used in various bulk and fine chemical industries, with recent interest extending into pharmaceuticals, in which an immiscible bridging liquid is added to agglomerate crystals prior to deliquoring. Spherical agglomeration has the potential to dramatically simplify downstream processing, and improves the handling of difficult, needle-shaped crystals. This review consolidates the understanding of the controlling process parameters, identifies the rate processes that control agglomerate attributes, and examines the modelling approaches taken in the literature to optimise the design of such systems. The most important controlling parameters are solvent system composition (requiring knowledge of the ternary phase diagram) and bridging liquid to solid ratio (BSR). Agglomerate size is a highly non-linear function of BSR with many literature systems showing qualitatively similar behaviour. However, there is no method to predict the optimum BSR. Other important process parameters are temperature, constituent particle properties, agitation rate and batch/residence time. Each parameter can have significant effects on the final agglomerate properties including agglomerate size, porosity, strength and dissolution profile.

The rate processes in spherical agglomeration are analogous to those in wet granulation. A general classification of rate processes is proposed in this review including nucleation by distribution or