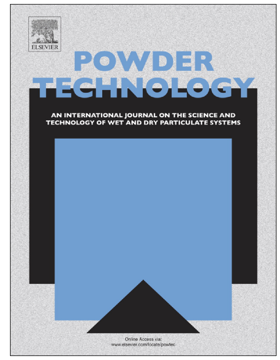

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KINETICS OF IMMERSION NUCLEATION DRIVEN BY SURFACE TENSION

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ABSTRACT

Immersion nucleation is the nuclei formation mechanism for wet granulation systems where the liquid drops are large relative to the primary particles. The process of immersion nucleation has been examined in many studies, however the kinetics of nuclei formation are not well understood, and there is a distinct lack of experimentally validated models for this process.

A kinetic model has been proposed by Hounslow et al. (2009) which describes surface tension driven immersion nucleation. This paper presents the results from a series of experiments measuring the kinetics of immersion nucleation, and these results are compared with the model predictions. Drops of model liquids (aqueous HPMC solution and silicone oil) are placed on static powder beds of zeolite and lactose. Nuclei granules are carefully excavated at different times and the change in granule mass with time is measured. As predicted by Hounslow et al.'s model, the granule mass increases with the square root of time to a maximum granule size at a time t_{max} after an initial adjustment period. The critical packing factor is shown to be a function of powder properties, and not dependent on the liquid properties. The model captures well the measured effects of liquid and powder properties. However, the kinetics of the nucleation process are much slower than predicted by the model. It is believed this is due to continued percolation of the liquid within the powder bed, after the liquid drop is fully immersed. This secondary liquid movement may have an important effect on granule growth kinetics, and influence final granule product properties.