

Quality enhancement for spray granulation with design of experiments

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Spray granulation (spray drying) is a process for drying dispersed, emulsified or dissolved substances in a liquid phase. The small components combine to form coarser particles, also known as granulates, which allows the targeted adjustment of properties. The granulate can then be processed using molding processes.

Better understanding of complex processes with statistical experimental design

Spray granulation is a very complex process, in which many factors influence the result (Fig. 1). Essentially, the raw materials, process parameters, technological conditions and ambient conditions affect the quality of the granulate. Statistical Design of Experience (DoE) can be used to analyze the influence of various parameters on relevant properties of the granulates obtained.

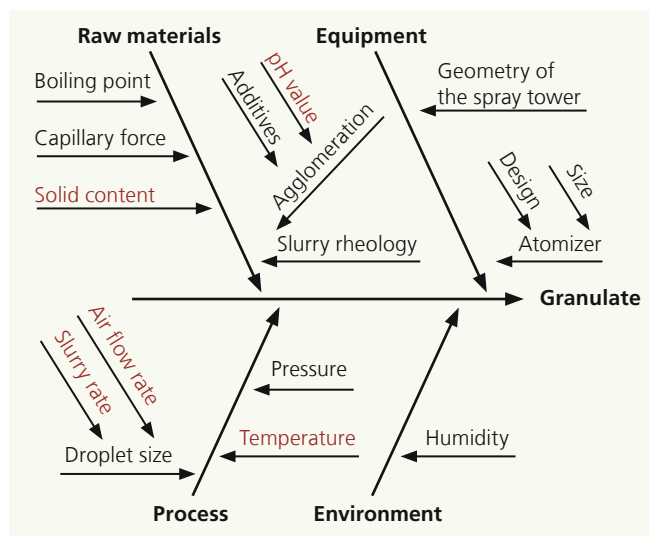


Fig. 1: Factors influencing the granulate, in red the analyzed parameters.

A two-stage full-factorial experimental design for high-purity Al_2O_3 powders and MgAl_2O_4 spinel powders was created at Fraunhofer IKTS, so that up to 31 influencing factors on the granulate properties could be investigated. Figure 2 shows an example of the evaluation of the granulate size of spinel (characterized by the d_{50} and d_{95} values of the particle size distribution) in relation to the solids content in the slurry. This diagram shows that a higher solids content leads on average to larger granulates.

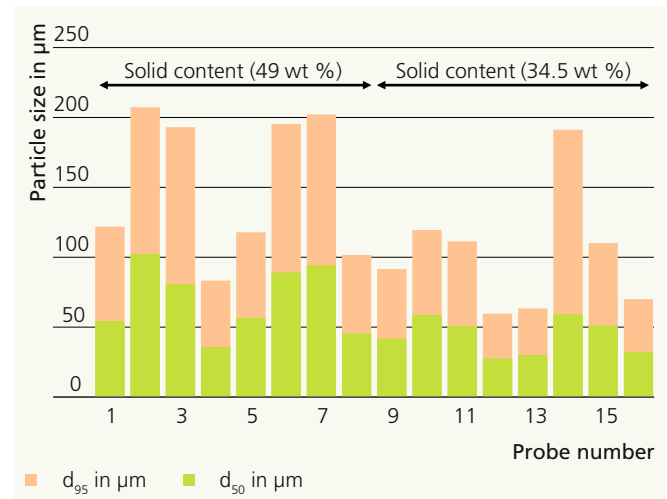


Fig. 2: Particle size for 16 spinel samples with different process and slurry parameters.

The application of DoE also makes it possible to identify the interactions of the influencing factors with the greatest impact on the targeted properties, to optimize the target values and to control the quality. The knowledge gained forms a foundation for understanding the interrelationships. Material developments on a laboratory scale can thus be efficiently scaled up to an industrial scale.

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