FLOW PROPERTIES OF GRANULES IN DEPENDENCE OF FABRICATION CONDITIONS

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MOTIVATION

Granules are important in the processing of ceramic components as base material for dry compaction shaping operations. Thereby, flowability of these granules is one important property within processing, e.g.:

- handling during storage and transport
- homogeneity of the die filling in compaction process

In the latter case the flow properties can have strong influence on the quality of the compacts and finally the sintered products.

EXPERIMENTALS

One of the most common granulation processes is spray-drying, including the upstream processing steps preparation of raw materials and suspension. The effects of varying formulation and technological parameters on the flow properties of granules are studied by the use of Design of Experiments. Nineteen experiments had been carried out.

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RESULTS

Flow properties could directly be linked to the following parameters and those to primary properties of granules e.g. granule size, shape and density:

- Nozzle pressure: Decreasing nozzle pressure leads to better flowability due to the influence on granules size.
- Organic components: Influence on agglomeration behaviour due to sticking mechanism during spray process.
- Mass flow of suspension, solid content and gas temperature: The combination of these parameters influences the drying kinetics during spray drying and thus the agglomeration tendency. As result, an improvement of flowability due to granule size enlargement was observed. But the broad granule size distribution and decrease of roundness of these granules could counteract the effect.
- Solid content: influences granule density, shape and size (viscosity of suspension - droplet size during spray process) and thus the flow behaviour.

Besides direct correlations between varied parameters and the flow properties strong interactions higher order had been determined.

CONCLUSION

- For process parameters with influence on granules size the strongest effect on flow behaviour could be observed. But also shape and density influencing parameters have notable effects.
- Complex mechanism during spray drying influencing granule properties and thus flow behaviour. This leads to the observed interactions higher order.
- Effects are depending on the used material system (powder, organic components) and equipment.