Influence of varied suspension properties on properties of spray-dried granules

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Abstract

To improve the poor flowability and handling behaviour of powdered materials an agglomeration step is necessary. Spray-drying is one of the most common processes to produce ceramic material mixtures with specific tailored properties from water or solvent based suspensions as feedstock. By varying the granule properties like granule density, size, shape, internal or external structure it is feasible, to conform the produced bulk to following processing steps. From literature and own investigations it is known, that the granule properties itself can be influenced by the suspension properties and spray-drying conditions. Especially in industrial applications it is essential, to fabricate constant granule product qualities or to be able to modify the product qualities in a well defined way. Therefore it is important to know, which influence the change of single suspension properties as well as single spray drying parameters has on the resulting product properties.

To study the effect of various suspension parameters on the suspension viscosity and resulting granule properties like internal granule structure and fracture behaviour, several suspensions of a particular Al_2O_3 material were produced. As the importance of suspension viscosity for the development of different internal granule structures is known, concentration lay on the selection of suspension parameters, which were able to modify the suspension viscosity:

- Solid content of the particular material
- Primary particle size
- Primary particle surface charge modification via pH value

The modification of suspension viscosity by different parameters enabled the investigation, if specific viscosity levels always result in comparable internal structures, independent of the parameter used for viscosity modification. During the drying process, the spray drying parameters were kept constant to exclude the influence of drying conditions. After spray drying, the resulting granules were characterized concerning internal granule structure and mechanical granule properties like granule strength and deformation behaviour.

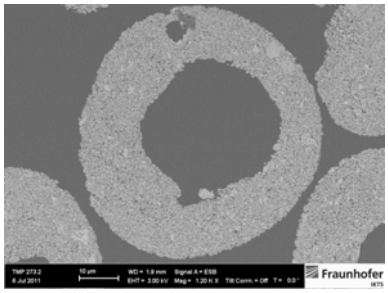

Figure 1: Solid content 40 wt%

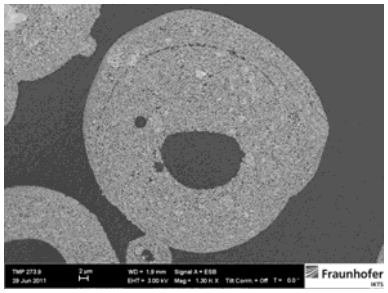

Figure 2: Solid content 68 wt%

Even if all suspension parameters changed the suspension viscosity, the resulting internal granule structures were not affected in comparable ways. E.g. an increase of solid content resulted in a viscosity increase and therewith a change in internal granule structure (see Figures 1 and 2). Higher solid contents resulted in smoother granules with thicker shells, which were responsible for an increase of fracture strength.

At the end of all investigations it should be possible to define, which suspension parameter influence the resulting suspension and granule properties the strongest to be able to influence the resulting granule properties systematically.

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