Achema 2015,
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Science based evaluation of fluidized bed spray granulation processes

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Abstract

Size-enlargement and structuration processes in fluidized beds such as granulation and agglomeration play an important role in the pharmaceutical, minerals and fine chemical industries as well as in food technology to improve the particle properties like flowability, redissolution and mechanical strength.

In this contribution a multiscale hierarchically structured simulation approach for fluidized bed spray granulation will be presented.

The dynamics of these processes are governed on the micro scale by a complex set of particle interactions such as wetting, particle impacts, agglomeration, sintering, drying, solidification and breakage, which can be described by the physically based discrete element method on the level of individual elements. Additionally, temperature and moisture conditions leading to lumping and bed collapse as well as undesired agglomeration effects are defined based on changing material properties.

On the one hand a profound knowledge on these mechanisms is needed to understand the influence of individual process parameters on the final product properties. On the other hand continuous granulation circuits with recycle of particle streams may lead to a complex interconnection of numerous apparatuses and process substeps. Therefore, multidimensional particle population balances are coupled with semi-empirical correlations for the apparatus and process functions of the entire granulation plant by means of flowsheet simulations, whereby transport processes for heat, mass, and momentum as well as growth kinetics for the particle formation can be described on the meso scale. All submodels on the different time and length scales are combined by interscale communications into one multiscale simulation framework (Figure).

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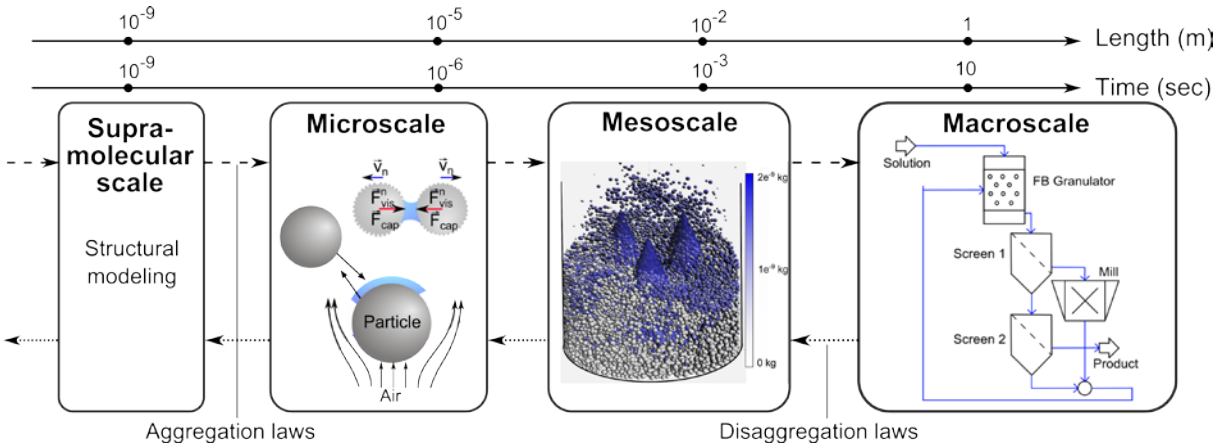

Figure. Structure of the multiscale simulation strategy for modelling of fluidized bed spray granulation.