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The merits of tailored nanoparticles synthesised bottom-up in dispersions will be presented and underlined with examples. This is followed by a discussion on the challenges to upscale and process small (nano) particle suspensions.

Bottom-up chemical syntheses of small particles (nanoparticles) come with many advantages: Firstly, particles can be tailored during synthesis as multi-functional objects by adding various attributes via molecular building-blocks. As a result, particles of desired chemical composition, size, shape and physical and chemical effects (magnetic, optical, catalytic and adsorbing properties, etc.) can be obtained. Secondly and most importantly, stable dispersions of individual nanoparticles (so called sols) can be obtained. Unlike most other particle synthesis methods nano-building-blocks and not only nanostructured aggregates are available in these dispersions. These individual particles may be used as value-adding ingredients in composites or coatings to ultimately exploit the advantages of “nano” and create superior, novel materials.

The challenge of preparing nanoparticles by means of wet-chemistry is, however, that the dispersions are highly diluted and unwanted by-products may still be present in the reaction solution after synthesis. Therefore, to obtain clean particle products, innovative processing methods need to be established.

Wet-chemical bottom-up nanoparticle syntheses methods need to be scalable to yield an industrially relevant output of particles. However, large chemical reactors pose challenges to the close in-situ control of the particle formation in large volumes of liquids.

Finally, when it comes to storage and shipment, particles kept in dispersion in a liquid is very impractical. Dry powders would therefore be much more preferred. But unfortunately, typical nanoparticle dispersion systems have to be prevented from drying-out as then, irreversible agglomeration occurs, sometimes called “hard-agglomeration”.

In this talk, the above considerations are discussed and innovative approaches are presented to deal with the challenges.



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