Nanoparticle processing: A scale-bridging approach exemplified by means of ink formulations for fuel cells and batteries

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Abstract:

New, micron and nano-sized functional materials play a key role for future technologies that are currently developed in the field of energy conversion (electrolysers, fuel cells) and storage (batteries). While new materials with outstanding properties are continuously developed by colleagues from chemistry and materials science, they rarely find their way into – urgently needed – large scale production and industrial applications. Overcoming and bridging this "valley of death" is an interdisciplinary endeavour for which chemical engineering and in particular, particle technology is indispensable. However, to fulfil this highly ambitious bridging function, the field needs to develop in such a way that we i) collect and make efficient use of more data and develop standard procedures that allow us to better understand process-structure and structure-property relationships, ii) replace idealized conditions and model formulations by technically relevant scenarios (testing at application concentration, full complexity of a formulation mixture) and iii) apply relevant processes (scalable dispersion, R2R-coating) already on lab-scale as integrating research tools. In my talk, I will first introduce the hierarchical concept that we developed and apply in my team before I will showcase aspects i-iii) by means of our recent research activities on battery and fuel cell ink formulations and their applications for functional electrode layers.