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Supraparticles: Material design via nanoparticle assembly

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In the past decades, tremendous effort has been made in synthesizing nanoparticles because of their unique size-related properties. In the last 15 years, a step further has been taken considering nanoparticles as building blocks[1] and creating more complex particulate units from them, *i.e.* supraparticles (Figure 1a). Such entities not only conserve nanoparticulate properties, while lifting the particle sizes to the microscale range but also provide additional functionalities exceeding the sum of properties of their constituent building blocks.[2]
This talk highlights the potential of spray-drying as an assembly process of colloidal nanoparticles to create supraparticles.[3] In this process, the confined space within a liquid droplet is reduced upon drying, forcing its ingredients to come together (Figure 1b). Thanks to the design of the supraparticulate architecture and composition new functionalities emerge opening up their use in diverse applications.[4] As examples, spray-dried supraparticle-based optical hydrogen sensors[5] and heterogeneous catalysts[6] containing catalytically active liquid phases will be shown. Altogether, it will be demonstrated that spray-drying is a very interesting and powerful tool for materials chemists to enable the scalable design of hybrid materials.

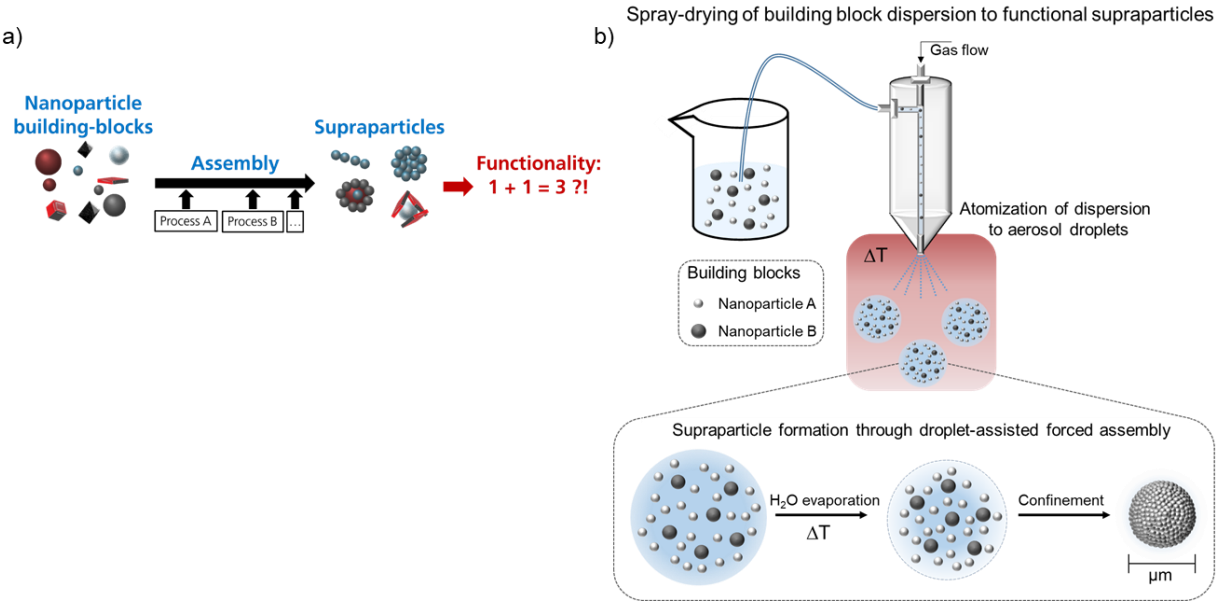

Figure 1: a) Unexpected functionalities emerge from an assembly of nano building blocks to supraparticles.[2] b) The spray-drying process of a binary nanoparticle dispersion and the forced assembly of these nanoparticles during droplet evaporation resulting in supraparticles.[6]

References:

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