Quantitative structural characterization of nanoparticle assemblies in 3D

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Nanoparticle assemblies have gained increasing scientific interest, due to their multiple applications and improved properties, compared to those of their building blocks. By modifying different experimental parameters such as the size and the shape of the individual nanoparticles, as well as the inter-particle distance, assemblies with various shapes and functionalities can be obtained. [1] In order to gain better insight concerning the connection between the structure and the properties, a detailed structural and morphological characterization is of utmost importance. Transmission Electron Microscopy is an ideal technique to investigate materials at both the nanometer and atomic scale and has therefore been widely used in the study of nanomaterials. However, TEM images only correspond to a two-dimensional (2D) projection of a three-dimensional (3D) object. Therefore, electron tomography has to be applied in order to obtain the necessary 3D structural information on the nanoassemblies. [2] By applying the technique at the different case studies, both qualitative and quantitative information could be obtained, such as number of particles in each assembly, inter-particle distances and coordinates of the nanoparticles in the system, which could be later used for a detailed theoretical study.

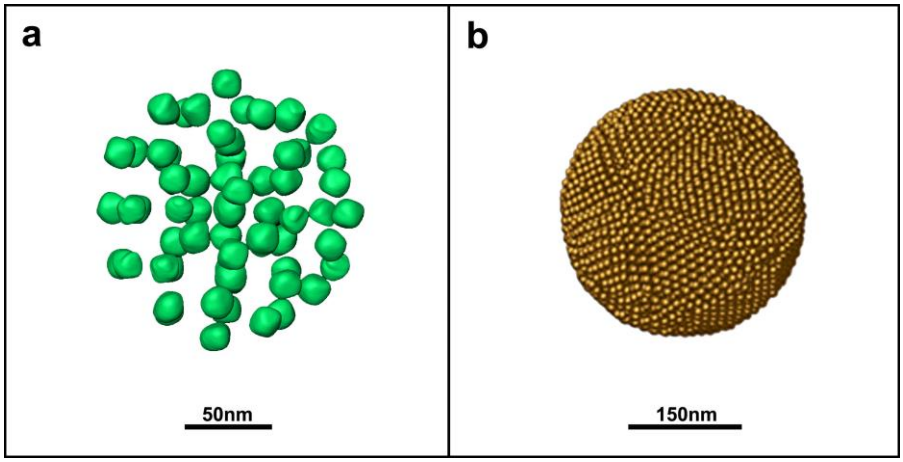

Figure 1: 3D reconstruction of a) a 3D assembly of Au nanoparticles consisting of concentring shells, [1, 2] b) a 3D assembly of Co-FeO nanoparticles. The assembly consists of more than 9000 particles. [3]

[1] A. Sánchez-Iglesias, M. Grzelczak, T. Altantzis et al., ACS Nano, 2012, 6, 11059-11065.
[2] T. Altantzis et al., Particle & Particle Systems Characterization, 2013, 30, 84-88.
[3] D. Zanaga, F. Bleichrodt, T. Altantzis et al., Nanoscale, 2016, 8, 292-299.