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Nanostructured Particles: Beyond the Trade-Off between Large-Scale Production & Nano-Scale Precision

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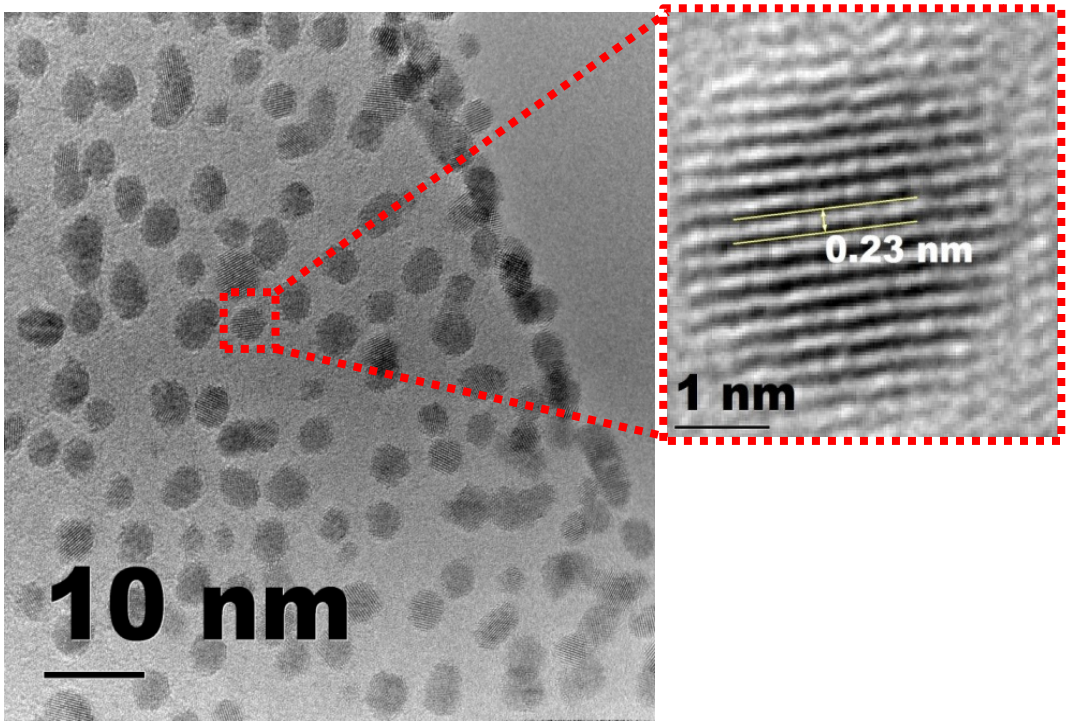

Platinum nanoclusters deposited on graphene using atomic layer deposition. The zoom-in shows the metallic nature of the nanocluster.

Core-shell nanoparticles and other nanostructured particles have high potential in applications such as catalysis, energy storage and pharma. However, a hurdle in their utilisation is that typically large amounts of such materials are required. Current liquid-phase and gas-phase synthesis methods often lack the high precision required or do not lend themselves to large-scale production. Gas-phase coating using atomic layer deposition (ALD, a variant of chemical vapour deposition) can be used to provide the surface of a particle with either an ultrathin continuous coating or a decoration of nanoclusters. When carried out in a so-called fluidized bed, ALD is an attractive way of producing nanostructured particles with excellent scale-up potential. In such a system, the particles are suspended in an upward gas flow. We can do this both for nanoparticles and micron-sized particles. Nanoparticles – contrary to what is typically observed for larger particles – are fluidized as very dilute agglomerates with distinctive fluidization characteristics. I will discuss the challenges related to fluidization and coating of nanoparticles. Moreover, I will give a number of examples of the applications of nanostructured particles.

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