MSS-Seminar

Wednesday, Nov. 28th, 15:30, Nägelsbachstr. 49b

From disorder to order to function in particle deposition

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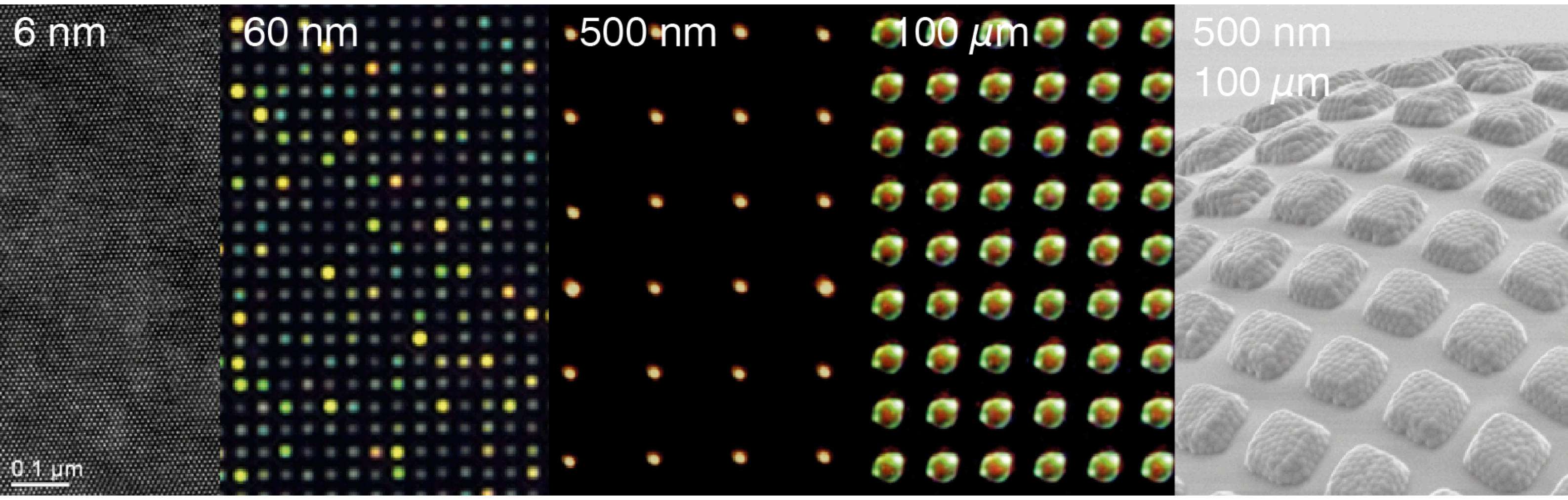

Regular arrays of small particles. From left to right: 6-nm-diameter gold nanoparticles, 60-nm-diameter gold nanoparticles, 500-nm-diameter polystyrene lattices, 100-micron-diameter glass spheres, and a combination of polymer and glass spheres.

Conventional deposition techniques yield smooth, but disordered particle coatings. In this Seminar, I will discuss processes that provide structural control. In convective and capillary particle assembly, we exploit hydrodynamic effects to deposit regular, predictable arrangements of sub-micron particles on flat or structured surfaces. A complex interplay of capillary forces, local variations in pressure drop, and particle-particle interactions provides dense layers of sub-micron polymer particles and sparse arrays of metal nanoparticles, for example (see Figure). We analyze the processes using in-situ interference microscopy and particle tracking to identify defect formation mechanisms and process parameters that lead to stable deposition. Successful film formation requires particle transport and a directing force strong enough to hold the particles in their desired positions. The overall hydrodynamic situation has to be stable and should localize defects. Such requirements can be generalized and occur in other order-inducing processes. Subsequent processing steps transfer and convert the deposited particle films into structured materials for microelectronics, adhesion control, or optical coatings.