Nanostructured Surfaces from Nanoparticles

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Colloidal metal nanoparticles have received much attention in recent years due to potential applications in areas of electronics, photonics, sensors, and catalysis. Monodisperse nanoparticles, for example, have been proposed as a basis for single electron transistors. In this and many other examples, potential applications require precise spatial control over nanoparticle assembly on Si/SiO_2 surfaces. One approach is to modify nanoparticles to recognize and bind selectively a specific region of a substrate. Another approach, is to modify a specific region of a surface to recognize and bind selectively nanoparticles. Both approaches, despite increased effort and significant advances, still offer the opportunity for innovation. This talk will demonstrate a novel facile method for fabrication of patterned arrays of gold nanoparticles on Si/SiO_2 by combining electron beam lithography and self-assembly techniques. Our strategy is to use direct-write electron beam patterning to convert nitro functionality in self-assembled monolayers of 3-(4-nitrophenoxy)-propyltrimethoxysilane to amino functionality, forming chemically well defined surface architectures on the 100 nm scale. These nanopatterns are employed to guide the assembly of citrate passivated gold nanoparticles according to their different affinities for amino and nitro groups. This kind of nanoparticle assembly offers an attractive new option for nanoparticle patterning a silicon surface, as relevant, for example, to bio-sensors, electronics and optical devices.