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Hybrid nanostructures made of gold nanoparticles and functional polymers: Chemistry and applications in sensors

Gold nanoparticles have stimulated a wide range of interest these past years due to their remarkable optical, electronic, and catalytic properties. Generally, the use of these nanoparticles requires their functionalization or combination with functional molecules, the nature of which depends on the target application. In this talk, we present the design of hybrid plasmonic nanostructures, made of regular arrays of gold nanoparticles (see Figure 1), coated by ultra-thin layers of functional polymers (smart, reactive and molecularly imprined polymers). We have studied the sensitivity of these plasmonic nanostructures to variations in properties of the local environment (temperature, refractive index, polymer thickness), in the context of sensing and active plasmonic applications. The grafting of the polymer on the gold nanostructures results from a multistep but simple approach in order to confine the polymer layers on the gold nanoparticles and to control the thickness of the polymer coating. Moreover, the coupling between gold nanostructures and molecularly imprinted polymer shells provide optical nanosensors enabling the direct, label-free detection of various kinds of molecules, such as folic acid and paracetamol. We do believe this synthetic approach provides a new general nanomaterial strategy design for the grafting of functional polymers on gold nanoparticles. This work could therefore provide an important step toward the use of hybrid structures for applications spanning from opto-mechanical modulators to nanoscale adhesion and molecular sensing.

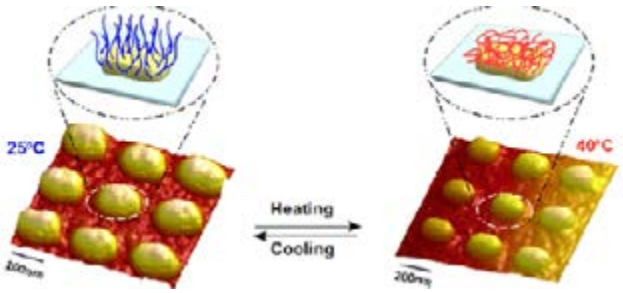

Figure 1: Regular array of gold nanoparticles, elaborated by electron beam lithography, and functionalized by smart thermos-responsive polymer brushes.

Biography

Claire Mangeney is full professor at the LCBPT Laboratory of University Paris Descartes. Her research is at the interface of surface chemistry, nanotechnology and biology. She has developed over the last decade original chemical strategies to attach polymers (brushes, imprinted and smart polymers, hydrogels) on planar and micro/nano-structured surfaces from diazonium salts as a new generation of coupling agents. Her primary goal is to develop hybrid nanomaterials for biological and energy-related applications.

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