Self-Assembly and Directed Assembly of Gold Nanoparticles

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The assembly of nanoparticle building blocks is a pre-requisite for the amplification of the properties of the components and/or the generation of new features unique to the ensemble. Usually, nanoparticles employed for these assemblies are spherical and lack a geometrical preference toward directional self-assembly, thus limiting their potential applications. In contrast, controlled self-assembly of non-spherical nanoparticles, such as gold nanorods, enables these arrays to form defined 1D, 2D or 3D structures with a vectorial dependence of the desired properties. We show in this communication several examples of directional nanoparticles assembly.

Standing 2D and 3D superlattices made of gold nanorods can be obtained through the use of gemini surfactants as capping agents in aqueous solution. The extreme directionality of these assemblies is reflected in the anisotropic optical properties of the crystalline superlattices.[1]

On an alternative approximation, H-bonding can be exploited as the driving force to induce chain formation in functionalized nanorods. This assembly can be directed in such a way that end-to-end junctions are preferential.[2]

Finally, grooved PDMS surfaces will be demonstrated to serve as stamps to create long range gold nanoparticle arrays, where the specific organization depends on the groove size and periodicity. Such ordered arrays can be applied as efficient substrates for improved SERS detection.[3]

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