Colloidal lithography: From surface modifications to applications

Engineering the surfaces and controlling their properties in nano/micro scales attracted a lot of attention due to their wide applications in various fields. Different studies have been carried out to find easy and cost-effective methods to control the surface properties. Among these, colloidal lithography is a clever, straightforward, and economic method to fabricate different structures using nano/micro sacrificial spheres which are usually made of Polymethylmethacrylate (PMMA), (Polystyrene) PS, and SiO_2. Having used the proposed method, it is possible to fabricate inverse opal photonic crystals (three-dimensional ordered porous structures) and control their pore size according to the application. Also, different metal nanoparticles arrays can be fabricated, such as nano-pyramid, nano-discs, and nano-crescent array, etc. Having unique optical properties such as photonic bandgap (PBG) and localized surface plasmon resonance (LSPR), the fabricated photonic crystals and plasmonic structure can be used in different applications that need trapping and manipulation of the light. For example, the observed PBG in inverse opal photonic crystals and the resonance frequency of plasmonic structures are highly dependent on the refractive index of the media that fill the pore or surround the metal nanoparticles, respectively. Thus, the introduced structures can be applied as highly sensitive chemical/biosensors. Furthermore, the fabricated structures can provide an increased light trapping, which is essential for some other applications such as solar cells and photocatalysts. Also, surface-enhanced Raman scattering is another field that the introduced structure can be beneficial for.

In this presentation, the colloidal lithography method and some of its applications are going to be discussed in detail.

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