Enhanced Transmission of Nanodots Metallic Arrays Fabricated by a Low Cost Directed Nanosphere Lithography (DNL)

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The phenomenon of Surface Plasmon Resonance (SPR) happens when the momentum matching conditions for the light incident on a thin metal film are met and the enhanced transmission happens at the resonance frequency. In addition to the surface geometry, the excitation of the surface plasmon polariton is sensitive to dielectric constant variations of its surroundings [1]. This enhanced transmission of light through periodic nanostructure patterned metallic films has been demonstrated as a functional approach for the detection of bio-molecules or other sensing applications [2].

Directed nanosphere lithography (DNL) combined with Reactive Ion Etching (RIE) has been applied as a low cost method to fabricate nanodots arrays with hexagonal symmetry where the size and spacing of the dots can be independently controlled [3]. Polystyrene spheres (PS) are deposited on a glass substrate using a silicon nitride tip. This tip is dragged along the surface in a step-wise fashion and the capillary force between the spheres results in a colloidal crystal at the liquid meniscus. The step rate is adjusted by visually confirming the assembly of periodic structures, which is experimentally related to the environmental conditions such as humidity and the water affinity of the substrate. The spheres are then etched by oxygen plasma to form isolated 250 nm nanodots followed by gold evaporation. This study includes comparison between transmission spectra of DNL patterned surfaces to those made by Focused Ion Beam (FIB) milling with different dot size an spacing.

Our results indicate that the nano-pillar patterned gold surfaces have large transmission enhancement at the red near-IR wavelength region, and the peak enhanced transmission wavelengths change with the surface dielectric environment for a chosen design geometry.

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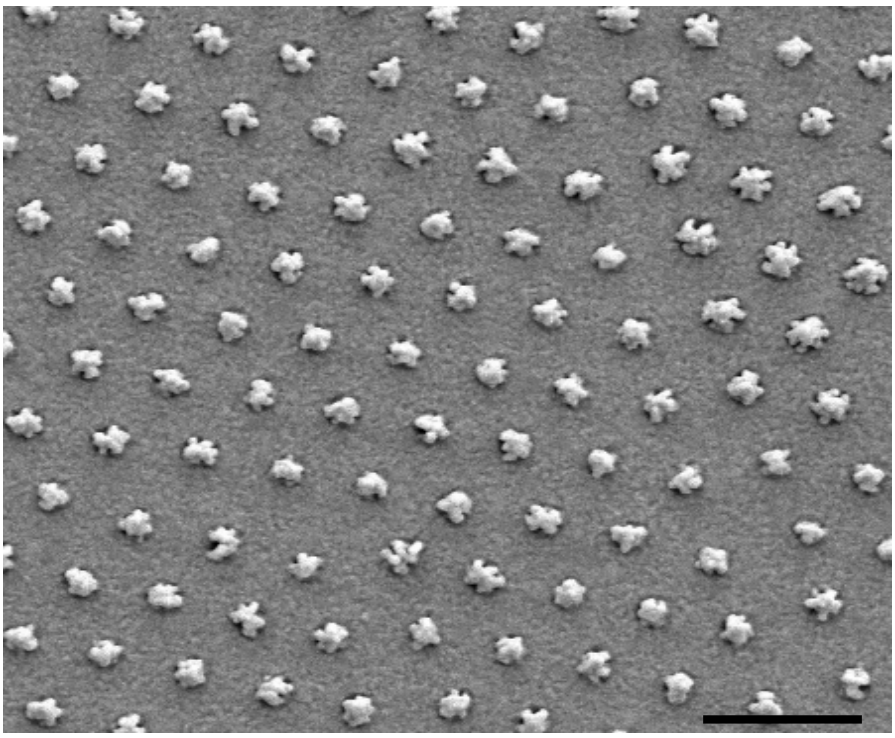

Fig 1. SEM picture of the nano-pillar arrays on a gold film made by polystyrene sphere directed self-assembly patterning method. The spacing between dots is 600 nm, the dot size is around 250 nm and the thickness of the gold layer is 100 nm.