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Hierarchically Ordered Plasmonic Mask for Photo-lithography
WOO SOO KIM, EDWIN L. THOMAS, MIT — A new high density nanolithography method for the fabrication of a hierarchically ordered plasmonic mask employs silver (Ag) nano-particles (NPs) attached to the surface of an amine- functionalized two-dimensional (2D) pattern fabricated by laser interference lithography (IL). The bi-functional sol-gel hybrid material (BFHM) is a negative-tone resist and can be directly patterned by IL. Since the BFHM has both an amine-function and a methacryl function on each molecule, photopolymerization provides network formation and a set of binding sites for the Ag NPs. The Ag NPs were then attached onto the BFHM pillars by immersing the patterned sample in a solution. Hierarchically ordered arrays of Ag NPs could be made by a block copolymer comprised of 40nm diameter spherical P2VP domains having a spacing of 88nm, forming a hexagonal pattern covering the hexagonally arrayed BFHM pillars. Lithography experiments using 430 nm wavelength light demonstrate transfer of both a 350 nm periodic pattern and a 88nm patten to a positive-tone photoresist via plasmonic field enhancement arising from the collective and individual excitation of the closely spaced interacting Ag NPs on the hierarchically patterned BFHM.

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