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3D Plasmonic and Metamaterial Structures

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Recently we have demonstrated that membrane projection lithography (MPL) is capable of creating 3D structures with sub-micron metallic inclusions for use in metamaterial and plasmonic applications [1-3]. MPL combines conventional semiconductor fabrication methods with directional deposition through a patterned membrane to provide one solution to the long-standing problem of creating truly 3D structures at the micron/submicron scale for use in advanced electromagnetic applications. Transitioning from 2D/planar structures to 3D structures provides several advantages for the EM designer: 1) enabling optimal coupling to both electric and magnetic fields; 2) increased isotropy of the unit cell and hence bulk material; and 3) access to non-planar geometries which enhance the ability to create directional emission/absorption. This paper will present detailed fabrication and characterization data of these materials, emphasizing the unique signatures of the 3D unit cells, and transition from single layer to multi-layer/bulk electromagnetic properties.

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100 Word Abstract

Recently we have demonstrated that membrane projection lithography (MPL) is capable of creating 3D structures with sub-micron metallic inclusions [1-3]. Transitioning from 2D/planar structures to 3D structures provides several advantages for the EM designer: 1) enabling optimal coupling to both electric and magnetic fields; 2) increased isotropy of the unit cell and hence bulk material; and 3) access to non-planar geometries which enhance the ability to create directional emission/absorption. This paper will present detailed fabrication and characterization data of these materials, emphasizing the unique signatures of the 3D unit cells, and transition from single layer to multi-layer/bulk electromagnetic properties.