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Fabrication of Plasmon Subwavelength Nanostructures for Nanoimprinting

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Plasmon subwavelength nanostructures enable the structurally modulated color due to the resonance conditions for the specific wavelength range of light with the nanoscale hole arrays on a metal layer. While the unique properties offered from a single layer of metal may open up the potential applications of integrated devices to displays and sensors, fabrication requirements in nanoscale, typically on the order of or smaller than the wavelength of light in a corresponding medium can limit the cost-effective implementation of the plasmonic nanostructures. Simpler nanoscale replication technologies based on the soft lithography or roll-to-roll nanoimprinting can introduce economically feasible manufacturing process for these devices. Such replication requires an optimal design of a master template to produce a stamp that can be applied for a roll-to-roll nanoimprinting.

In this paper, a master mold with subwavelength nanostructures is fabricated and optimized using focused ion beam for the applications to nanoimprinting process. Au thin film layer is deposited by sputtering on a glass that serves as a dielectric substrate. Focused ion beam milling (FIB, JEOL JIB-4601F) is used to fabricate surface plasmon subwavelength nanostructures made of periodic hole arrays. The light spectrum of the fabricated nanostructures is characterized by using UV-Vis-NIR spectrophotometer (Agilent, Cary 5000) and the surface morphology is measured by using atomic force microscope (AFM, Park System XE-100) and scanning electron microscope (SEM, JEOL JSM-7100F). Relationship between the parameters of the hole arrays and the corresponding spectral characteristics and their potential applications are also discussed.

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Reference

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