Planarized Ag Nanopattern Array for Plasmonic Resonance-driven Electroluminescence Enhancement

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Metallic nanostructure arrays have attained growing interests due to their potential impacts on various optoelectronic devices and sensors. Metallic nanostructures, often referred to as metallic photonic crystals, can act as light-scattering centers through plasmonic resonant excitation and outcoupling of the incident electromagnetic field. They can therefore enhance the resonant plasmonic field and outcoupled emissions and contribute to increasing the energy transformation efficiency in optoelectronic devices [1-2] and improving sensing quality [3-5]. Typical fabrication method creates the metal dots with the protruded shape through either lift-off or metal direct milling following the pre-defined template pattern fabrication. This essential roughness on metal pattern surface causes the unexpected problems such as current leakage or resistivity increase in its applied optoelectronic device performance because the following multilayer process keeps the corrugation shape conformal to metal dot pattern array.

This work will present cost-effective advanced fabrication strategies to realize the planarized plasmonic nanopattern array via (1) bilayer resist system and hybrid nanoimprint approach, and (2) Imprint transfer lithography for the emission enhancement in optoelectronic applications. First, the bilayer resist stack comprised of thermal and half-cured UV curable imprint resist was imprinted at high pressure and temperature, followed by UV exposure to completely cure the underlayer UV curable resist as shown in Figure 1(a). Silver deposited in Figure 1(b) was lifted-off with top-layered thermal imprint resist in Figure 1(c). Metal embedded in the imprinted UV curable resist was shown in Figure 2(a) for 150 nm dot size in diameter, and the corresponding transmittance spectra in Figure 2(b). Alternatively silver film deposited on mold pattern was made to imprint and transfer in the pre-cured UV curable at the elevated temperature and moderate pressure in Figure 3, which will be also presented.

Keywords

Plasmonic resonance, Nanopattern, Metal nanopattern, Optoelectronics, Electroluminescence

References

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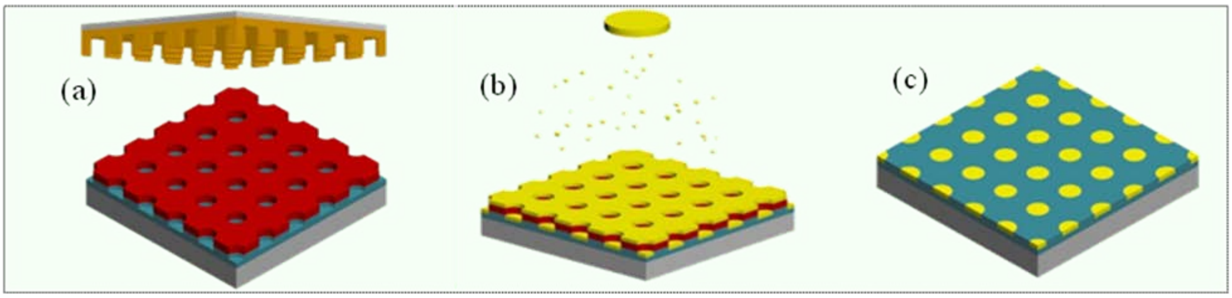

Figure 1. (a) 50nm line pattern by Hybrid Nanoimprint, (b) Imprint transfer process of 50 silver pattern

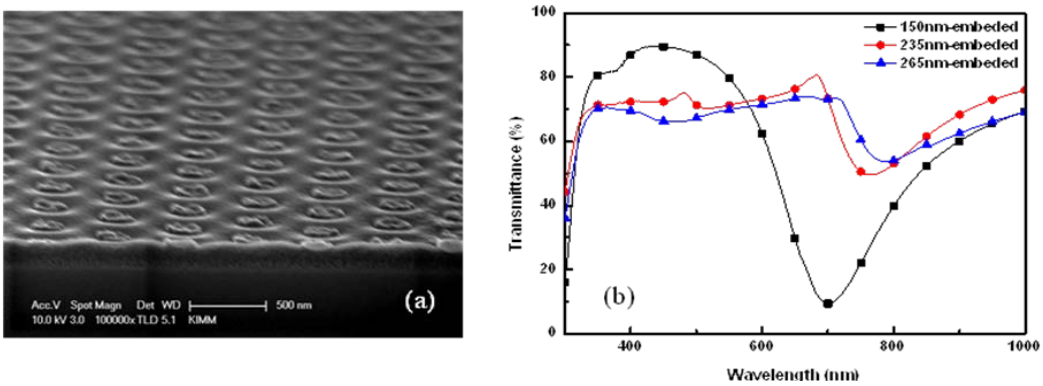

Figure 2. (a) 50nm line pattern by Hybrid Nanoimprint, (b) Imprint transfer process of 50 silver pattern

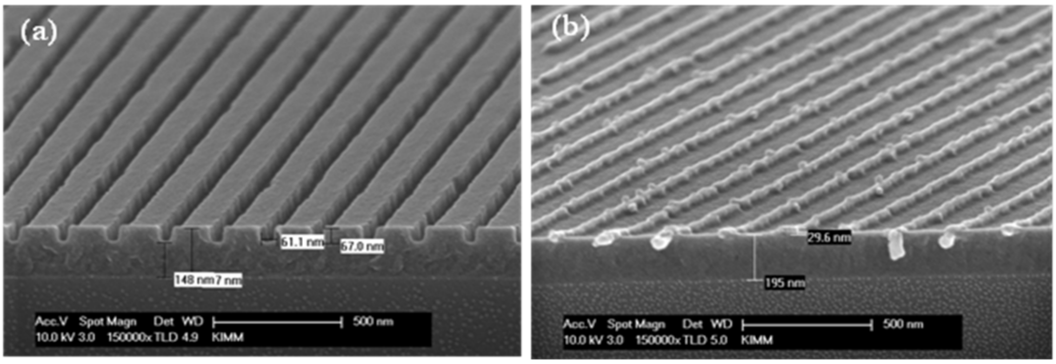

Figure 3. (a) 50nm line pattern by Hybrid Nanoimprint, (b) Imprint transfer process of 50 silver pattern