Abstract

Improved Transmittance in One-Dimensional Metallic Photonic Crystals

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We show, from theoretical calculations including the absorption losses in metal layers, that the transmittance of a one-dimensional metallic photonic crystal can be increased up to 67%. The structure consists of five layers of Ag and four layers of GaN. The layer thickness of Ag is 30 nm, and that of GaN 64 nm. We further add one GaN layer of 32 nm at the top and the bottom, respectively. The total thickness of Ag layers in this photonic crystal is 150 nm, which is several times longer than the skin depth of Ag. However, we could achieve the peak value of 67% transmittance at 500 nm wavelength owing to the two half thick GaN layers added at the top and bottom of the film. Without these additional two layers, strong oscillations appear in the transmittance spectrum with the peak value of only 30%. When only one half-thick GaN layer is added to the structure, the oscillation becomes smoothed out so that the overall transmittance increases, but the peak value is still 30%. The two additional layers make the spectrum smoother and further increase the transmittance.

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