



Extraordinary Transmission and Enhanced Emission with Metallic Gratings Having Converging-Diverging Channels

<http://www.firstlight.cn> 2007-12-26

Transmission metallic gratings having the shape of converging-diverging channel (CDC) give an extra degree of freedom to exhibit enhanced transmission resonances. By varying the gap size at the throat of CDC, the spectral locations of the transmission resonance bands can be shifted close to each other and have high transmittance in a very narrow energy band. Hence, the CDC shape metallic gratings can lead to almost perfect transmittance for any desired wavelength by carefully optimizing the metallic material, gap at the throat of CDC, and grating parameters. In addition, a cavity surrounded by the CDC shaped metallic grating and a one-dimensional (1D) photonic crystal (PhC) can lead to an enhanced emission with properties similar to a laser. The large coherence length of the emission is achieved by exploiting the coherence properties of the surface waves on the gratings and PhC. The new multilayer structure can attain the spectral and directional control of emission with only p-polarization. The resonance condition inside the cavity is extremely sensitive to the wavelength, which would then lead to high emission in a very narrow wavelength band. Such simple 1D multilayer structure should be easy to fabricate and have applications in photonic circuits, thermophotovoltaics, and potentially in energy efficient incandescent sources.

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