

Invited talk

Not-so-extraordinary transmission through an array of nano-holes in a metal film

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Extraordinary strong transmission of light through a metal films perforated with sub-wavelength channels, such as an array of nanoscale holes, is a classical cornerstone phenomenon of nanophotonics that has yielded numerous applications. However, at extremely small thicknesses the perforation of semi-transparent metal films with arrays of nanoscale holes has, conversely, been shown to suppress transmission. On the other hand, it has been suggested recently that the transmission of sub-wavelength channels may be enhanced by filling them with a low-loss ‘epsilon-near-zero’ (ENZ) medium. Here we show that filling nanoscale holes in semi-transparent metal films with an epsilon-near-zero plasmonic material increases the overall transmission of the film. Moreover, using a generic oscillator model for ENZ media, describing a dielectric response compliant with Kramers-Kronig relations, we demonstrate that filling nano-holes with such material actually reduces transmission at the zero-epsilon frequency.