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Title:Non-resonant terahertz field enhancement in periodically arranged nanoslits
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Abstract:We analyze ultra strong non-resonant field enhancement of THz field in periodic arrays of nanoslits cut in ultrathin metal films. The main feature of our approach is that the slit size and metal film thickness are several orders of magnitude smaller than the wavelength λ of the impinging radiation. Two regimes of operation are found. First, when the grating period P ≪λ, frequency-independent enhancement is observed, accompanied by a very high transmission approaching unity. With high accuracy, this enhancement equals the ratio of P to the slit width w. Second, when the grating period approaches the THz wavelength but before entering the Raleigh-Wood anomaly, the field enhancement in nanoslit stays close to that in a single isolated slit, i.e., the well-known inverse-frequency dependence. Both regimes are non-resonant and thus extremely broadband for P <λ. The results are obtained by the microscopic Drude-Lorentz model taking into account retardation processes in the metal film and validated by the finite difference frequency domain method. We expect sensor and modulation applications of the predicted giant broadband field enhancement. © 2012 American Institute of Physics.
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