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Title:Measurement of surface plasmon correlation length differences using Fibonacci deterministic hole arrays
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Abstract:Using terahertz (THz) transmission measurements through twodimensional Fibonacci deterministic subwavelength hole arrays fabricated in metal foils, we find that the surface plasmon-polariton (SPP) correlation lengths for aperiodic resonances are smaller than those associated with the underlying grid. The enhanced transmission spectra associated with these arrays contain two groups of Fano-Type resonances: Those related to the two-dimensional Fibonacci structure and those related to the underlying hole grid array upon which the aperiodic Fibonacci array is built. For both groups the destructive interference frequencies at which transmission minima occur closely match prominent reciprocal vectors in the hole array (HA) structure-factor in reciprocal space. However the Fibonacci-related transmission resonances are much weaker than both their calculated Fourier intensity in k space and the grid-related resonances. These differences may arise from the complex, multi-fractal dispersion relations and scattering from the underlying grid arrays. We also systematically studied and compared the transmission resonance strength of Fibonacci HA and periodic HA lattices as a function of the number of holes in the array structure. We found that the Fibonacci-related resonance strengths are an order of magnitude weaker than that of the periodic HA, consistent with the smaller SPP correlation length for the aperiodic structure. © 2012 Optical Society of America.
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