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Title:Conformal dual-band near-perfectly absorbing mid-infrared metamaterial coating
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Abstract:Metamaterials offer a new approach to create surface coatings with highly customizable electromagnetic absorption from the microwave to the optical regimes. Thus far, efficient metamaterial absorbers have been demonstrated at microwave frequencies, with recent efforts aimed at much shorter terahertz and infrared wavelengths. The present infrared absorbers have been constructed from arrays of nanoscale metal resonators with simple circular or cross-shaped geometries, which provide a single band response. In this paper, we demonstrate a conformal metamaterial absorber with a narrow band, polarization-independent absorptivity of >90% over a wide ±50° angular range centered at mid-infrared wavelengths of 3.3 and 3.9 μm. The highly efficient dual-band metamaterial was realized by using a genetic algorithm to identify an array of H-shaped nanoresonators with an effective electric and magnetic response that maximizes absorption in each wavelength band when patterned on a flexible Kapton and Au thin film substrate stack. This conformal metamaterial absorber maintains its absorption properties when integrated onto curved surfaces of arbitrary materials, making it attractive for advanced coatings that suppress the infrared reflection from the protected surface. © 2011 American Chemical Society.