Electronic Supplementary Material (ESI) for Nanoscale.
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Supporting information

Near-atomically flat, chemically homogeneous, electrically conductive optical metasurface

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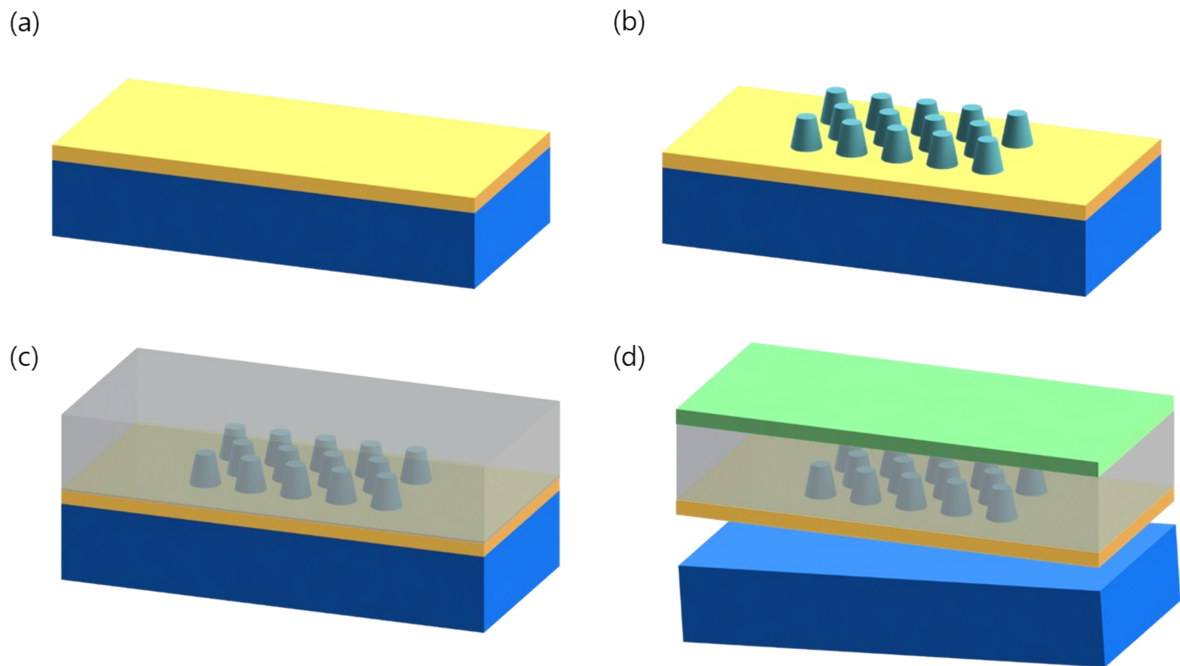

Figure S1 Procedure for fabrication of the concealed optical metasurface (COM). (a) A thin metallic film (Au) is deposited by DC magnetron sputtering on a bare Si substrate. (b) Fabrication of the dielectric structures by e-beam lithography and e-beam evaporation methods. (c) A reflective thick metallic mirror layer (Ag) is deposited by DC magnetron sputtering. (d) The fabricated structure is transferred to a glass substrate by using NOA 72 adhesion layer.

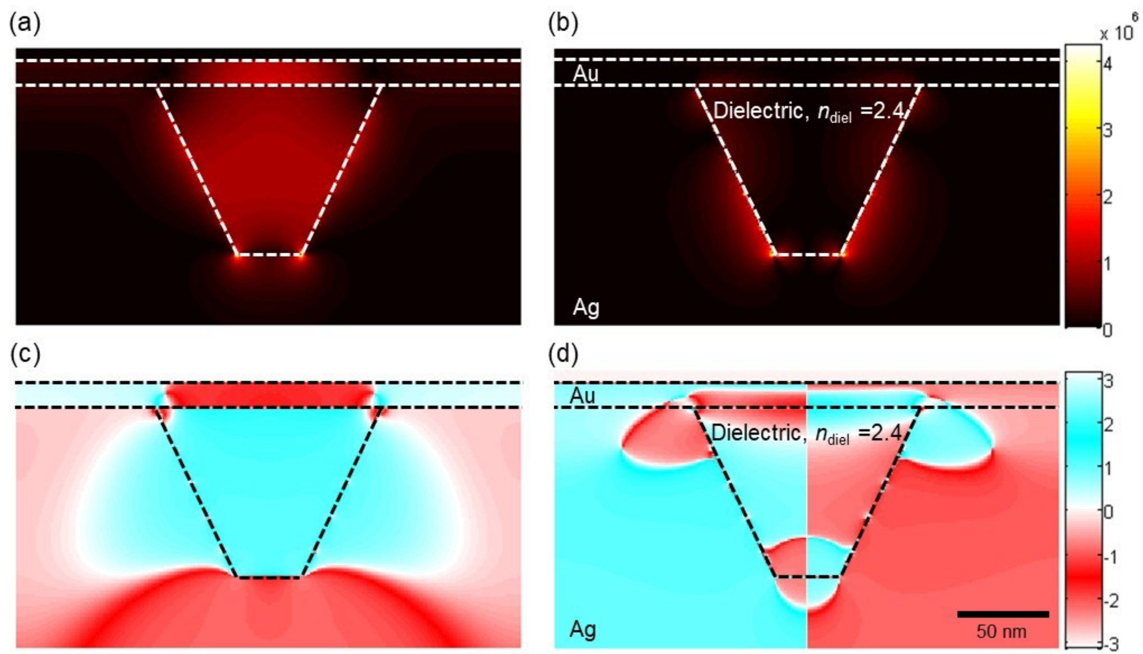

Figure S2 Current density profile of the COM. Thickness of top metallic layer is 15 nm, upper dielectric diameter, D_1, is 135 nm, lower dielectric diameter, D_2, is 40 nm, and dielectric height, H, is 100 nm. The profile is taken at the resonance wavelength of the fundamental mode (550 nm). (a) and (b) show the amplitude of the conduction and displacement current densities in x- and z-directions. (c) and (d) show the phase of the x- and z-directional current densities. The densities reveal the dipolar nature of the resonance mode.

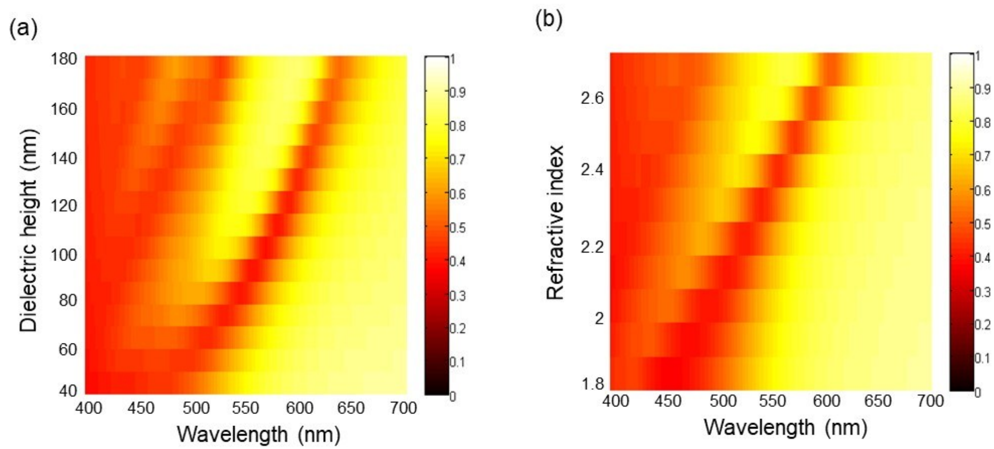

Figure S3 Simulated reflectance spectra of the COM for (a) various dielectric heights from 40 to 180 nm, (b) various refractive indices of the dielectric from 1.8 to 2.8. In all cases, other geometrical parameters of the dielectric structure and the thickness of the top metallic layer are constant.

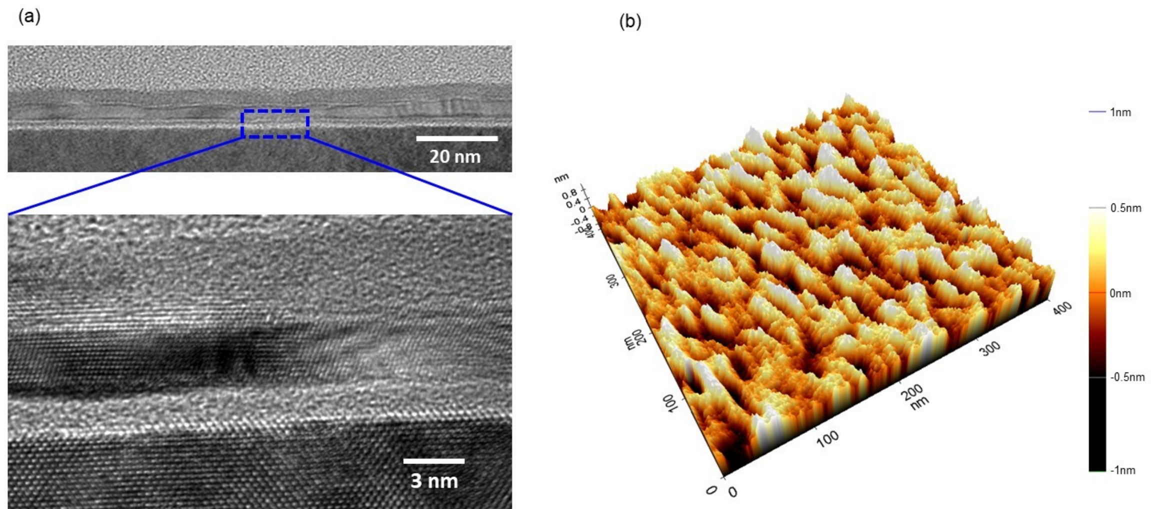

Figure S4 5 nm thick Al thin film deposited by thermal evaporation. (a) TEM image of vertically sectioned Al thin film sample shows uniform and continuous Al layer on the Si substrate. (b) AFM image of the deposited Al surface reveals a root-mean-square roughness of 3.9 Å.

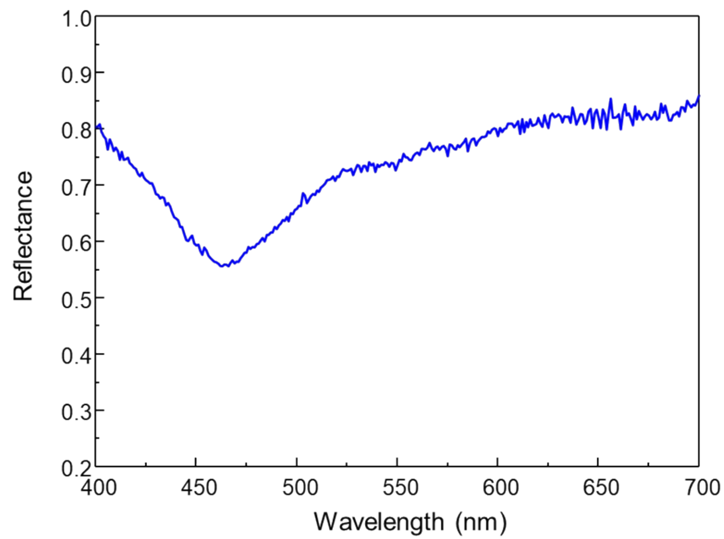

Figure S5 Measured reflectance spectrum of the COM with the top Au layer replaced by an Al layer. For the Al-based COM, a 8 nm thick Al layer is deposited on a glass substrate. Dielectric structures (Al_2O_3) have the height of 130 nm with the upper and lower diameter of 135 and 45 nm, respectively. Silver is used for the thick metal backing layer. For the optical measurements, white light is illuminated through the glass substrate.

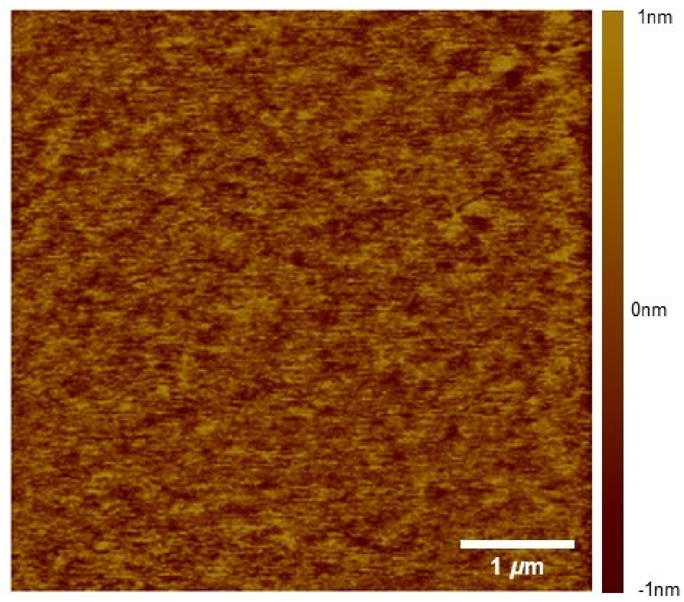

Figure S6 AFM image of a bare Au film transferred to a glass substrate by using the template stripping method.

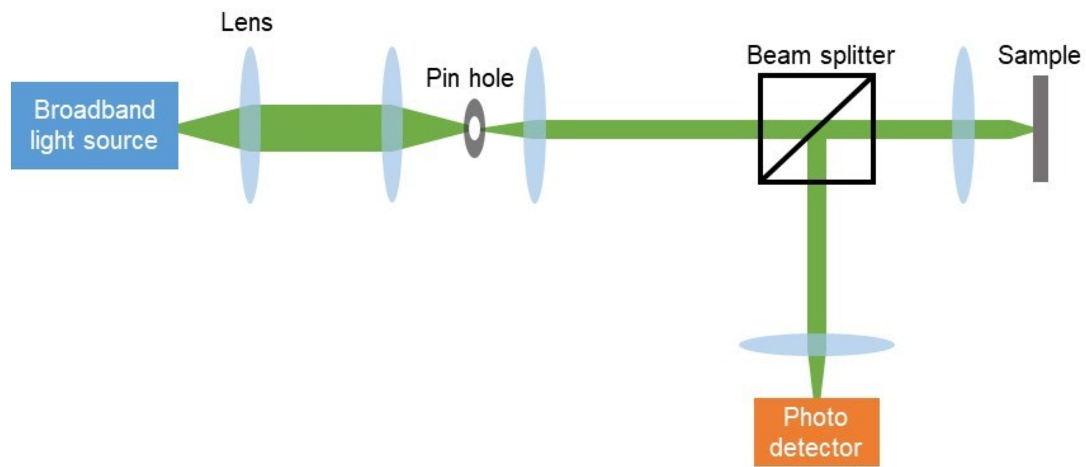

Figure S7 Schematic diagram of the experimental setup for reflectance measurement. A xenon arc lamp was used as a broadband light source, and the beam was weakly focused by a system of lenses to the sample region. A pinhole was used to control the illuminated sample area. The reflected beam was focused by a lens onto a femotowatt photo detector.