Electronic Supplementary Material (ESI) for Nanoscale.

Supplementary Information

Compact discs as versatile cost-effective substrates for releasable nanopatterned aluminium films

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1. Optical simulations

The transmission spectrum of an Al nanohole square lattice was calculated using the finite-difference time-domain (FDTD) algorithm. The simulated device geometry consisted of a 500-nm-period array of 3x3 cylindrical holes of 250 nm in diameter in a 100 nm thick layer of Al on a semi-infinite substrate (adhesive material of the tape). The frequency-dependent dielectric constant of Al was modeled by the well-known Drude-Lorentz equation with the fitted parameters reported in the literature. The dielectric constants of the superstrate (air) and substrate were assumed to be frequency-independent and equal to 1 and 2.16 (refractive index = 1.47), respectively. Periodic boundary conditions were chosen along the device plane coordinates (x- and y-axis of the array) and perfectly matched layer (PML) boundary condition was used along the incident beam propagation direction (z-axis), normal to the device plane. Frequency analysis of the transmission was achieved by launching a pulsed excitation from the substrate towards the Al array and calculating the fast Fourier transform (FFT) of the time-domain field component E_x on a plane above the holes.

The device was simulated for three different nanohole situations: a) holes are empty (filled with air), b) holes are fully filled with tape adhesive material, and c) holes are partially filled with adhesive material. It is seen that for all three cases resonance features (transmission minima) are located at the same wavelengths; however, depending on the filling degree of the holes, there are clear differences in both the width of the resonances and the wavelength value of the maximum transmission. The simulation curve most resembling the experimental spectrum is that corresponding to holes semifilled with adhesive material. This is an expected result since the adhesive material could penetrate partially inside the holes during the finger-pressure operation.

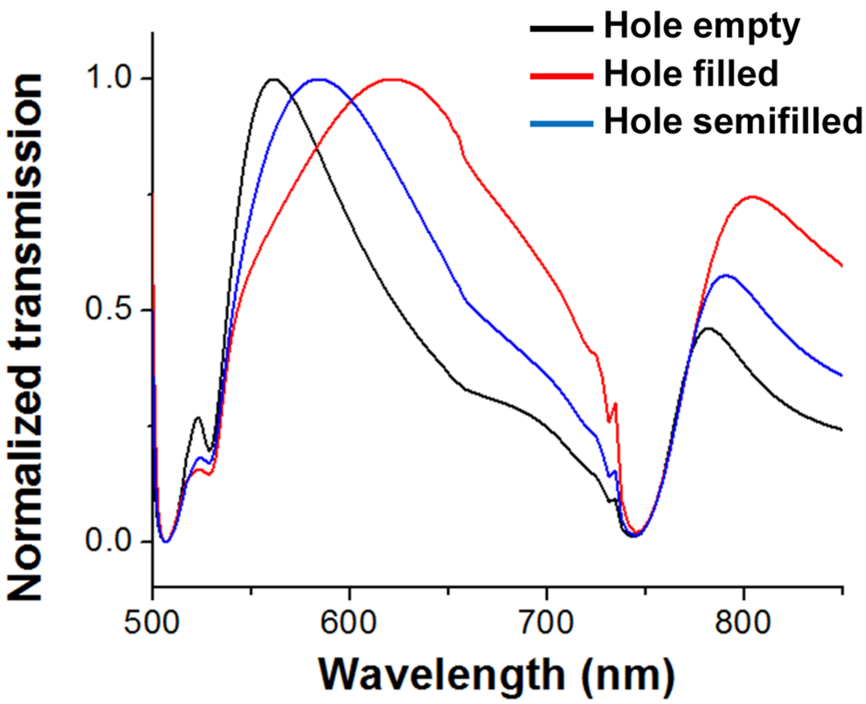

Figure SI.1. *Calculated transmission spectra of a 500-nm-period Al NHA on Scotch tape. Calculated spectra correspond to three nanohole filling cases: holes filled with air (black line), holes filled with adhesive material (red line) and holes partially filled with adhesive material (blue line).*

2. ***Optical coupling via an Al NHA on Scotch tape***

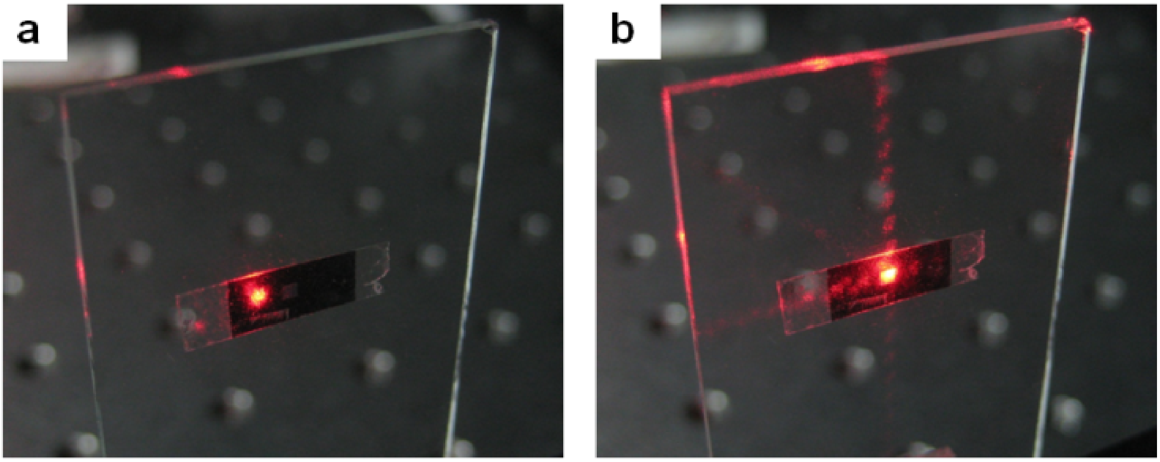

Figure SI.2. *Al NHA on a Scotch tape piece adhered onto a glass slide. A He-Ne laser beam hitting the unpatterned region of the Al film (a) does not produce directional optical coupling into the slide. When the laser beam hits the NHA (b), light is coupled along the main axes of the square lattice of nanoholes.*

3. ***Electrostatics-based Opto-Mechanical Cantilever***

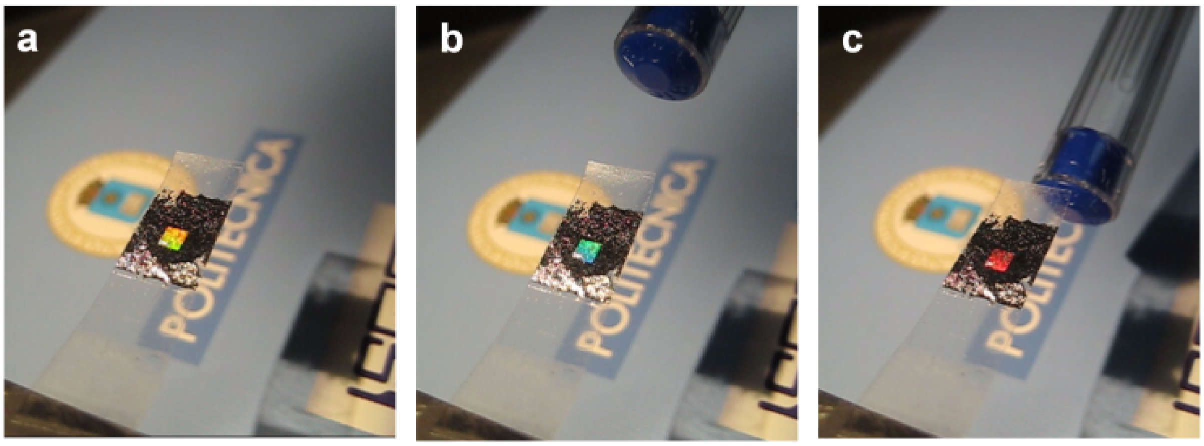

Figure S6. *An electrostatics-based opto-mechanical sensor. a) A piece of Scotch tape with an Al NHA adhered to a support by one of its ends forms a cantilever. The tape has been electrically charged by peeling it off. An uncharged plastic pen is placed near the charged tape (b,c), inducing opposite charge in the pen region closest to the tape. Thus the tape-cantilever bends and this is observed as an iridescent color change of the Al NHA.*

4. ***Video 1:*** *Transfer of Al film nanostructured with nanohole array from a polycarbonate CD surface onto a Scotch tape.*
5. ***Video 2:*** *Opto-mechanical electrostatics-based sensor: Electrical Attraction.*
6. ***Video 3:*** *Opto-mechanical electrostatics-based sensor: Electrical Repulsion.*