Supporting Information

Polarization-independent, narrowband, near-IR spectral filters via guided mode resonances in ultra-thin a-Si nanopillar arrays

Ryan C. Ng,[†,] Juan C. Garcia,[‡] Julia R. Greer,[§] & Katherine T. Fountaine[‡,*]*

[†]Division of Chemistry and Chemical Engineering, California Institute of Technology, Pasadena, CA 91125, United States

[‡]NG Next, Northrop Grumman Corporation, One Space Park, Redondo Beach, CA 90278, United States

[§]Division of Engineering and Applied Sciences, California Institute of Technology, Pasadena, CA 91125, United States

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Atomic Force Microscope Profiles

The fabricated nanopillars exhibit tapering characteristic of ICP-RIE processes. Prior to encapsulation in SiO_2, AFM scans and their associated profiles of the nanopillars are obtained with AFM and presented in Figure S1. These profiles provide the height, radius, and periodicity of the nanopillar arrays. Figures S1a-S1c provide AFM data for variable radius which corresponds with the spectra in Figure 4b. Figures S1d-S1f provide AFM data for variable periodicity which corresponds with the spectra in Figure 4c.

Effect of Variable Radius and Variable Periodicity

The spectra for the fabricated nanopillars for the sweep in variable periodicity is shown in Figure 4c. While these nanopillars should have a constant radius, fabrication imperfections cause a slight disparity between the radius in each of these arrays. In Figure S2, the effect of a change in radius and a change in periodicity on the GMR peak location is presented. The top radius of the nanopillar in the variable periodicity sweep varies from 263 nm to 302 nm. Over this radius range, we observe minimal shifting of the GMR location at a constant periodicity of a = 1050 nm (Figure S2a). The GMR locations for each array are 1559 nm (green), 1569 (orange), and 1581 (blue). On the other hand, for variable periodicity, we see a much more significant shift in the GMR location as we vary the periodicity from 1000 nm to 1100 nm which causes the peak to shift with peak locations of 1508 nm (green), 1569 nm(orange), and 1633 nm (blue) in Figure S2b. This range of radii and periodicities reflect the range over which the nanopillar arrays exhibited experimentally.

Due to the much stronger effect of the periodicity on the GMR location, we assume the radius to be approximately constant for the variable periodicity arrays. The spectral characteristics of these fabricated arrays in experiment and simulation are summarized in Table S1.

Ellipsometry

Ellipsometry data is obtained for 100 nm thick a-Si deposited in PECVD using the conditions specified in the methods section (Figure S4). This n,k is input into the FDTD simulations.

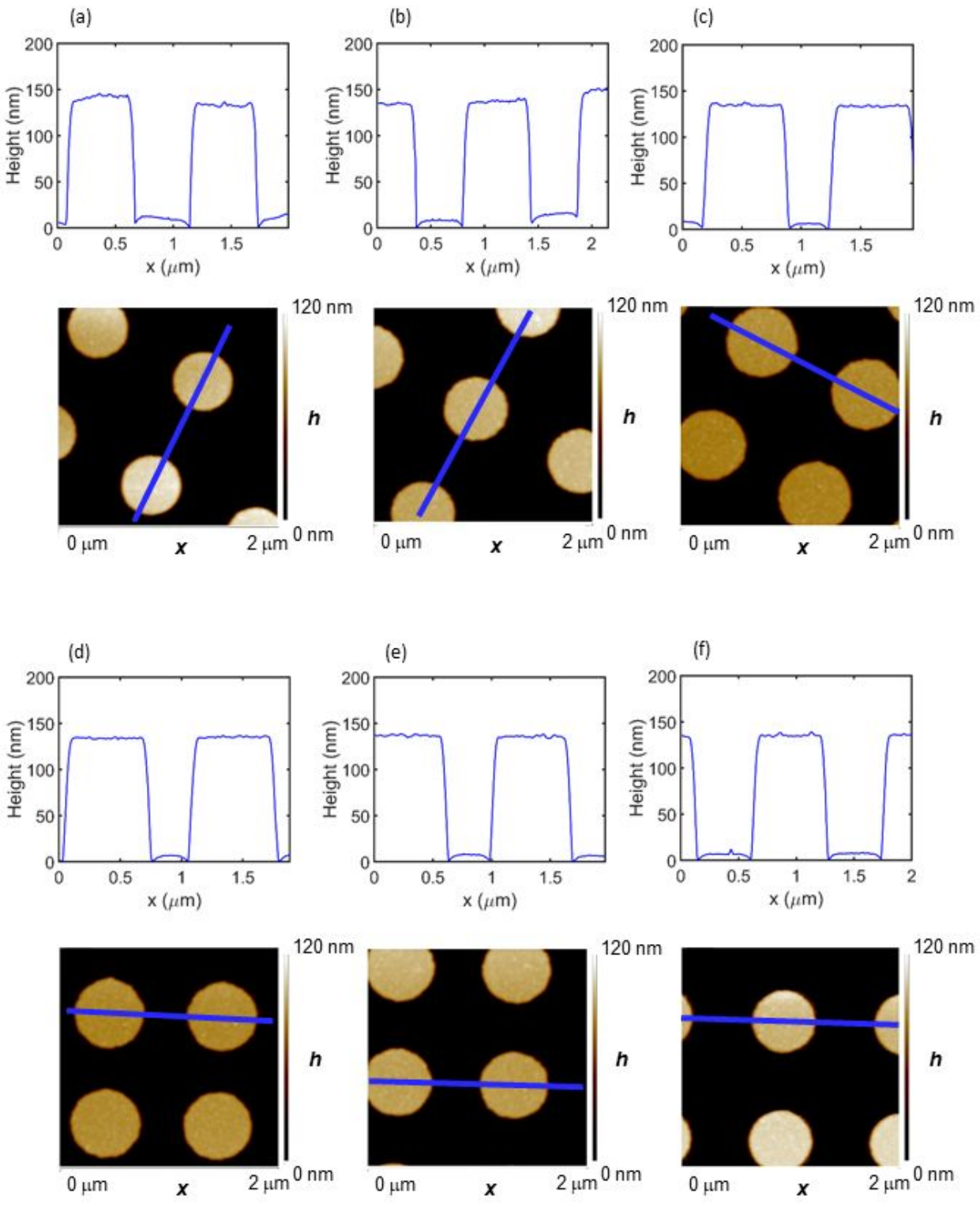
(a)
(b)
(c)
Height (nm)
x (μm)
120 nm
h
0 nm
0 μm
x
2 μm
(d)
(e)
(f)

Figure S1. AFM profiles of the radius of the tapered wires in Figure 4b with variable radius for (a) green spectrum, (b) orange spectrum, and (c) blue spectrum and in Figure 4c with variable period for (d) green spectrum, (b) orange spectrum, and (c) blue spectrum.

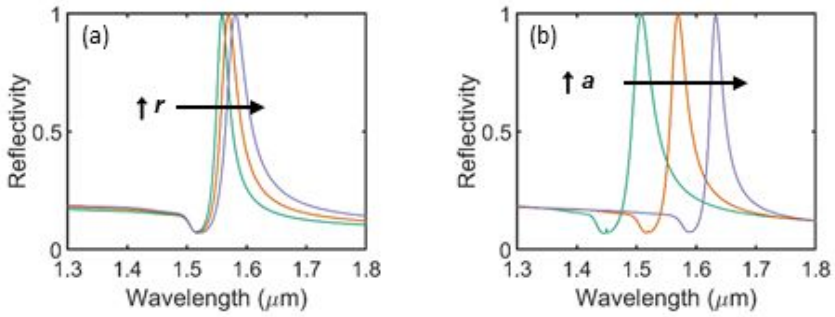

Figure S2 – FDTD simulations for (a) a = 1050 nm, r = 260 nm (green), 280 nm (orange), 300 nm (blue) and (b) r = 280 nm, a = 1000 nm (green), 1050 nm (orange), 1100 nm (blue).

Table S1 – Spectral characteristics for each array in {experiment / simulation} for variable radius and variable periodicity. The color scheme is consistent with that in Figure 4.

Variable Radius

Array	Peak Position (nm)	Peak Amplitude	FWHM (nm)
Green	1569 / 1565	87.6 / 99.8	22.4 / 33.4
Orange	1580 / 1582	95.1 / 99.9	31.4 / 45.4
Blue	1614 / 1612	92.6 / 100.0	51.4 / 58.9

Variable Period

Array	Peak Position (nm)	Peak Amplitude	FWHM (nm)
Green	1537 / 1554	93.5 / 100.0	49.9 / 62.8
Orange	1590 / 1598	90.1 / 100.0	40.4 / 54.4
Blue	1644 / 1646	85.0 / 99.9	22.4 / 39.4

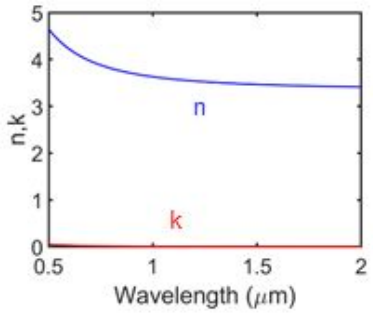

Figure S3. Raw n and k data for a-Si determined from ellipsometry.