

## Electronic Supplementary Information (ESI)

### A Scalable Fabrication Method for Gold Nanodisk-Upconverting Nanoparticle Hybrid Nanostructures

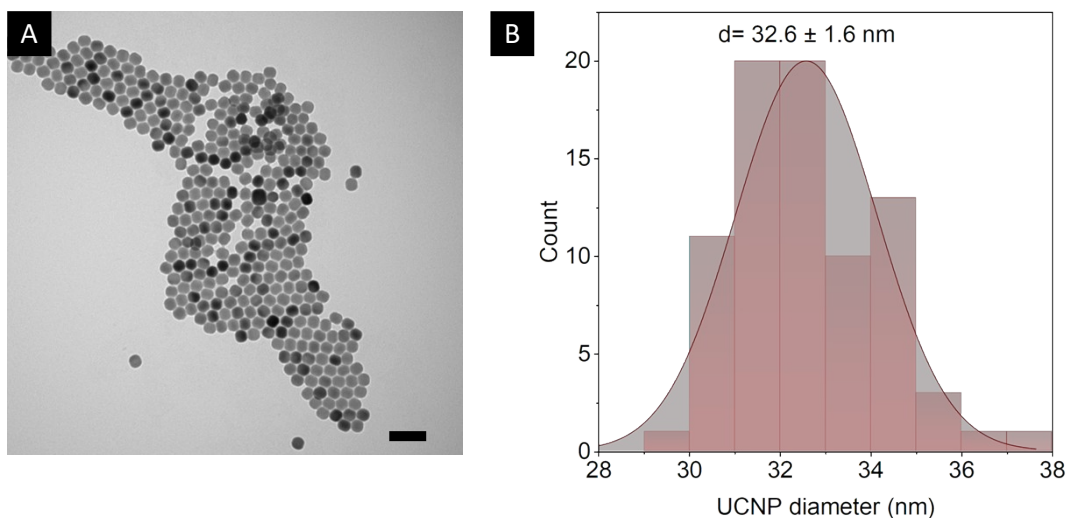
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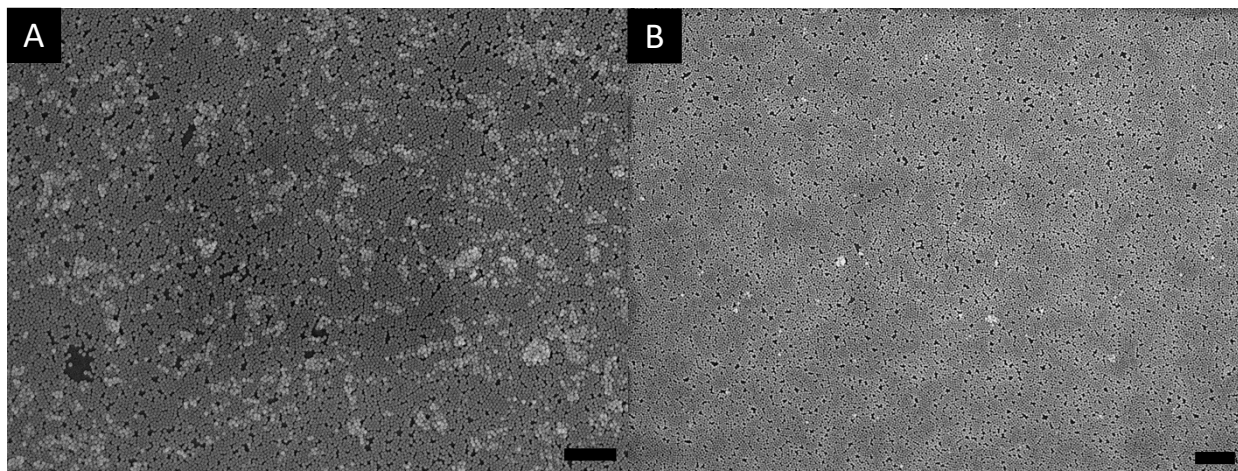
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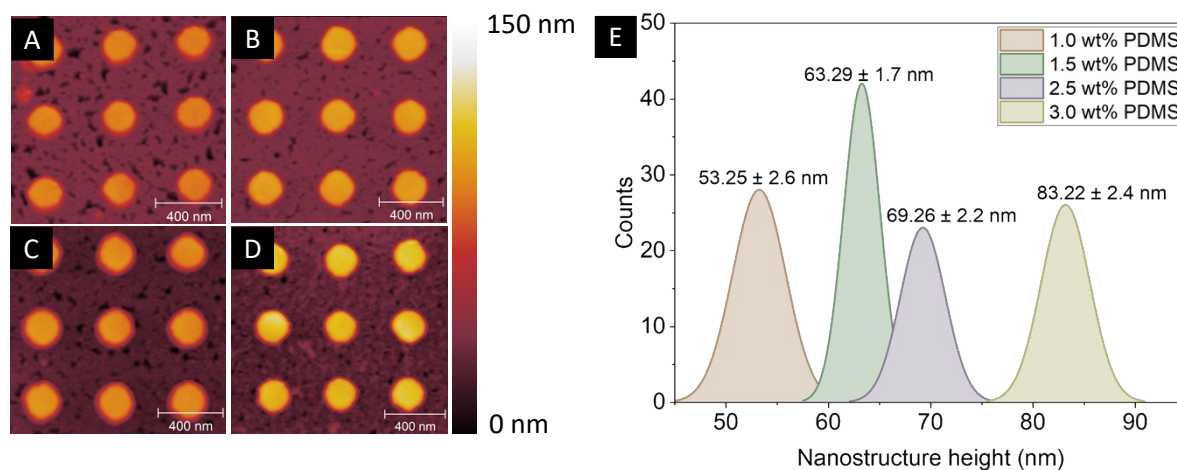
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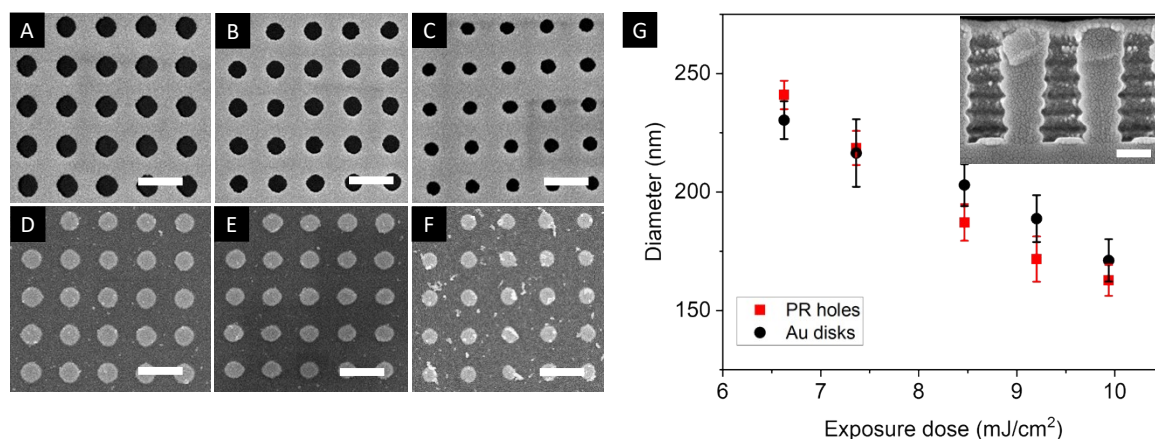
**Figure S1.** (A) TEM image of as-synthesized NaYF<sub>4</sub>: Yb<sup>3+</sup>, Tm<sup>3+</sup> UCNPs. Scale bar is 100 nm. (B) Distribution of the NaYF<sub>4</sub>: Yb<sup>3+</sup>, Tm<sup>3+</sup> UCNPs diameters as calculated from the TEM images using ImageJ.



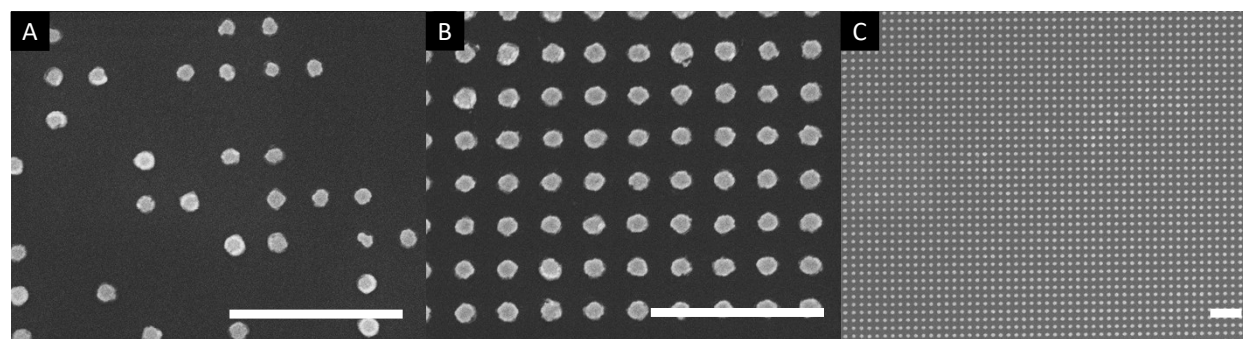
**Figure S2.** Large scale SEM images of self-assembled UCNP films prepared with a UCNP concentrations of 0.01 mg/mL and ethanol amount of (A) 800  $\mu$ L and (B) 200  $\mu$ L. Scale bar is 500 nm.



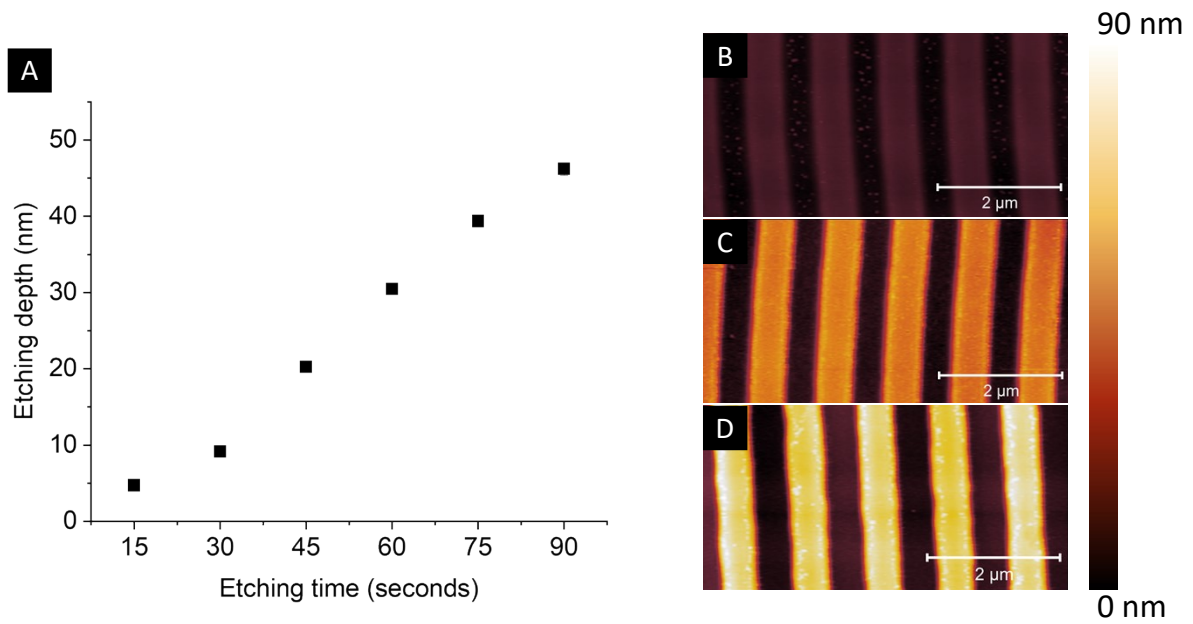
**Figure S3.** (A-D) Representative AFM maps of the plasmonic nanoarray on PDMS-UCNP layers after the PDMS in between the structures was etched away, exposing the UCNPs in the background. (E) Distributions of the hybrid nanostructure heights as obtained from  $3 \times 3 \mu\text{m}^2$  AFM maps for the different PDMS concentrations.



**Figure S4.** SEM images of PR hole and gold nanodisk arrays fabricated with exposure doses of (A,D) 6.6 mJ/cm<sup>2</sup>, (B,E) 7.4 mJ/cm<sup>2</sup>, and (C,F) 9.9 mJ/cm<sup>2</sup>. Scale bar is 500 nm. (G) Correlation between PR hole and gold nanodisk diameters as a function of exposure dose and with a period of 440nm. Inset shows a sideview of the PR holes (at 9.9 mJ/cm<sup>2</sup>) after gold evaporation. The presence of undulation on the sidewall prevents the formation of a continuous gold film which helps with the lift-off process. The thickness of the deposited gold nanodisks is around 30 nm as expected. Scale bar is 200 nm.



**Figure S5.** SEM images of gold disks fabricated at an exposure dose of 8.5 mJ/cm<sup>2</sup>, 250 nm period, and pre-baking for 1 minute at (A) 150 °C, (B -C) 125 °C. Scale bar is 1 μm.



**Figure S6.** (A) PDMS etching depth as a function of RIE time. (B-C) Representative AFM maps of the periodic PDMS grating created after RIE and PR removal.