Supplementary Materials

Engineering SERS Properties of Silicon Nanotrees at the Nanoscale

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3.1 Morphology of SiNTR

3.1.1 Synthesis method A - temperature dependence on SiNTr growth

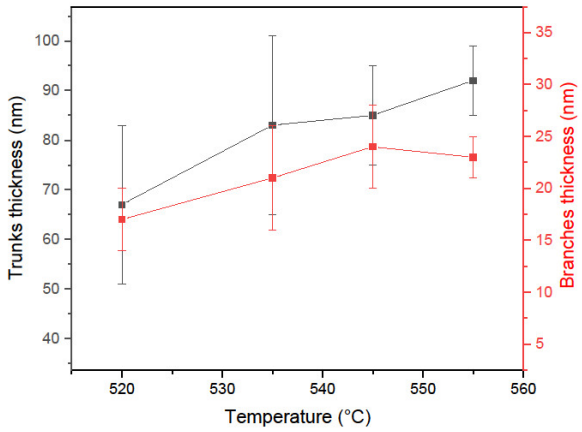


Figure S1: Trunks' and branches' thicknesses for different temperatures growth.

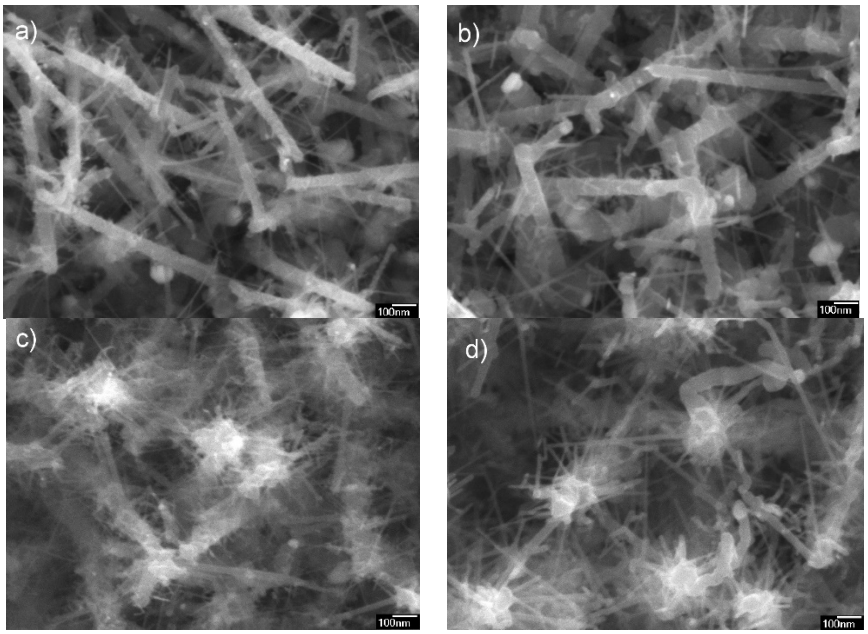


Figure S2: Si trunks' of the SERS substrate synthesized at 545c for 17 min. Branches were obtained by Silane shots: a) 1 shot, b) 2 shots, c) 3 shots, and d) 4 shots.

3.1.2. Synthesis method B - branches density in correlation with cycles number

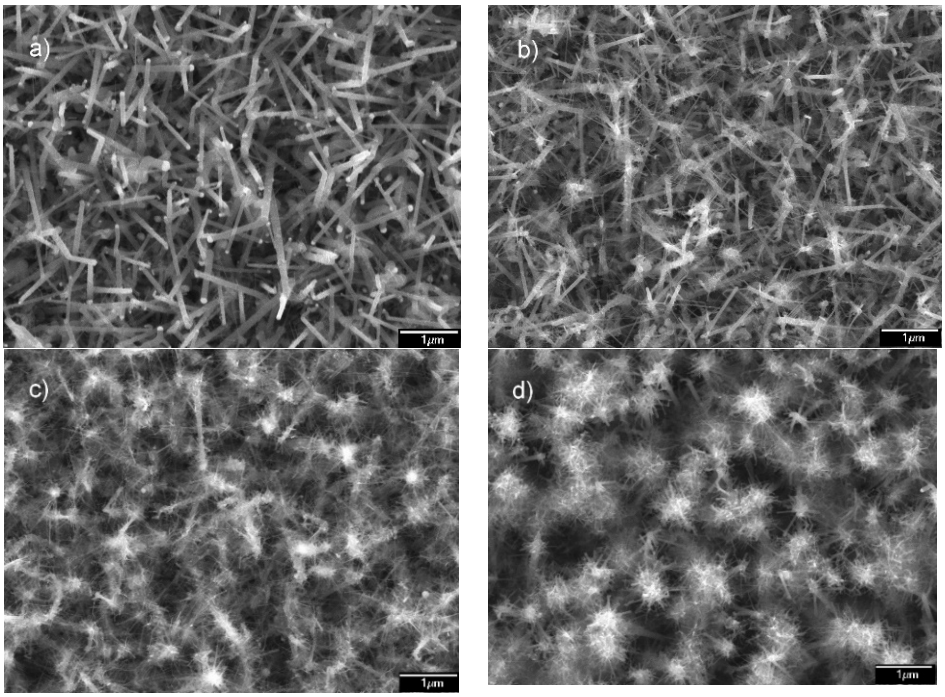


Figure S3: SEM figures of samples synthesized at 520°C utilizing method 'b': a) 1 cycle, b) 2 cycles, c) 3 cycles, d) 4 cycles.

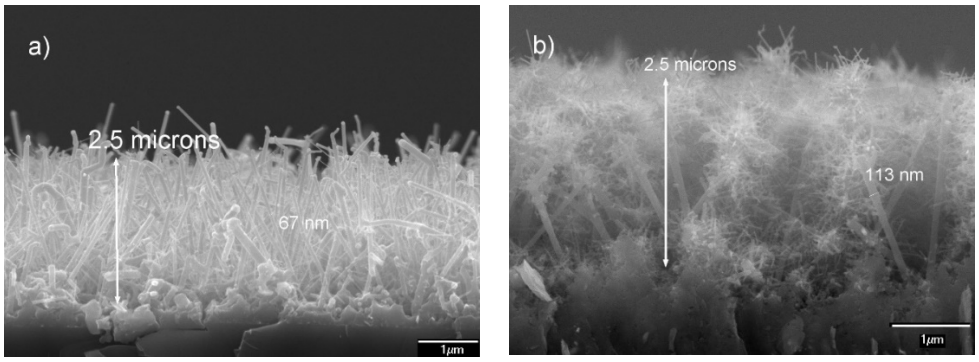


Figure S4: Cross-section of samples synthesized at 520°C utilizing method 'b': a) 1 cycle, b) 4 cycles.

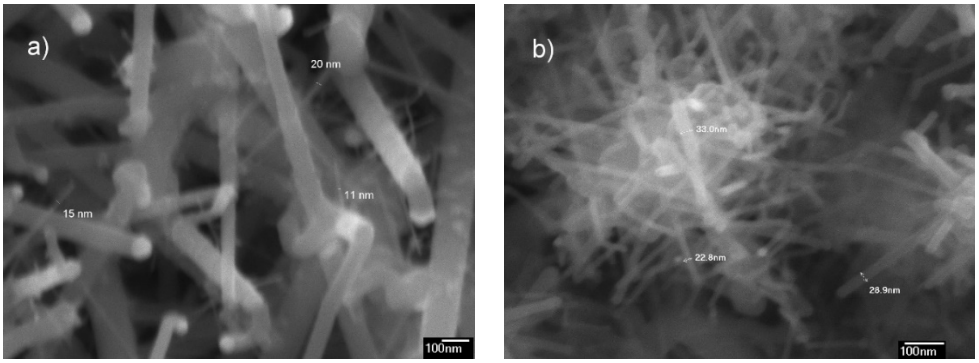


Figure S5: Branches' thickness for samples synthesized at 520°C utilizing method 'b': a) 1 cycle, b) 4 cycles.

3.2 The flexibility of the structure in correlation with metal plating

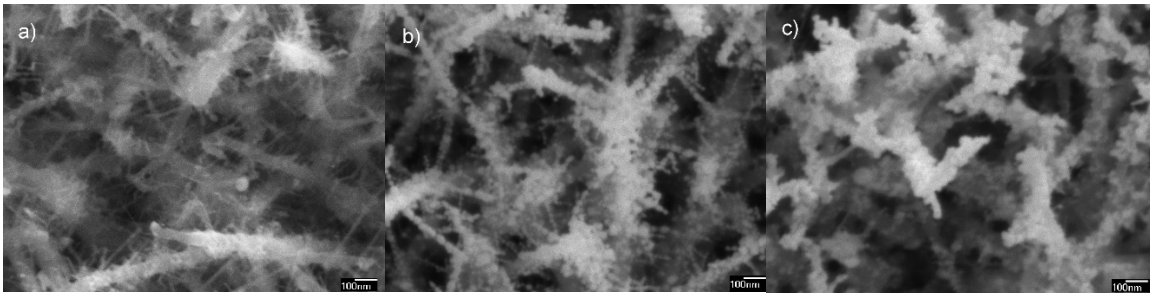
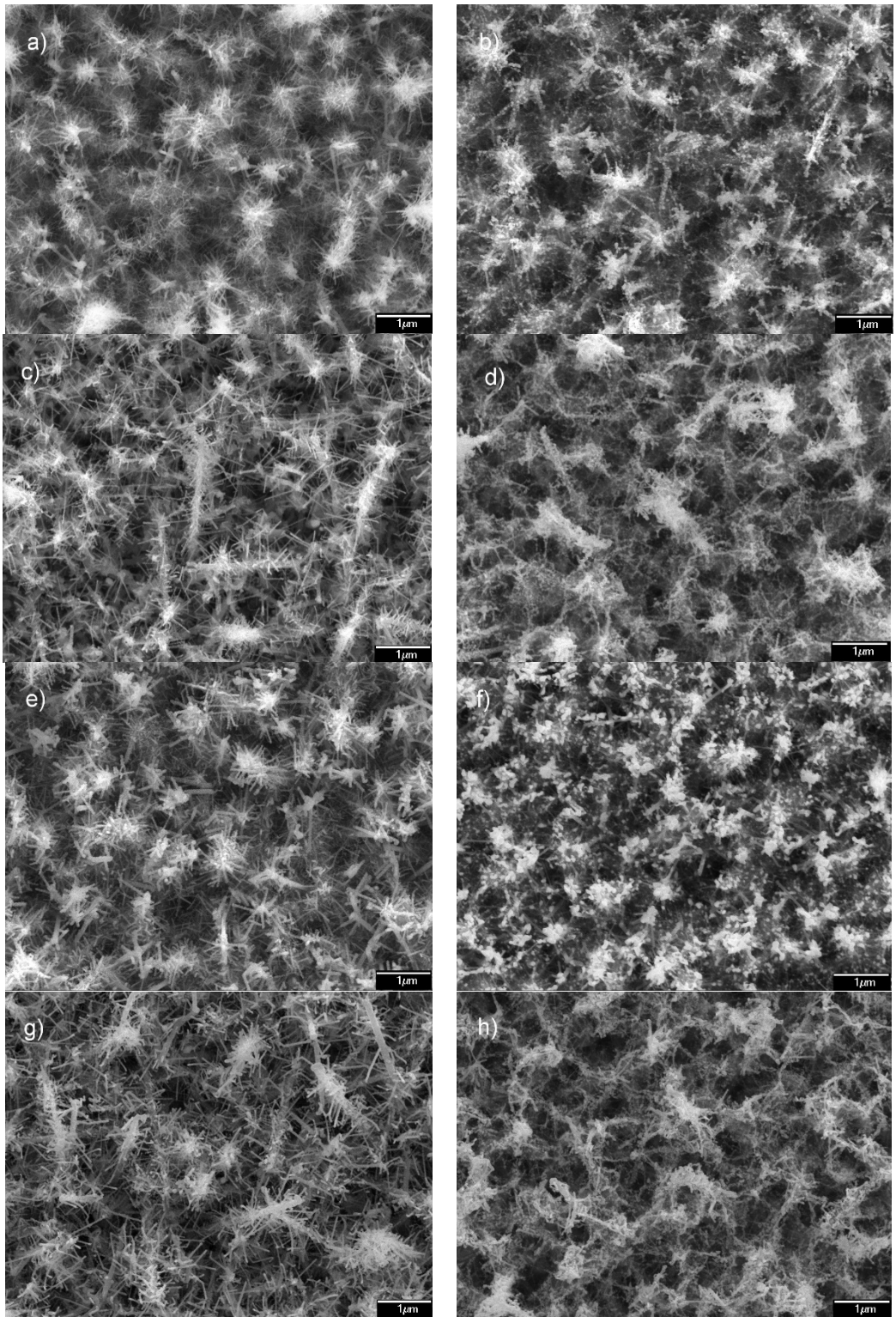


Figure S6: NTrs nanostructure before and after water immersion: a) pristine SiNTrs nanostructure, b) dry substrate with 14 nm Ag coating layer, c) wet dry substrate with 14 nm Ag coating layer.


a)
1μm
b)
1μm
c)
1μm
d)
1μm
e)
1μm
f)
1μm
g)
1μm
h)
1μm

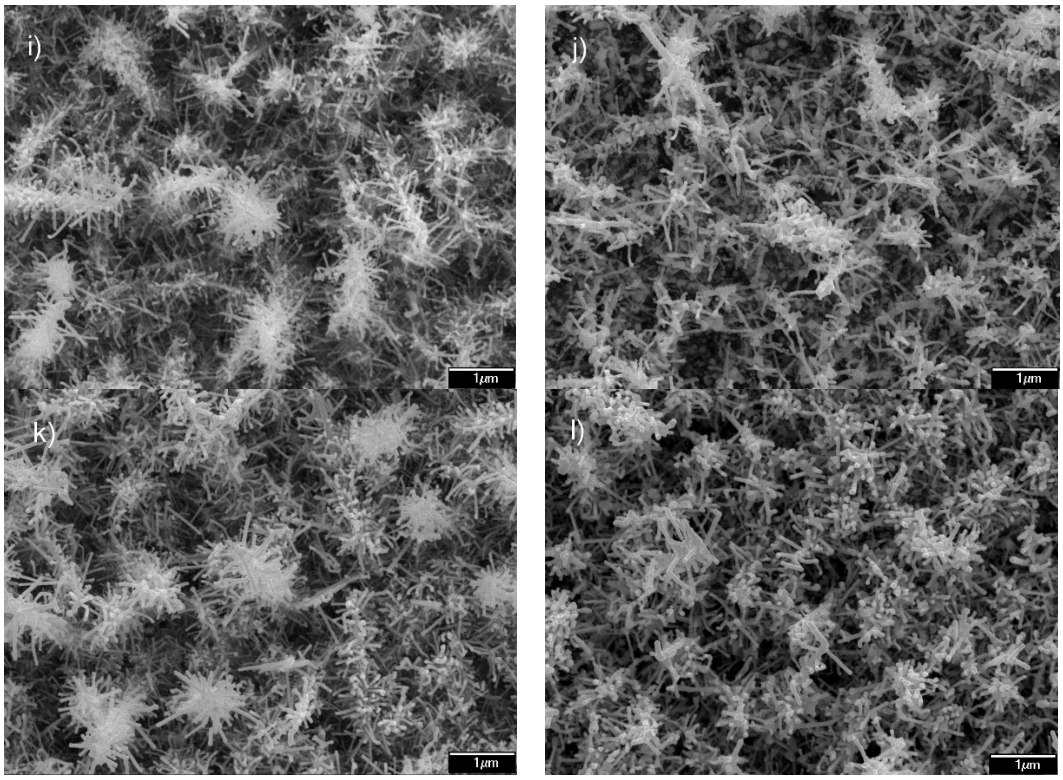


Figure S7: NTrs nanostructures change for various Ag coating thicknesses before and after water immersion: a) 8 nm Ag layer, dry substrate, b) 8 nm Ag layer after wetting, c) 10 nm Ag layer, dry substrate, d) 10 nm Ag layer after wetting, e) 14 nm Ag layer, dry substrate, f) 14 nm Ag layer after wetting, g) 20 nm Ag layer, dry substrate, h) 20 nm Ag layer after wetting, i) 30 nm Ag layer, dry substrate, j) 30 nm Ag layer after wetting, k) 40 nm Ag layer, dry substrate, l) 40 nm Ag layer after wetting.

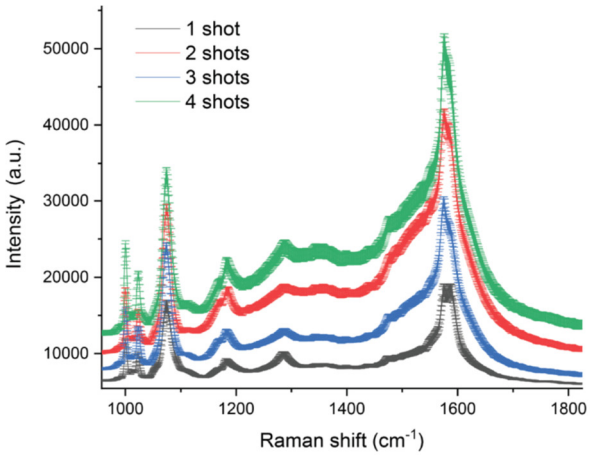


Figure S8: SERS spectra of 10 nm Ag coated NTrs substrates for various shots numbers. The substrates were synthesized at 535°C for 17 min. 20 spectra of each sample were monitored and averaged.

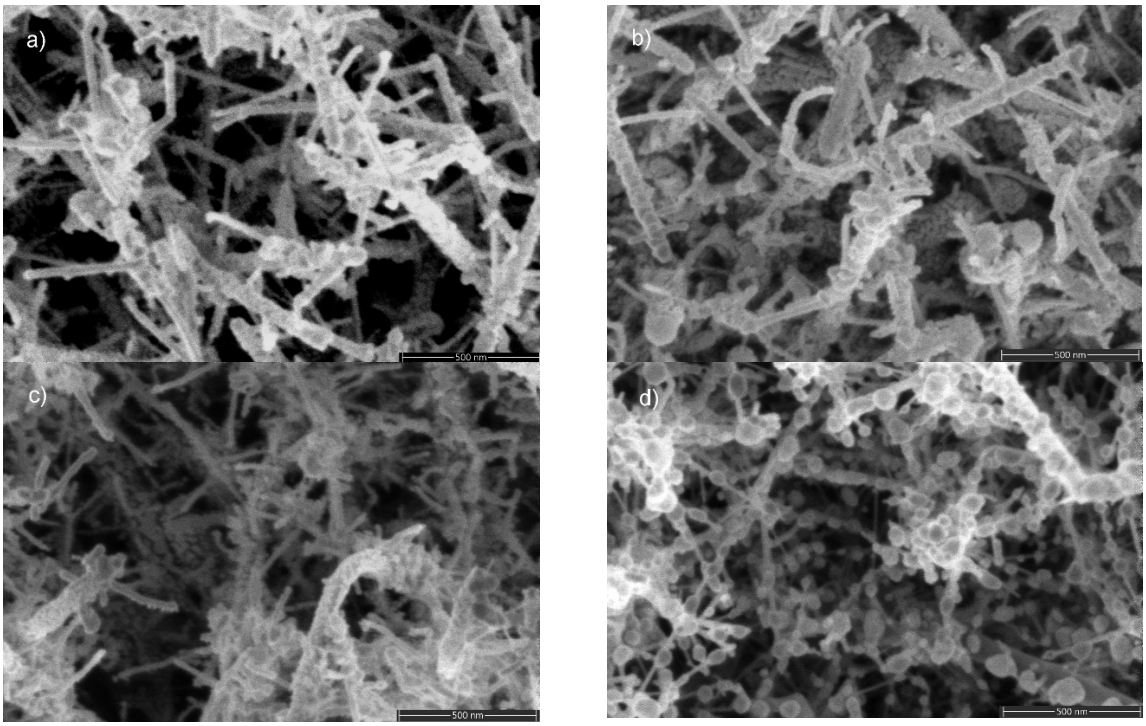


Figure S9: SEM figures of Au plated silicon nanotrees: a) 1 shot, b) 2 shots, c) 3 shots, d) 4 shots.

To confirm that SERS reproducibility is adequate on silicon nanotrees fabricated as described in the manuscript, as well as on the SiNWs, we performed the following mapping of the sample fabricated at 545°C with 3 shots injection and plated with Au. SERS was measured in 233 different points separated by 10 microns utilizing Renishaw instrument and 633 nm laser excitation. For 1073 cm^{-1} peak and the averaged intensity of 11649 counts, the Relative Standard Deviation (RSD) 5.3%.

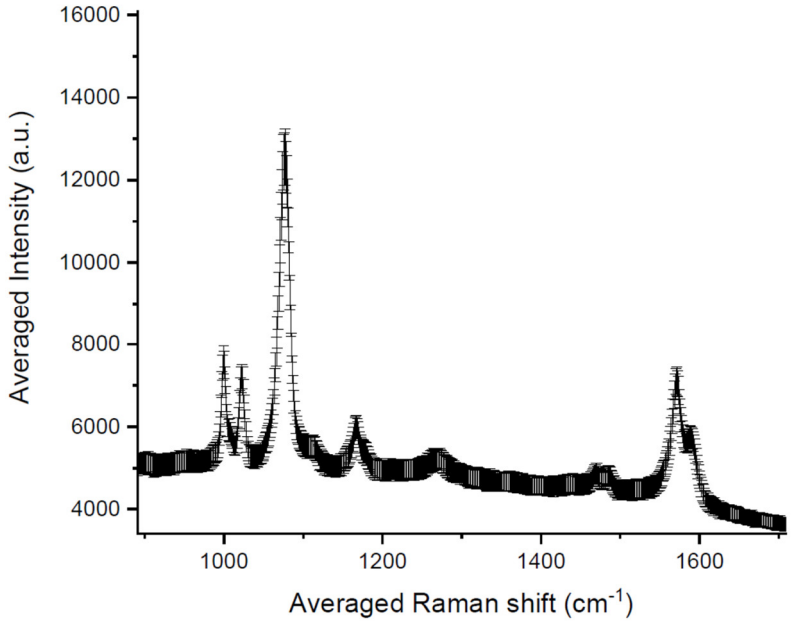


Figure S10: Standard deviation after mapping of silicon nanotrees SERS substrate immersed into MPBA concentration of 10^{-5} M.

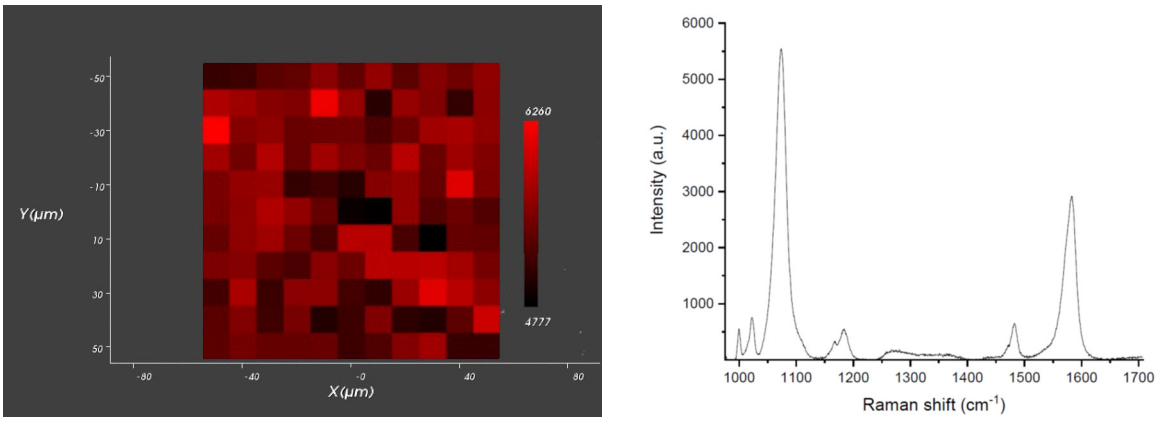


Figure S11: Map of Au-plated nanotrees obtained by '3 shots' and corresponding averaged spectra of 10^{-5} M MPBA. Map parameters: step 10 µm, scan sized 50x50 µm, the number of points 121.

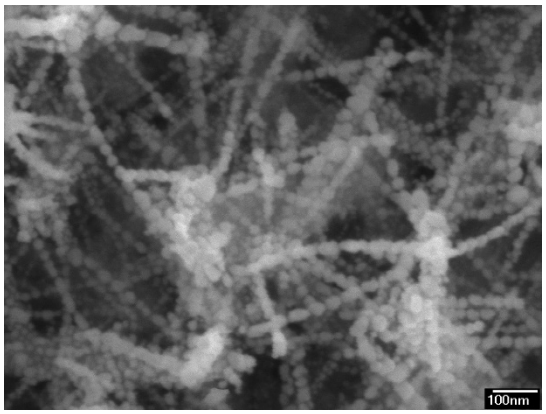


Figure S12: Example of Ag-plated substrate with island-like structure. The sample's trunks were synthesized at 545°C for 17 min and 3 shots were performed.

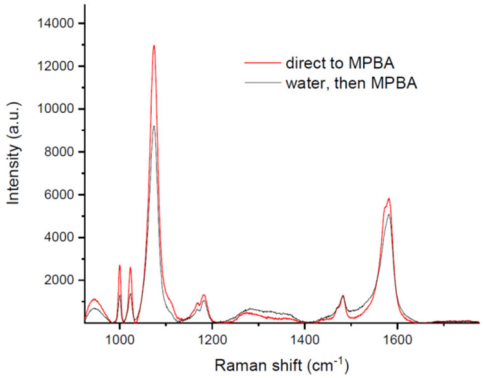


Figure S13: The contribution of a flexible nanostructure for MPBA detection.

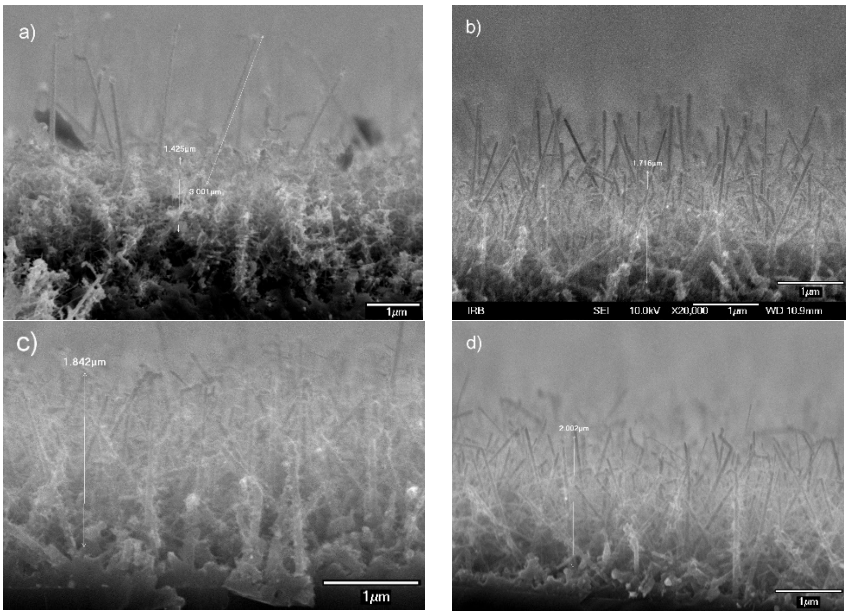


Figure S14: SEM, NTr cross-sections examples: a) regrowth at 545°C and 5 shots, b) regrowth at 535°C and 3 shots, c) no-regrowth sample, 3 shots at 535°C, d) no-regrowth sample, 2 shots at 545°C.

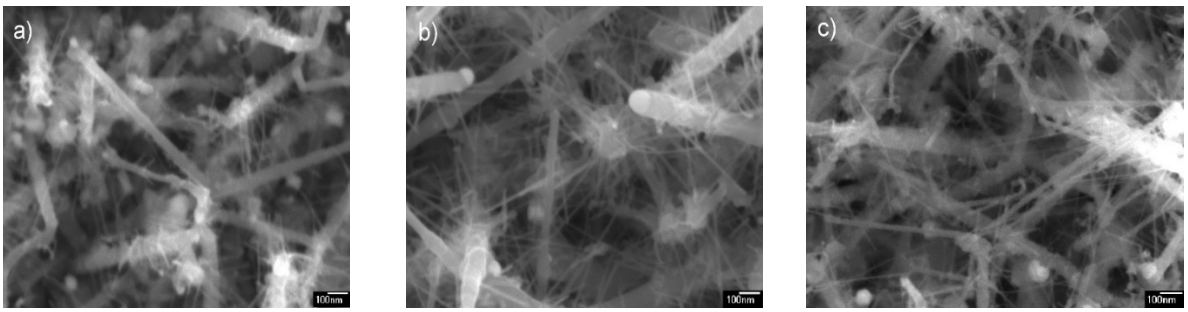


Figure S15: Shot duration variation: a) 15 s (6 shots), b) 30 s (3 shots), c) 90 s (1 shot). Trunks were synthesized at 535°C for the same time duration, 17 min.

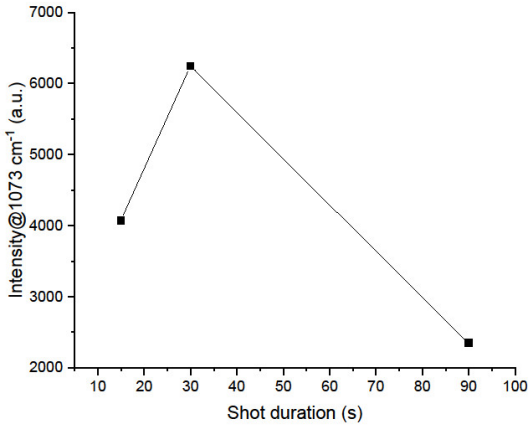


Figure S16: SERS intensities of 10^{-6} M MPBA for samples correlated with Fig. 12S.