Supplementary Information

Ag-Diamond Core-Shell Nanostructures Incorporated with Silicon-Vacancy Centers

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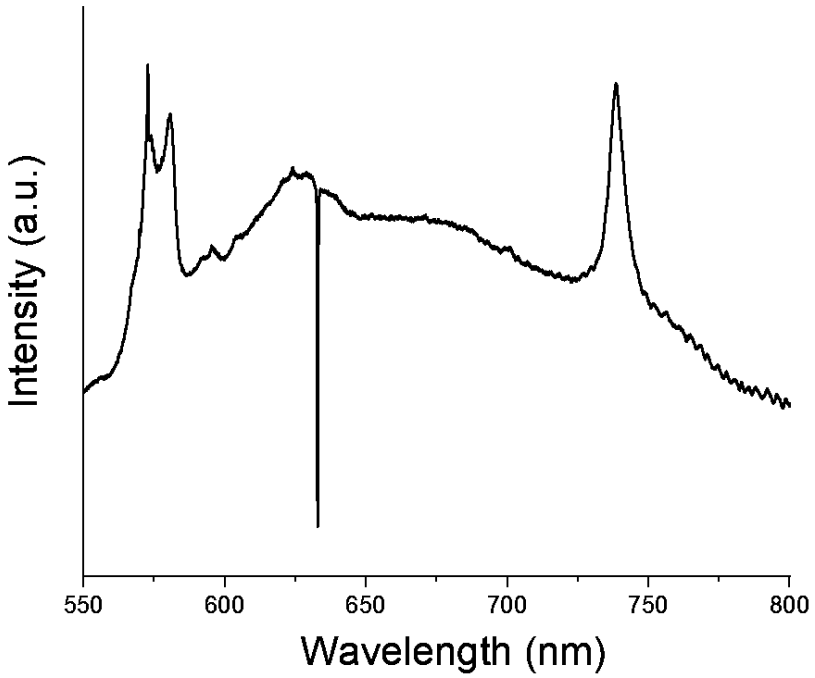

Figure S1 PL spectrum of Ag-Diamond core-shell sample ranging from 600-800 nm with 532 nm laser. The dip at 633 nm is from a notch filter (633 nm center wavelength, 0.3 nm full-width at half-maximum) that is part of the optical path.

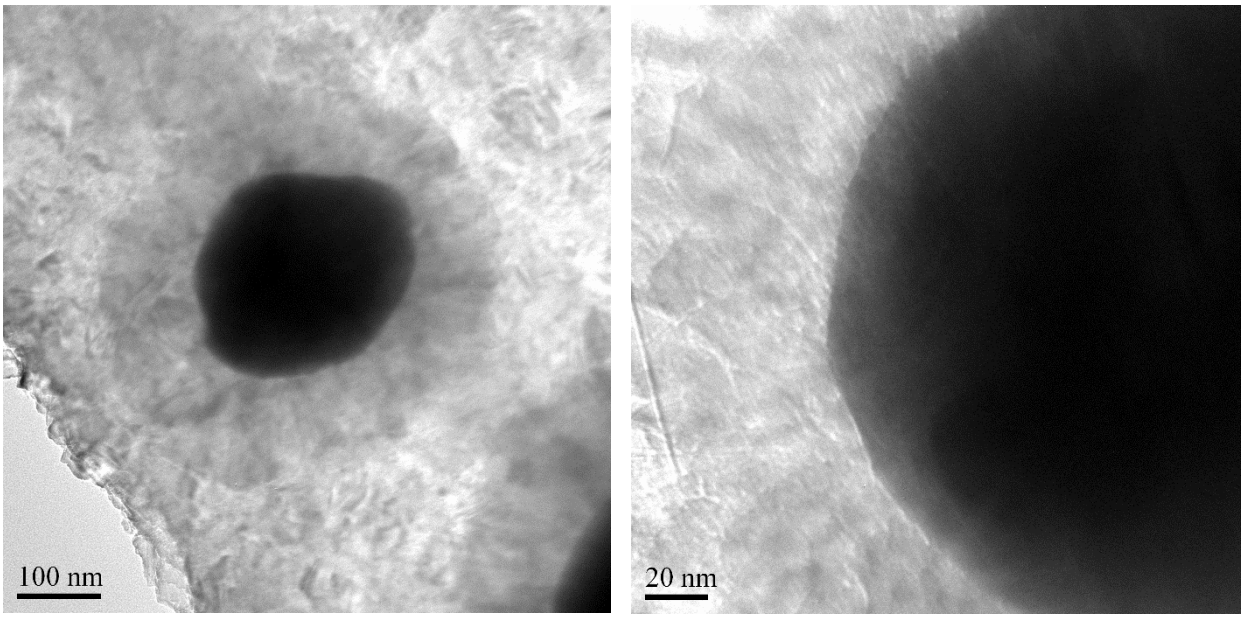

Figure S2 Zoom-in TEM images of Ag-Diamond structures

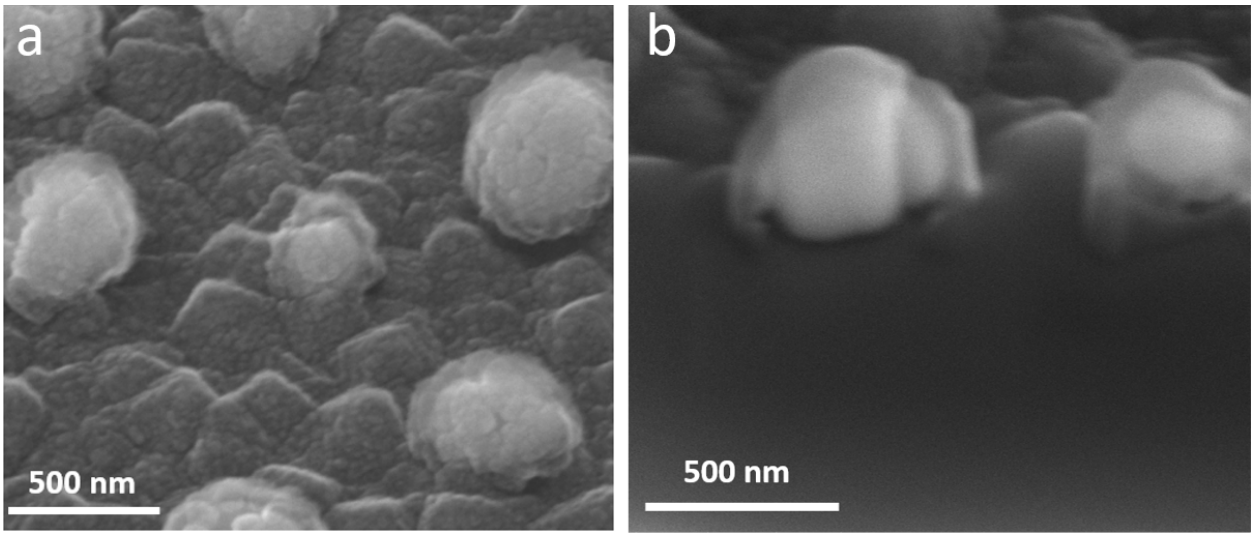

Figure S3 (a) SEM image of a Ag-Diamond core-shell structure shown in Figure 1 taken at tilted 40^{o} to the surface normal of the sample. (b) Cross-sectional SEM image after the Ag-Diamond structure is cut with focused ion beam (FIB). It can be seen that the diamond shell is completely surrounding the Ag core. The structures are spherical with Ag sizes at around 300 nm and diamond shell thicknesses at around 50 nm, and are lying on the first grown diamond layer.

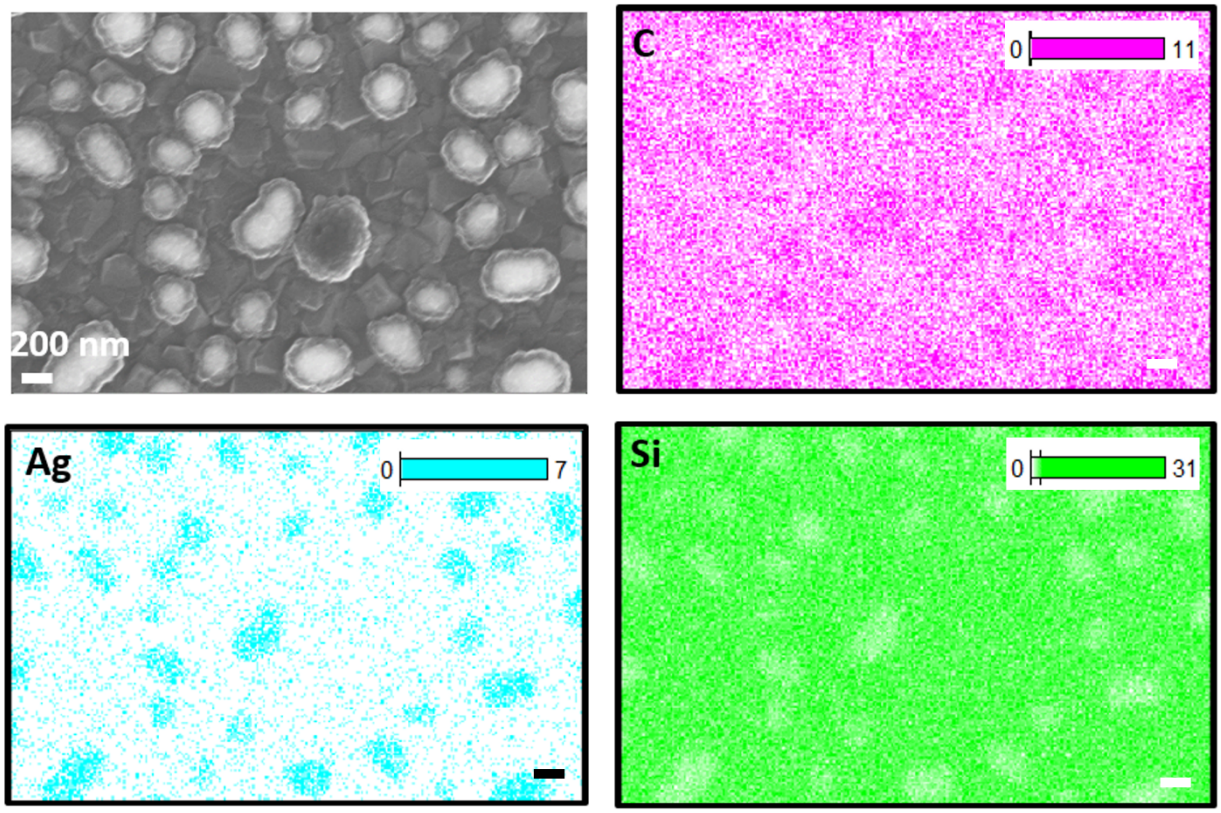

Figure S4 SEM and corresponding carbon (purple), Ag (cyan) and Si (green) EDS mapping of Ag-Diamond structures after boiling concentrated triacid treatment. The sample was immersed in concentrated triacid solution (H_2SO_4:HNO_3:$HClO_4$ = 1:1:1) which was heated to boiling and kept for 24h under reflux condensation. Only a small fraction of the Ag-Diamond structure was damaged (the hollow dark sphere in the middle of the image), which shows no Ag signal and a small pinhole which indicates the etch of the non-diamond.

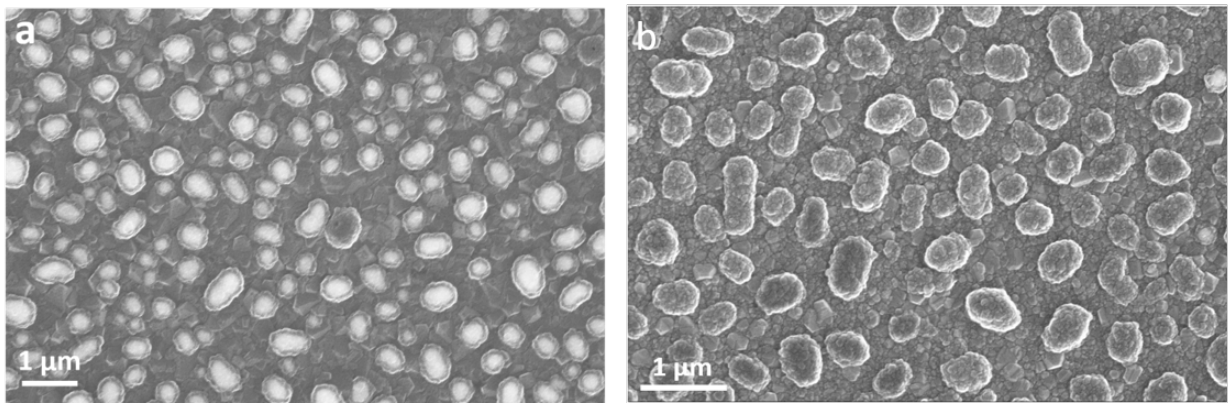

Figure S5 SEM images of samples after boiling concentrated triacid (H_2SO_4:HNO_3:$HClO_4$ = 1:1:1) treatment (a) Ag-Diamond and (b) nitrogen-implantation treated Ag-Diamond. The nitrogen-implantation caused more graphitization and amorphization of the diamond shell, therefore after the boiling acid treatment more hollow structures were created compared with non-implanted samples.

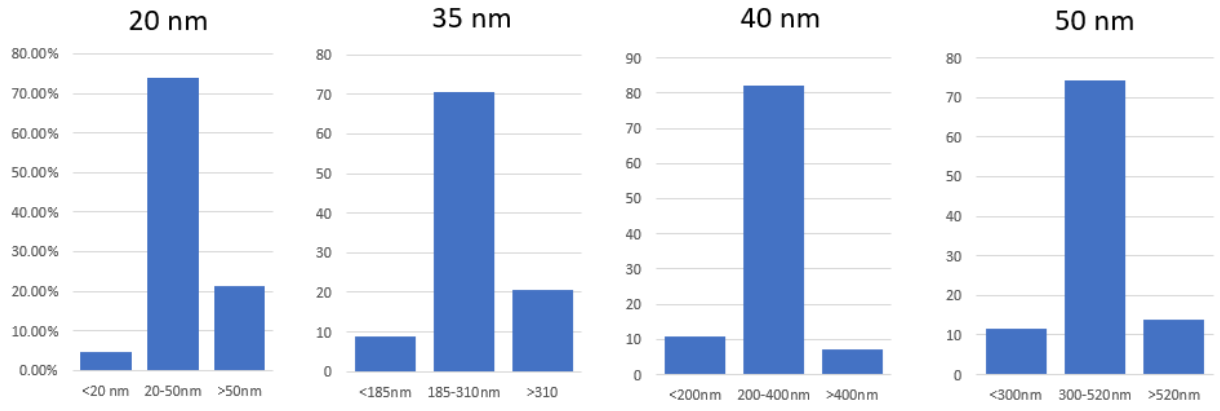

Figure S6: Size distributions of nanostructures with different Ag thickness

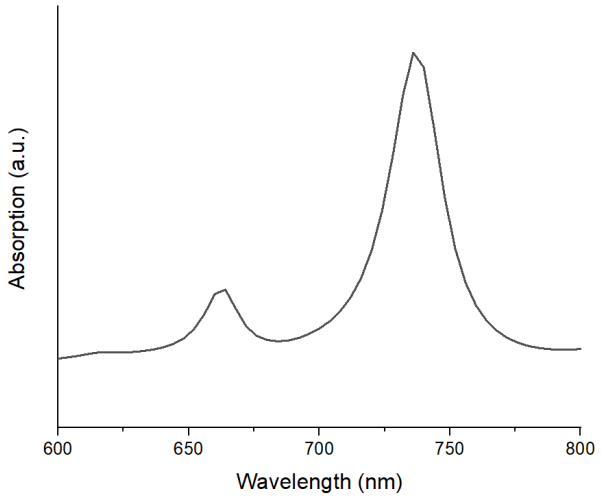

Figure S7: Simulated absorption spectra of 350 nm Ag nanoparticles in 50 nm diamond using Mie theory

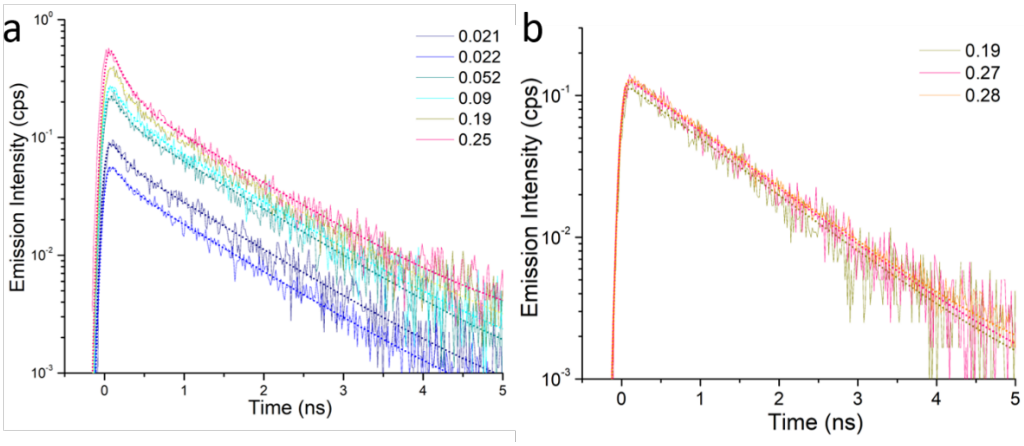

Figure S8 Lifetime curves of (a) Ag-diamond and (b) pure diamond sample at different excitation powers. The faster and slow components are visible at different fluences and no changes in the decay rate can be found in Ag-Diamond (a), while for pure diamond the single exponential decay is consistent with the slow component in (a). The power of 0.25 a.u. corresponds to a fluence of roughly 20 mJ/cm^2.

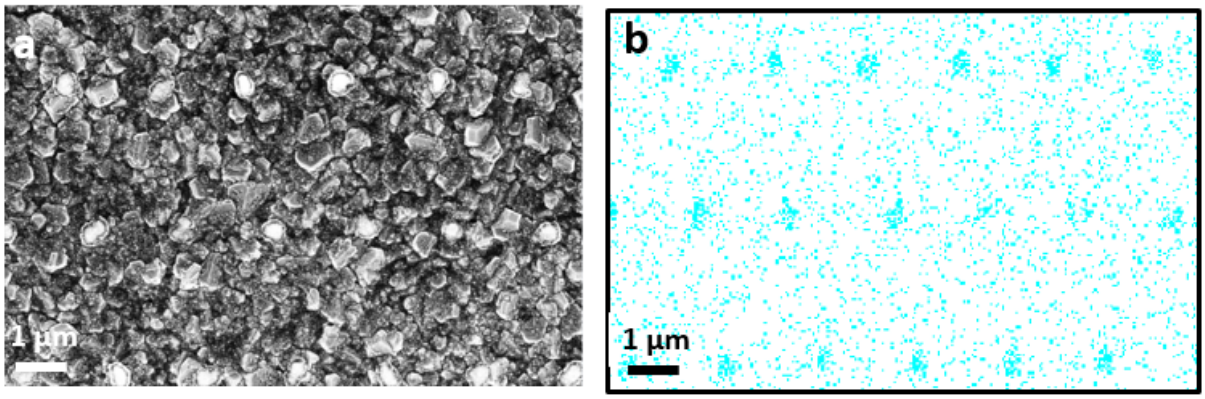

Figure S9 (a) SEM image and (b) corresponding EDS Ag mapping of Ag-Diamond arrays.

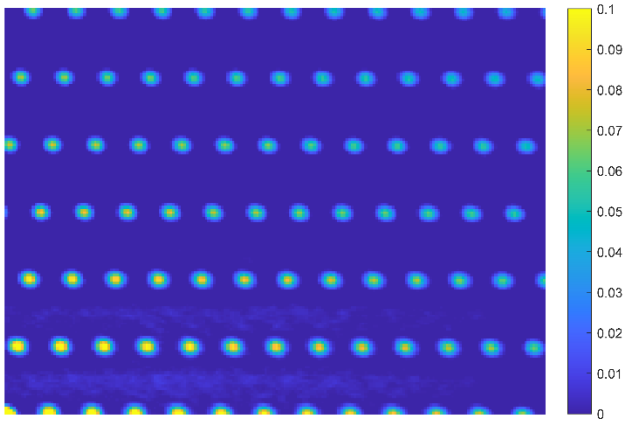

Figure S10 Autocorrelation function of analysis of the patterned Ag-Diamond arrays in Figure 4, indicating a high degree of periodicity with a peak-to-peak spacing of 1.85 um.