Supporting Information

Ultrasensitive Analyte Detection with Plasmonic Paper Dipsticks and Swabs Integrated with Branched Nanoantennas

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Figures

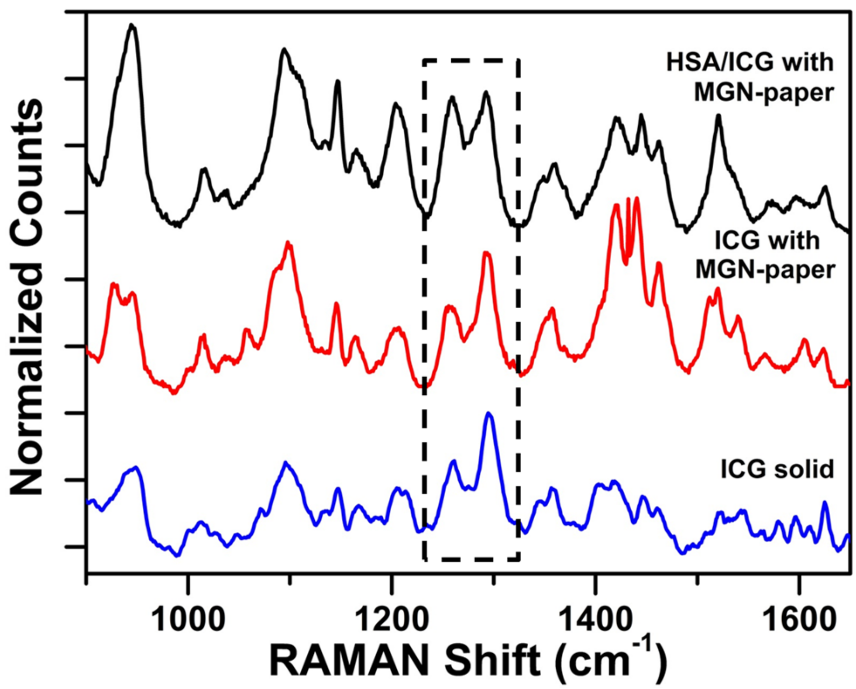

Figure S1. SERS detection of 42 μM:21 μM HSA:ICG with MGN-paper dipstick (black). SERS detection of 20 μM ICG with MGN-paper dipstick (red). Raman of solid ICG (blue). Spectra were normalized to their respective 1294 cm^{-1} peaks and then stacked for comparison. Boxed region focuses on the intensity ratios of the 1258:1294 cm^{-1} peaks for each sample.

Table S1. Comparison of the ratio of 1258:1294 cm^{-1} double peak intensities of varying human serum albumin (HSA)/indocyanine green (ICG) conjugates to determine their respective binding conformations.

Probe with Substrate	Ratio of 1258:1294 cm^{-1} peaks
HSA/ICG with MGN-paper (42 μM/21 μM)	0.962
HSA/ICG with MGN-paper (1 μM/500 nM)	0.717
HSA/ICG with MGN-paper (1 nM/500 pM)	0.712
HSA/ICG with MGN-paper (100 fM/50 fM)	0.696
HSA/ICG with MGN-paper (10 fM/5 fM)	*N/A
ICG with MGN-paper (20 μM)	0.600
ICG solid	0.644

*The ratio for 10 fM/5 fM HSA/ICG could not be calculated because of the overlapping of the double peak to form a broad singlet.

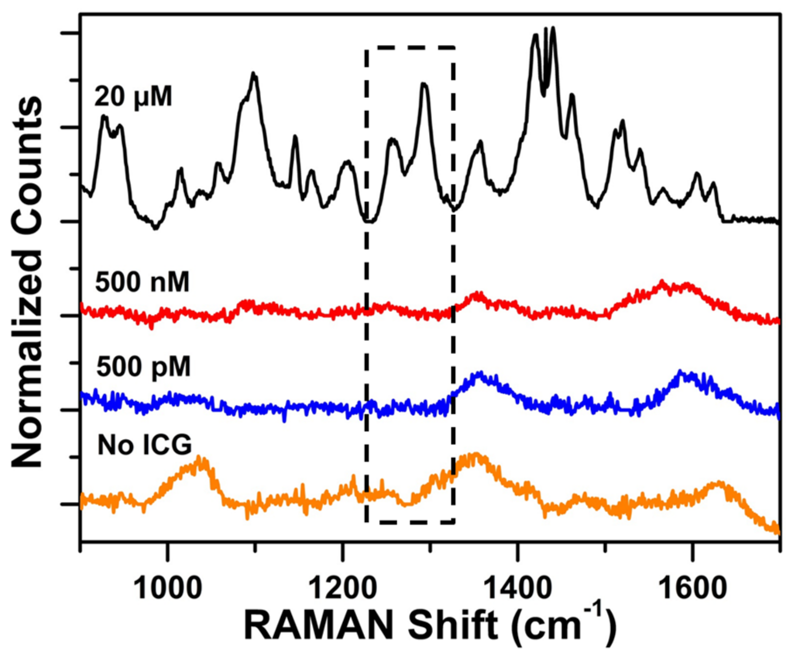

Figure S2. SERS detection of 20 μM ICG with MGN-paper dipstick (black). Attempted SERS detection of 500 nM (red) and 500 pM (blue) ICG with MGN-paper dipstick showing that ICG could not be detected at such low concentrations. The Raman spectrum of the MGN-paper (orange) is provided to distinguish peaks originating from the MGN-paper substrate itself. Spectra were normalized to the maximum peak for each corresponding sample and then stacked for comparison. The double peaks of interest 1258:1294 cm^{-1} are boxed for each sample to provide a guide to the eye.

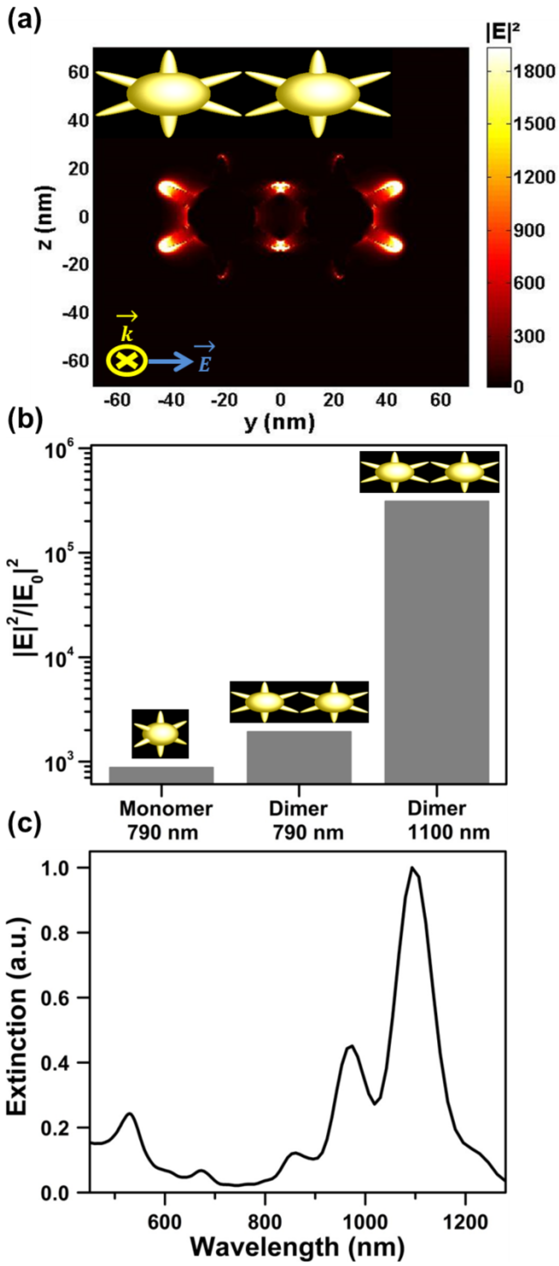

Figure S3. (a) FDTD simulation of a 25 nm core MGN dimer. Profile was collected at a wavelength of 790 nm. A plane wave of intensity one was injected along the x-axis with the E-field polarized along the y-axis. Color bar represents the intensity of the resulting electric field. The inset displays the actual geometry of the dimer. (b) Electric field enhancement of MGNs compared for single particle and dimers. Images of the respective MGNs are shown above each bar. Actual $|E|^2/|E_0|^2$ values for single MGN vs. MGN dimer of 25 nm core are as follows: 878 (Single, 790 nm), 1930 (Dimer, 790 nm), and 311000 (Dimer, 1100 nm). The dimers were calculated with a gap distance of 1 nm between adjacent MGNs and showed a 2.2X enhancement at 790 nm and a 354X enhancement at 1100 nm over a single MGN. (c) Simulated extinction spectrum of a dimer of 25 nm core MGNs showing an enhanced dimer plasmon resonance at 1100 nm.