Electronic Supplementary Material (ESI) for Lab on a Chip

Biochemical Sensor Tubing for Point-of-Care Monitoring of Intravenous Drugs and Metabolites

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Electronic Supplementary Information

Nanodome sensor surface durability

In order to verify that no metal particle break-off or delamination occurs on the nanodome surface from continuous exposure to aqueous reagents, a long-term surface-enhanced Raman scattering (SERS) measurement was performed on the nanodome sensor device filled with 1 μM rhodamine 6G (R6G) solution. The SERS measurement was made on the same locations for five

days after the initial exposure to the R6G solution, where measurements were made roughly every 24 hours. Fig. S1(a) shows the SERS spectra measured for 1 μM R6G solution in the nanodome sensor tubing up to five days after the initial exposure. Fig. S1(b) shows the plot of the average Raman intensity observed at 1370 cm^{-1} as a function of the duration that the nanodome surface was exposed to the aqueous solution. Between each measurement, the nanodome sensor tubing was washed by flowing 5 mL of deionized water through the flow cell and leaving it in overnight until the next day when another measurement was made. The error bars indicate ± 1 standard deviation measured from three different locations on the sensor surface that were 0.5 mm apart from each other (N = 3). For this measurement, the laser power was set to 60 mW with the spectrometer integration time of 5 s. The measurements were made on the same locations on the sensor surface for the experiment. The SERS spectra and the Raman intensity measured for 5 days indicate that no surface damage or particle break-off occurs on the nanodome surface.

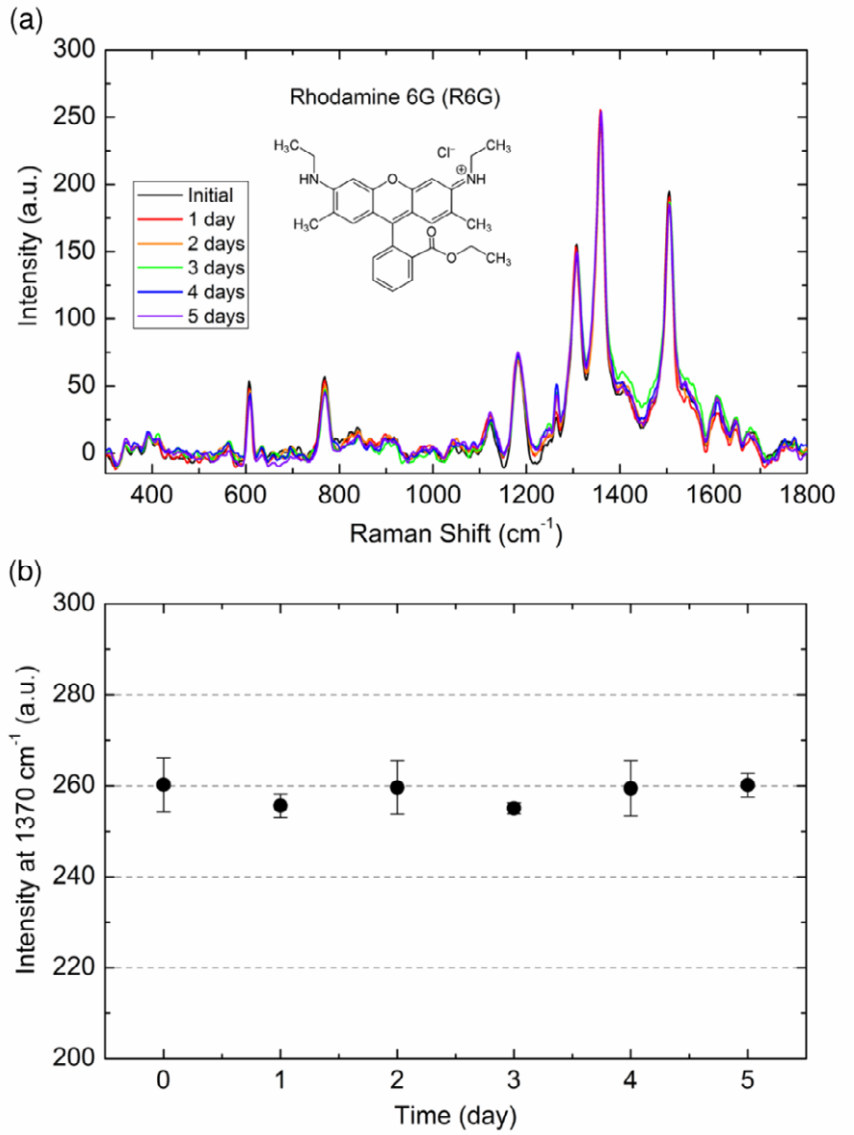

Fig. S1(a): SERS spectra measured for 1 μM R6G solution in the nanodome sensor tubing up to five days after the initial exposure. (b): Plot of the average Raman intensity observed at 1370 cm^{-1} as a function of the number of days the nanodome surface was exposed to an aqueous solution. The error bars indicate ± 1 standard deviation measured from three different locations on the sensor surface that were 0.5 mm apart from each other (N = 3).

In addition to the SERS measurements, an SEM image of the nanodome substrate was also taken before and after exposure to DI water for 5 days for visual verification on the

durability of the nanodome surface. Fig. S2(a) shows an SEM image of the nanodome substrate before incorporation into a flow cell. Fig. S2(b) shows an SEM image of the nanodome substrate after continuous exposure to deionized water for 5 days. From the SEM images, it can be seen that no particle break-off or delamination of the nanodome structure occurred.

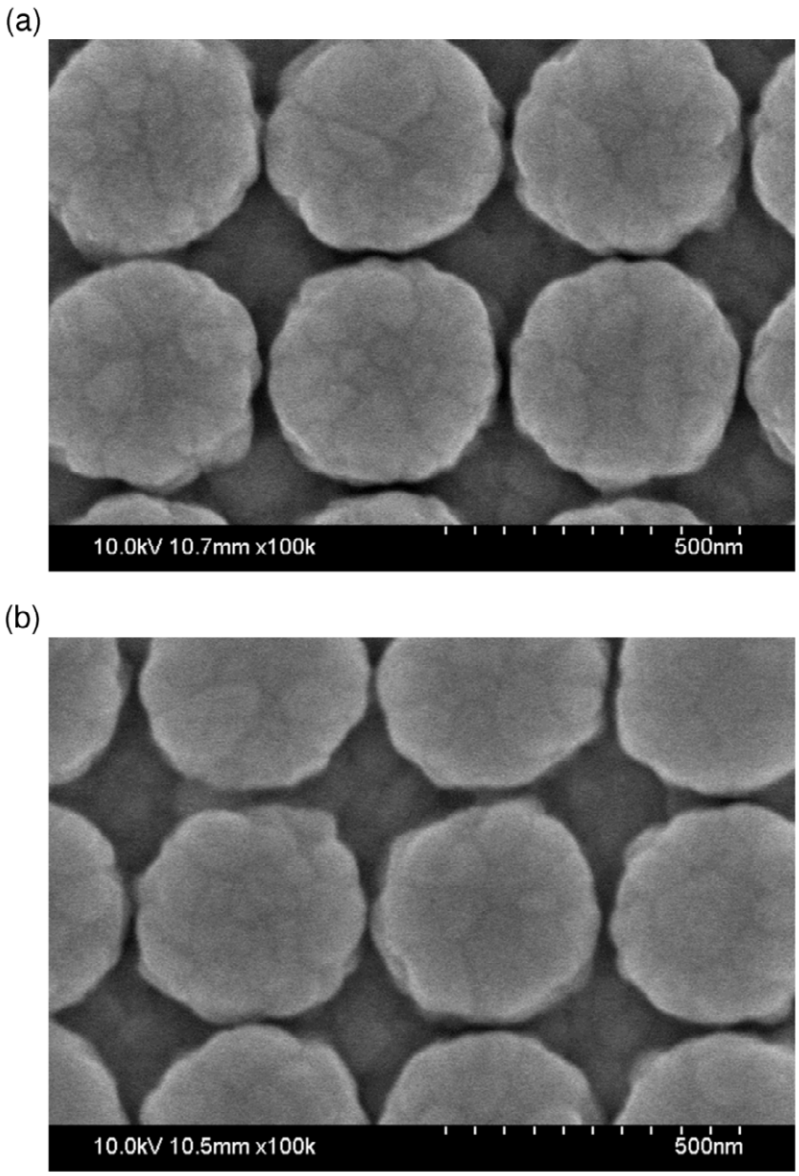

Fig. S2 SEM image of the nanodome substrate (a): before incorporation into a flow cell and (b): after continuous exposure to deionized water for 5 days.

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Sensor measurement reproducibility

In addition to the concentration series (measuring average Raman intensity as a function of analyte concentration) performed on a single device, the measurement was repeated on a different sensor device and compared to check the reproducibility between different sensor devices. Fig. S3(a) and (b) show the plots for the average Raman intensity as a function of analyte concentration of two different sensor devices exposed to promethazine and urea solution, respectively. Within each plot, Device 1 (blue hollow circle) corresponds to the data shown in the paper as inset of Fig. 4(a) and 5(a) and Device 2 (red hollow square) corresponds to the data from a repeat concentration series measurement made on a different sensor device. The experimental procedures and measurement parameters, as described in the paper, were identical for both sensor devices. The error bars in the plot indicate ± 1 standard deviation measured from five separate concentration series (N = 5). In each series, a single SERS measurement was made for each analyte concentration where a wash step consisting of emptying and flowing through 5 mL of buffer solution was repeated three times between each analyte concentration.

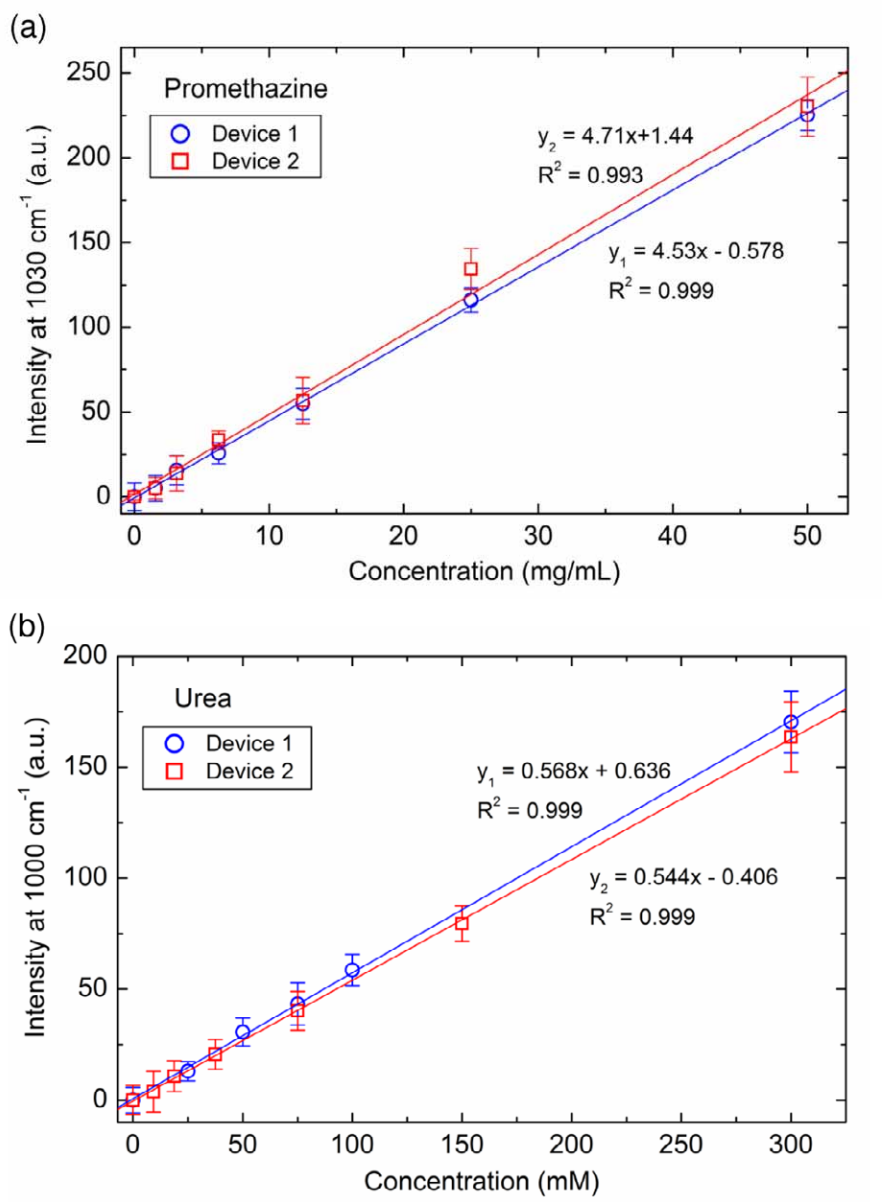

Fig. S3 Plot of average SERS intensity measured as a function of analyte concentration for (a): promethazine and (b): urea. Within each plot, Device 1 (blue hollow circle) corresponds to the data shown in the paper as inset of Fig. 4(a) and 5(a) and Device 2 (red hollow square) corresponds to the data from a repeat concentration series measurement made on a different sensor device. The error bars in the plot indicate ± 1 standard deviation measured from five separate concentration series (N = 5).