Electronic Supplementary Material (ESI) for Nanoscale.

Dual-mode mass and charge sensing to investigate complex surface chemistry on nanostructures

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1. High Performance Liquid Chromatography and Absorbance

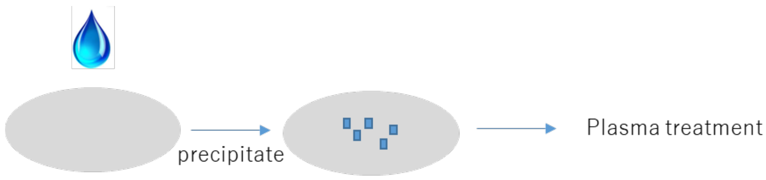

Figure S1: Schematic of plasma treatment: The diluted aptamer solution was dropped on the nMIS sensor surface and then the buffer was allowed to precipitate for plasma treatment. After plasma treatment a drop of PBS (150 µl) was deposited on the sensor surface to dilute the surface residues (aptamers). The solution with surface residues was then analyzed using HPLC and UV-absorption.

The aptamer stock solution was diluted in PBS in a ratio of 1:3 (50 µl aptamer: 150 µl PBS) and was treated with oxygen plasma (600 J, 1200 J and 1800 J). Briefly, the diluted aptamer solution was dropped on the nMIS sensor surface and then the buffer was allowed to precipitate for plasma treatment. After plasma treatment a drop of PBS (150 µl) was deposited on the sensor surface to dilute the surface residues (aptamers). The solution with surface residues was then analyzed using high performance liquid chromatography (HPLC) and UV-Vis absorbance spectrophotometer. The treated solutions were analyzed and compared with untreated aptamer solution using HPLC and UV-absorption. The aptamer solution was reacted with 15 mM thriethylammonium acetate-hexafluoro-2-propanol before subjecting it to HPLC analysis.

The HPLC equipment (UFLC, Shimadzu, Japan) consists of columns made with HypersilGold ODS with dimensions of 150 mm x 2.1 mm x 5 mm. The system was integrated with a UV-VIS detector set at wavelength of 254 nm. The 5 µl of aptamers solutions were then injected at a flow rate of 0.3 ml/min and measurements were subsequently recorded.

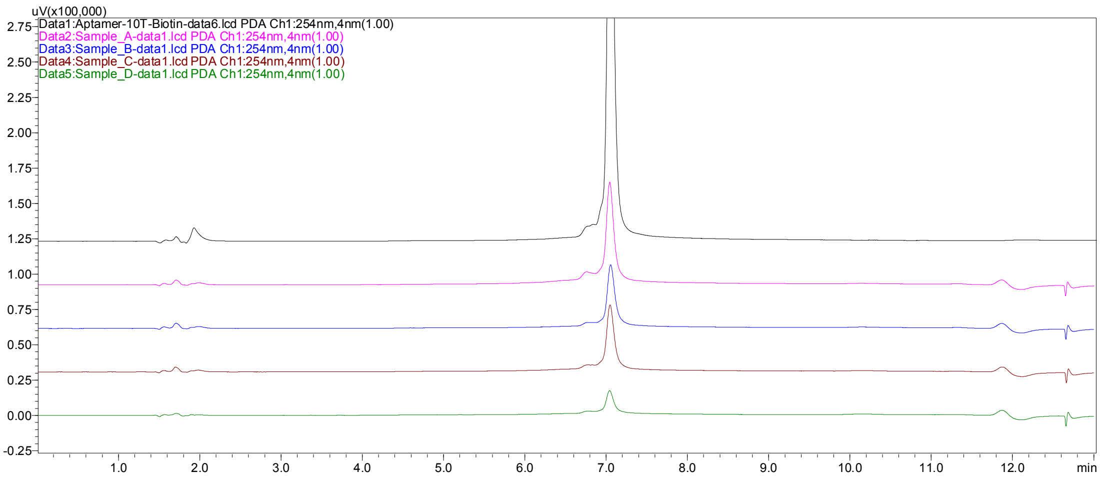

Figure S2: Data1 Untreated Aptamers; Data 2: Aptamers treated with 600 J; Data 3: Aptamers treated with 1200 J; Data 4: Aptamers treated with 1800 J.

Figure S2 shows HPLC data and indicates that while a lot of aptamers survive 600 J oxygen plasma treatment, some aptamers even survive at 1200 J and 1800 J of plasma treatment. These results suggest that while precipitation occurs on the surfaces, the formation of multiple layer of aptamers and the removal of the biolayer consisting aptamers is dependent on the time of exposure to oxygen plasma. The exposure time of 1800 J is three times more than the 600 J, therefore significantly higher concentrations of aptamer residues are left on the surface as compared to 1800 J.

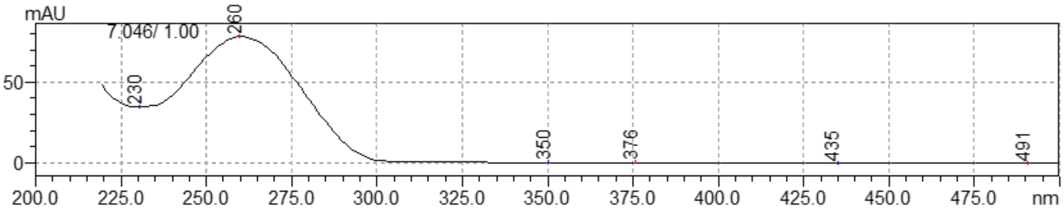

Figure S3-1: UV absorption of no plasma treatment aptamer sample

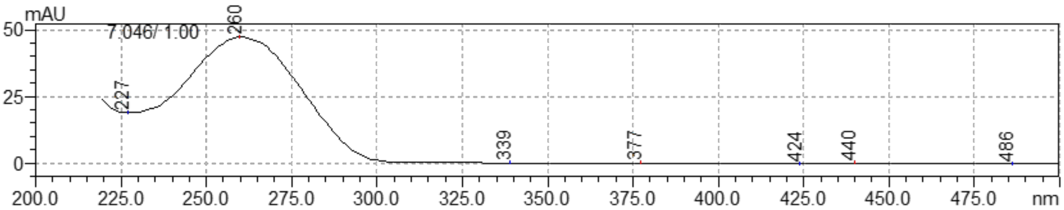

Figure S3-2: UV absorption of 600 J plasma treatment of aptamer sample

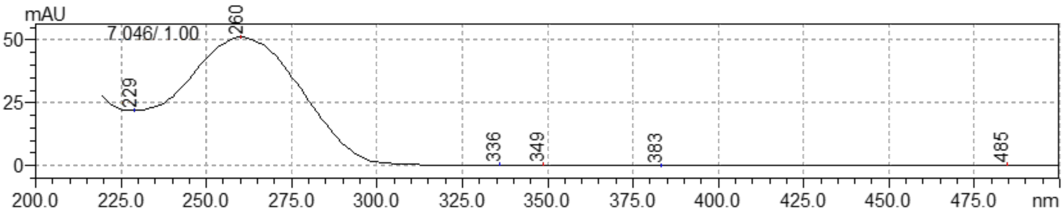

Figure S3-3: UV absorption of 1200 J plasma treatment of aptamer sample

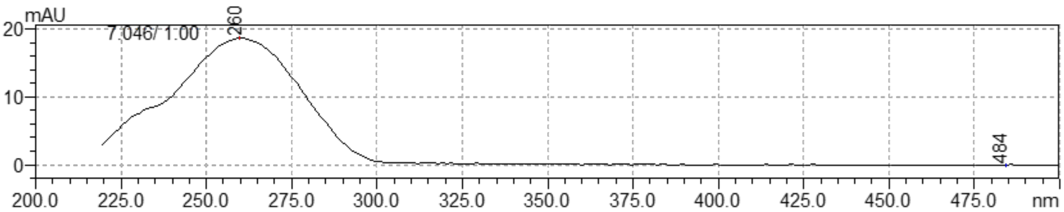

Figure S3-4: UV absorption of 1800 J plasma treatment of aptamer sample

Figure S3(1-4): display the UV absorption characteristics of the plasma/no plasma treated aptamers solutions, with light being absorbed at 260 nm. The content of all the samples is similar.

2. Nonspecific attachment of IL-6

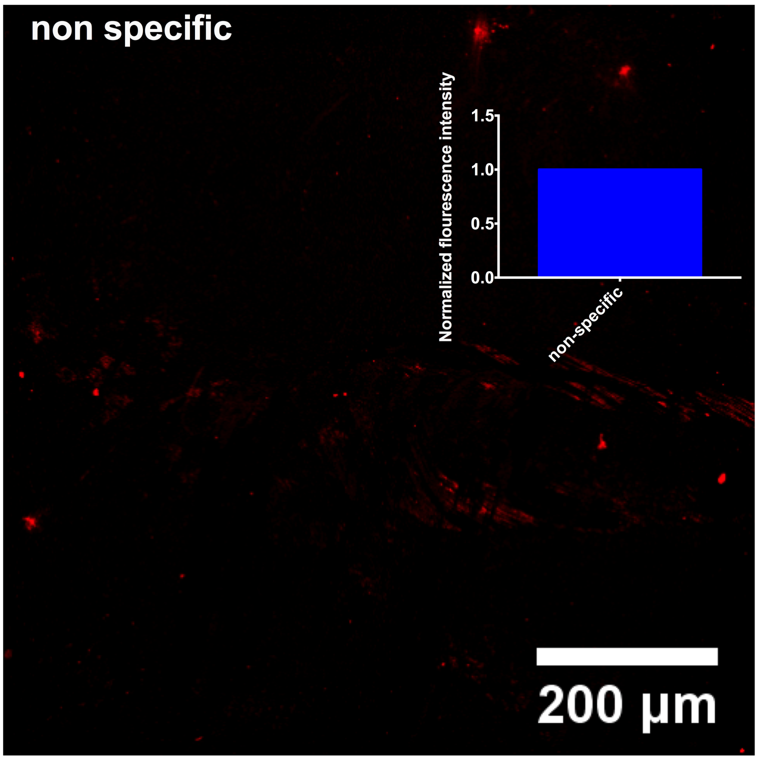

Figure S4: Quantification of the survived aptamers following plasma treatment.

In Figure S4 non-specific adsorption of the dye was characterized by treating blank gold nanoisland samples with streptavidin dye. Fluorescence image depicts the non-specific adsorption of streptavidin dye to the surface. The histogram depicts the mean fluorescence intensity plotted using ImageJ for the non-specifically adsorbed streptavidin dye. These intensity measurements were then used to normalize the mean fluorescence pixel intensities for each image of the tested conditions using ImageJ and plotted in the form of a histogram in Figure 4 of the main manuscript.

3. Fabricating gold nanoislands

The process of fabricating gold nanosilands is simple, cost effective, with high throughput production potential, and does not involve the use of skilled techniques such as lithography. Moreover, the fabrication process is time independent, i.e., the time to make nanoislands on a substrate of 1 mm × 1 mm (surface area) would be the same as it takes to make on a substrate of 100 mm × 100 mm substrate. We show detailed fabrication steps below.

1) Evaporation of 4 nm of gold on the SiO_2/Si wafer

Figure S5-1: The schematic shows a 3 layered material. This topography is achieved after completion of the first step in fabrication of nanoislands

2) The second step involves annealing of a thin layer of gold. Upon annealing at 560 °C for 4 hours, the gold layer develops into nanoisland like structures on the top of SiO_2.

Figure S5-2: A thin layer of gold develops into nanoisland like structures due to dewetting of gold on SiO_2 surfaces.