Supplementary Information

Highly Sensitive SERS-active Substrate with Uniform Gold Nanostructures on Heat-treated Ni Foam for Detection of Cardiovascular Disease Biomarker

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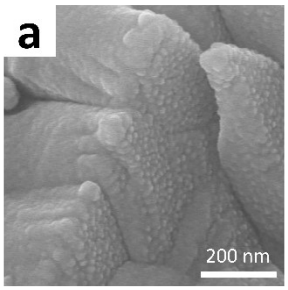
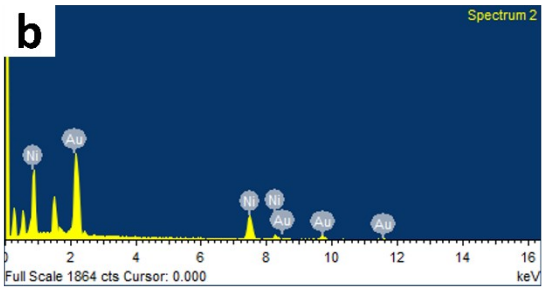
Determination of enhancement Factor (EF)

the enhancement factor was determined by the following equation.[1,2]:

$$Enhancement\ factor = \frac{I_{SERS}}{I_{Ref}} \cdot \frac{S_{SERS} V_{Ref} C_{Ref}}{S_{Ref} V_{SERS} C_{SERS}}$$

A 200 µL of 1×10^{-7} M MGITC solution was dropped onto the SERS substrate surface and allowed to react for 12 hours followed by washing. A substrate of 1×1 cm^2 was used, assuming MGITC molecules were evenly distributed across the entire surface area. The Raman intensity (I_{SERS}) was measured using a 633 nm laser with an ND filter at 10% power. To establish a reference value (I_{Ref}), pure Ni foam was used as a reference substrate. Measurements were conducted under identical conditions using a 1×10^{-2} M MGITC solution. The enhancement factor was determined by the following equation. The Raman intensity of the SERS substrate using 1×10^{-7} M MGITC was 16469.234, while the Raman intensity of pure Ni foam substrate using 1×10^{-2} M MGITC solution was 621.0083, resulting in an enhancement factor of 2.65×10^6.





c

Element	Weight %	Atomic %
Ni K	40.89	69.88
Au M	59.11	30.12
Totals	100.00	

Figure S1. (a) SEM image and (b), (c) the corresponding EDS spectra the substrate fabricated through heat treatment and gold deposition, showing the presence of Ni and Au as the constituents for SERS substrate.

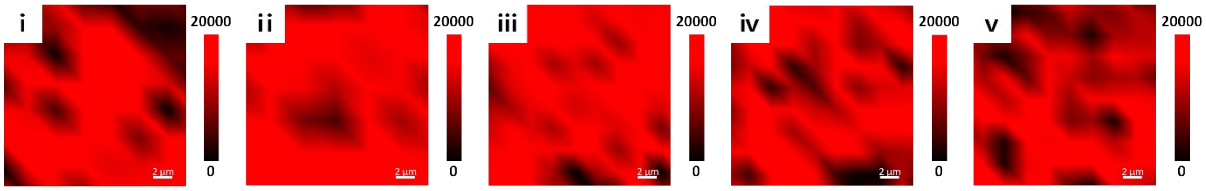


Figure S2. SERS mapping data for (i - v) different substrates. All SERS mapping measurements were measured using a 633 nm laser.

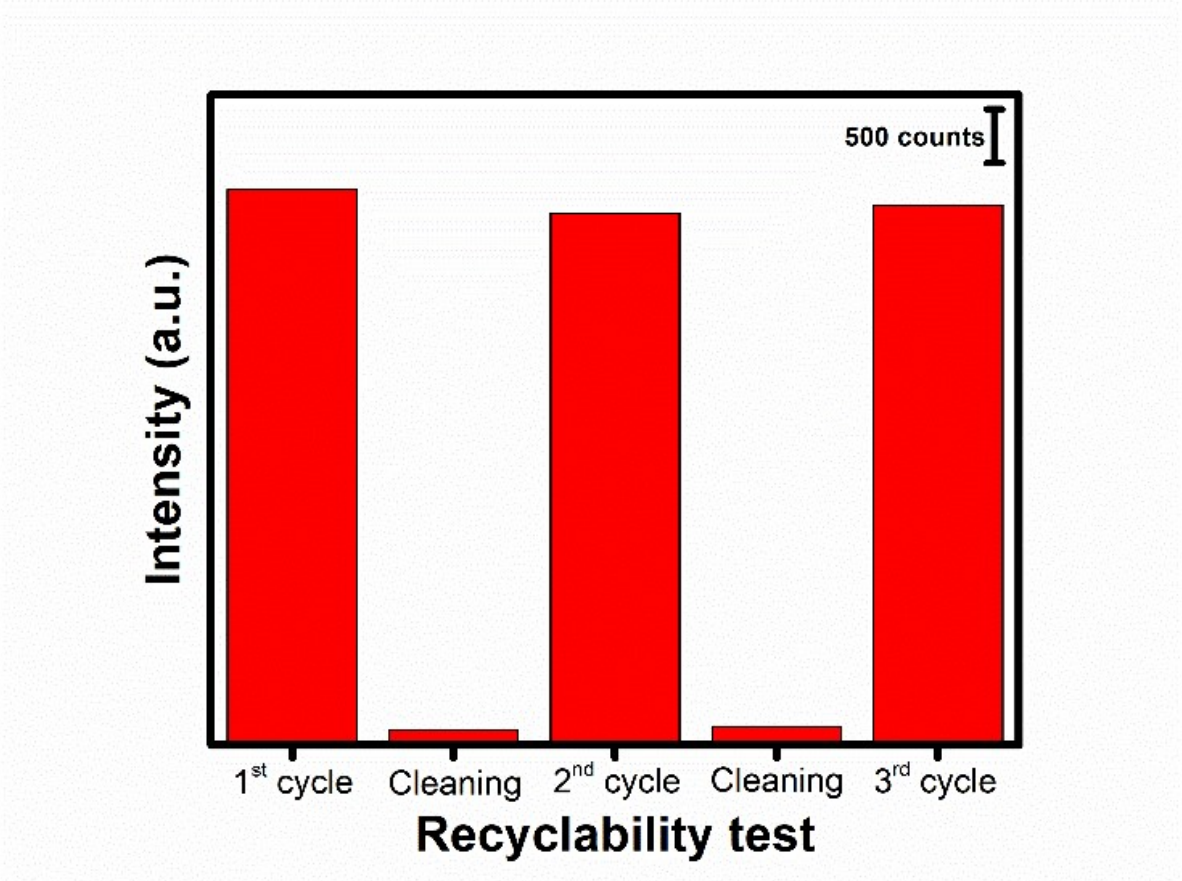


Figure S3. Raman intensity comparison to determine the recyclability of SERS substrates. In each cycle, SERS was measured with 10 nM concentration of MGITC, and cleaning was done after 10 s of plasma cleaning.

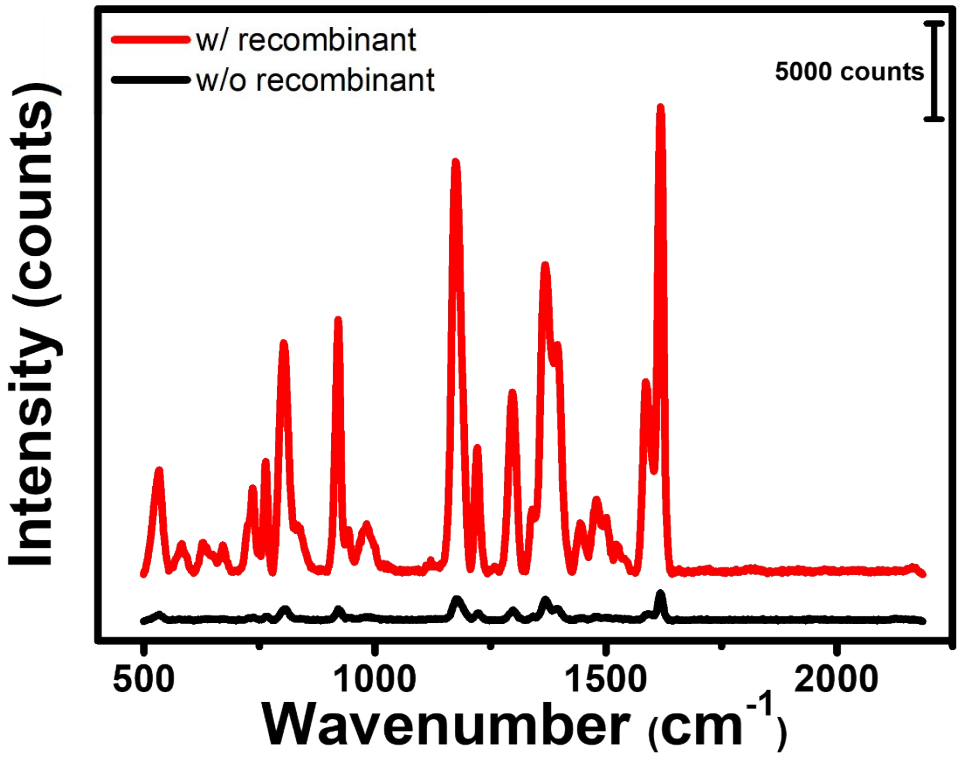


Figure S4. SERS spectra obtained from the interaction between antibody-conjugated 50 nm gold nanoparticles and SERS substrates without immobilized recombinant proteins (black line) and with immobilized recombinant proteins (red line).

Reference

1 X. Gu, S. Tian, Y. Chen, Y. Wang, D. Gu, E. Guo, Y. Liu, J. Li and A. Deng, *Sensors and Actuators, B: Chemical*, 2021, **345**, 130230.

2 J. Ko, S. G. Park, S. Lee, X. Wang, C. Mun, S. Kim, D. H. Kim and J. Choo, *ACS Applied Materials and Interfaces*, 2018, **10**, 6831–6840.