Supplementary information

Single Nanowire on Graphene (SNOG) as an Efficient, Reproducible, and Stable SERS-Active Platform

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Author Contribution

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Supplementary information M1:

Enhancement Factor of SNOG Platform

To calculate the enhancement factor (EF) of SNOG platform with Ag and Au film, we measured SERS spectra of Cu-phthalocyanine (CuPc) from pristine glass, SNOG with Ag film, and SNOG with Au film, respectively. Figure S1 shows surface-enhanced Raman scattering (SERS) spectra of CuPC measured from glass (black), SNOG with Ag (red) and Au film (blue). We estimated EF of SNOG platforms using the expression of EF = $(I_{SERS}/I_{Ref}) \times (N_{Ref}/N_{SERS})$. I_{SERS} is the intensity of 1,531 cm^{-1} CuPc band on SNOG platforms and I_{Ref} is the intensity of 1,531 cm^{-1} CuPc band on a glass. N_{SERS} is the number of CuPc contributing to I_{SERS} and N_{Ref} is the number of CuPc contributing to I_{Ref}. Assuming uniform adsorption of CuPc, the expression can be changed to EF = $(I_{SERS}/I_{Ref}) \times (A_{Ref}/A_{SERS})$. A_{SERS} indicates the surface area of SERS-active region in SNOG platforms and A_{Ref} is the laser-illuminated area of a glass. The diameter of NW is about 180 nm and the diameter of laser spot is 500 nm. A_{SERS} is calculated to be 1.41 $\times 10^4$ nm^2 condsidering the shape of NW and A_{Ref} is 7.85 $\times 10^5$ nm^2. Therefore, the EF of SNOG platform with Ag and Au film was calculated to be 1.90 $\times 10^6$ and 1.18 $\times 10^6$, respectively. In addition, the EF of Au NW on Au film was calculated to be 7.36 $\times 10^5$ based on Fig. 2a.

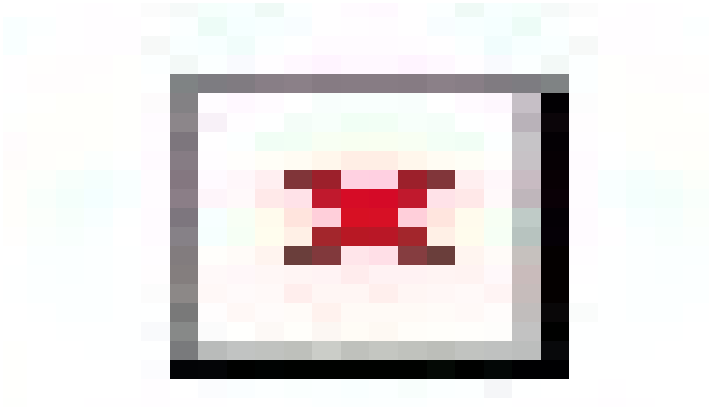

Fig. S1. SERS spectra of CuPc measured from SNOG platform with Ag film (red) and Au film (blue), and pristine glass (black). Spectrum from pristine glass is 100 times magnified in the vertical scale. The asterisk-marked peaks denote G and 2D bands of graphene.

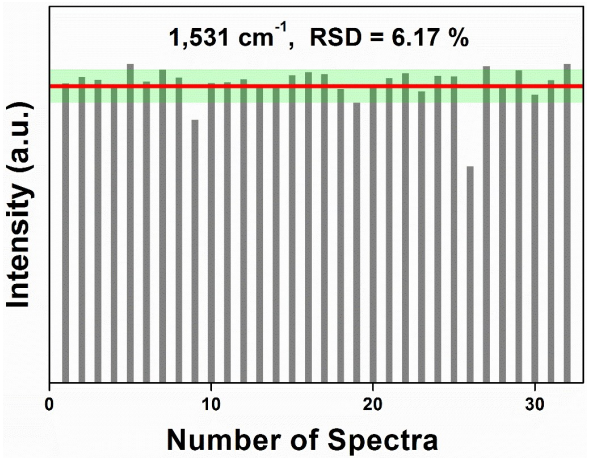

Fig. S2. Intensity distribution of 1,531 cm^{-1} band of CuPc measured from 32 different SNOG platforms. The RSD was calculated to be 6.17 % of the average intensity.

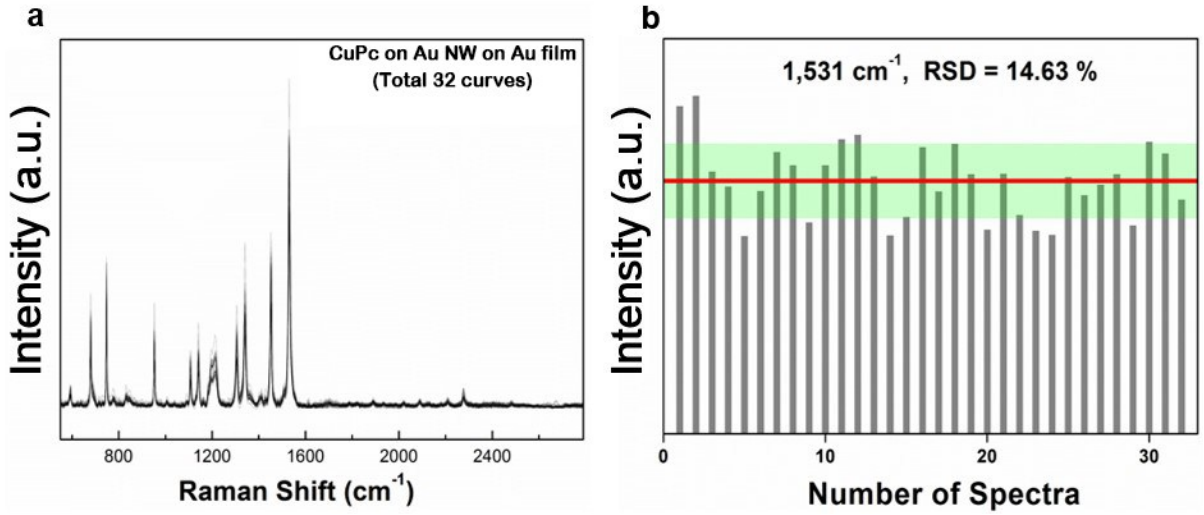

Fig. S3. (a) Overlapped SERS spectra of CuPc from 32 randomly selected Au NW on Au film structures. (b) Intensity distribution of 1,531 cm^{-1} band of CuPc measured from 32 different Au NW on Au film structures. The RSD was calculated to be 14.63 % of the average intensity.

Fig. S4. (a) Schematic illustration of Au NW on Ag film, Au NW on Au film, SNOG with Ag film, and SNOG with Au film. (b) Normalized 1,531 cm^{-1} band intensities of CuPc measured from 4 different platforms for 320 s. The SERS intensities are normalized by the highest 1,531 cm^{-1} band intensity. Compared to the NW-based SERS-active platforms without graphene, SNOG platforms show much improved photostability.