Supporting information

Substrate Influence on the Polarization Dependence of SERS in Crossed Metal Nanowires

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1) Raman measurement setup scheme

The Raman measurement setup scheme have been shown in the Figure 1s. A linearly polarized beam from a He-Ne laser (wavelength 632.8 nm) was used as illuminant. The reflector allowed fine adjustment of the incident angle, and a half wave plate (HWP) permitted us to change the incident polarization, while a lens focused the beam to increase the intensity of the incident light. The Raman spectra were detected by the spectrometer at different polarization angles.

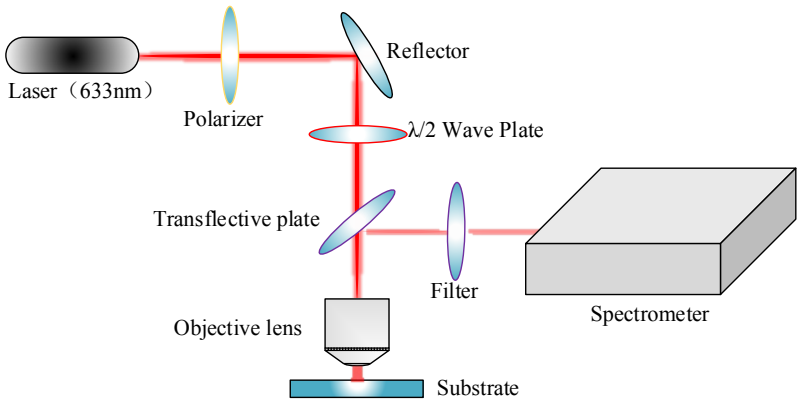

Figure 1s. The Raman measurement setup schematic

2) Polarization dependence of single Ag nanowire on Au film

In figure 2s, a single silver nanowire adsorbed the 4NBT molecule was used to detect the Raman spectra at different polarization angles in experiment. And the nanowire exhibited a strong polarization dependence shown in the polar plot, in addition the maximum SERS signal at 1336 cm^{-1} was achieved when the polarization was vertical it.

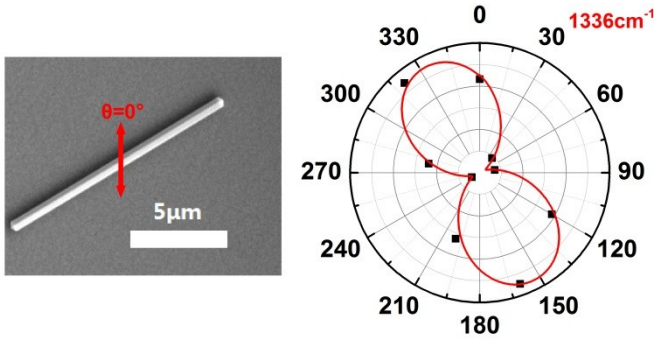

Figure 2s. The SEM image of signal nanowire and the polar plot .

3) Simulation of Ag NWs with 5-twined cross-section

In Figure 3s, the simulation model of two Ag NWs with a 5-twined cross-section was established and calculated. And the maximum signal was obtained when the polarization was vertical to the bottom NW ($\theta=90^0$) at the cross position on the Au film. This result confirmed our previous conclusion and the cross section of nanowire were irrelevant.

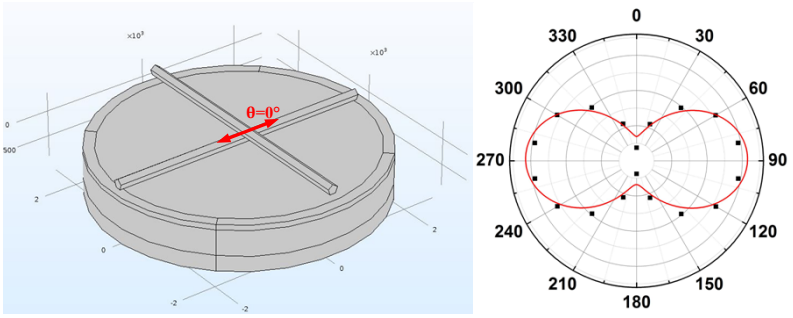

Figure 3s. The simulation model of two Ag NWs with a 5-twined cross-section and the simulation polar plot at cross-point.

4) Synthesis of silver nanowires

The polyol method is used for the synthesis of silver nanowires in the article[1], PVP and AgNO3 solutions were slowly added into heated EG, stirring at 160 °C for about one hour and rinsed with ethanol. And the quality of nanowires was shown in the Figure 4s.

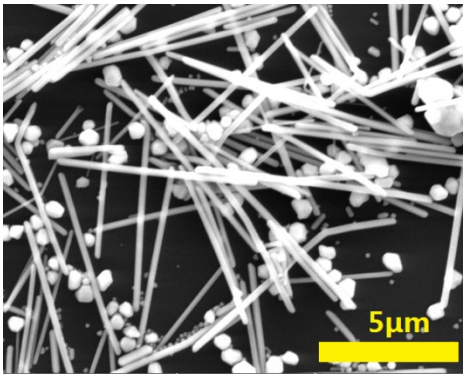

Figure 4s. The SEM of nanowires

5) The polar plot of the Ag NWs on the gold film

The polarization dependence experiments of the crossed NWs on the gold film were repeated. And the results of the experiment coincide with those of the manuscript as shown Figure 5s, the maximum signal was obtained with the polarization vertical to the bottom NW under different conditions.

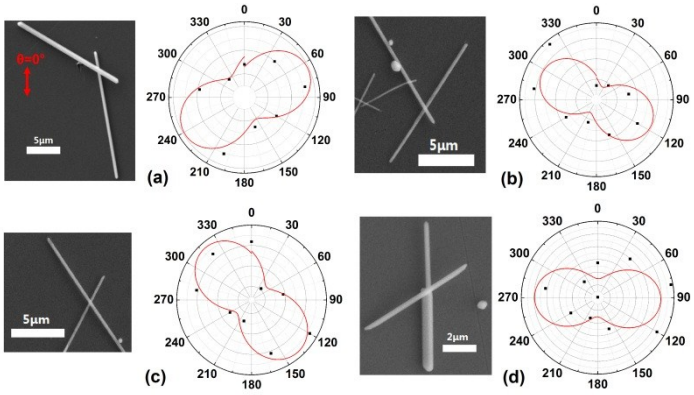

Figure 5s. (a)-(d) The polarization diagram (cross position) and SEM image of the Ag NWs on the gold film.

6) Dark field scattering spectrum

Dark field scattering spectrum of the cross Ag NWs on the Au film with different polarization of the incident light was shown in Figure 6s(a), the spectra indicated the strong polarization dependence at cross-point. The intensities at 710nm as a function of the polarization angle θ are illustrated in Figure 6s(b), the maximum value was obtained when the polarization was vertical to the bottom NW. For glass substrate, the experimental results were different from the former, the maximum value was obtained when the polarization was vertical to the top NW. These conclusions further confirms the results of our experiments in the manuscript.

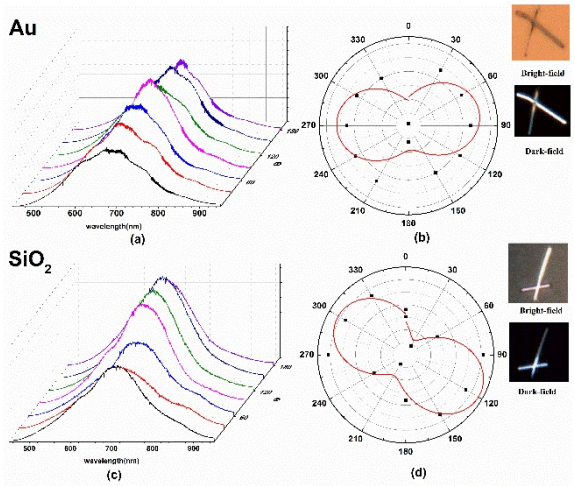

Figure 6s. $\theta=0^0$ indicates the polarization angle in the vertical direction of the substrate plane. (a) The dark field scattering spectra of cross point in different polarization angles on the Au film. (b) The polar plot of cross-point on the Au film (intensity represent the value at 710 nm in (a)). (c)-(d) The dark field scattering spectra and polar plot of cross-point on the SiO_2 film.

Reference:

[1] Sun Y, Xia Y. Large-Scale Synthesis of Uniform Silver Nanowires Through a Soft, Self-Seeding, Polyol Process[J]. Advanced Materials, 2002, 33(36).