Supporting Information for

Mapping Minimum Reflection Distribution of Surface Plasmon Resonance With Complex Refractive Index

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1. MI map calculated based on angular SPR

In this glass /metal/enhancement layer/water structure, the optical properties of each layer are described as dielectric constant, ε_j permeability μ_j and thickness h_j. The transverse magnetic (TM) He-Ne laser with a fixed wavelength of 633nm illuminates the glass/gold interface. SPR exhibits as a dip in the distribution curve of reflection vs incident angle. At each interface, the light goes through transmission and reflection, which is based on Fresnel coefficients. The MI on the SPR was extracted and mapped with both real and imaginary parts of the complex refractive index as shown in the following.

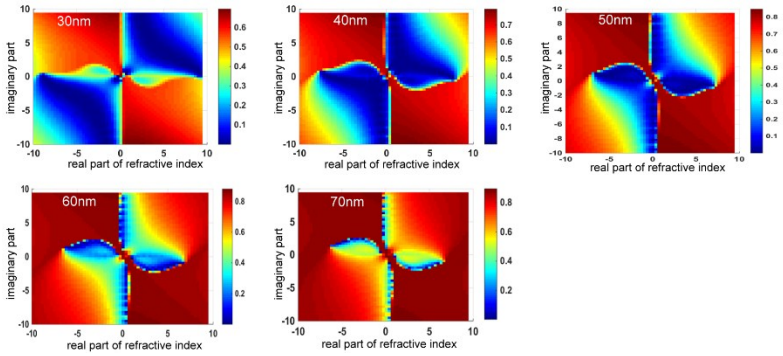


Figure S-1. MI maps based on angular SPR with the excitation wavelength at 633nm for the thickness of gold film is 30nm, 40nm, 50nm, 60nm and 70nm respectively.

2. Peak absorption extracted from OD measurement

To reduce the uncertainty caused by the procedure during the gold film deposition, each chip was calibrated first by its own reflection illuminated at the electric field set to be perpendicular polarization (transverse electric, TE), at which no SPR can be excited and provide a reference spectrum of the illumination source as I_0. Then the excitation was set to be a parallel polarization (transverse magnetic, TM), in which the SPR occurs shown with a typical dip in the spectrum, as I. The OD was calculated based on these two spectrum and recorded in real times shown (c), with the equation (1),

$$\text{OD}=\log\frac{I_0}{I} \quad \text{.....} \quad (1)$$

The peak absorption was extracted from the absorption spectrum calculated from equation (1) by the following,

$$absorption = 1.0 - \frac{1.0}{10^{OD}} \text{.....(2)}$$

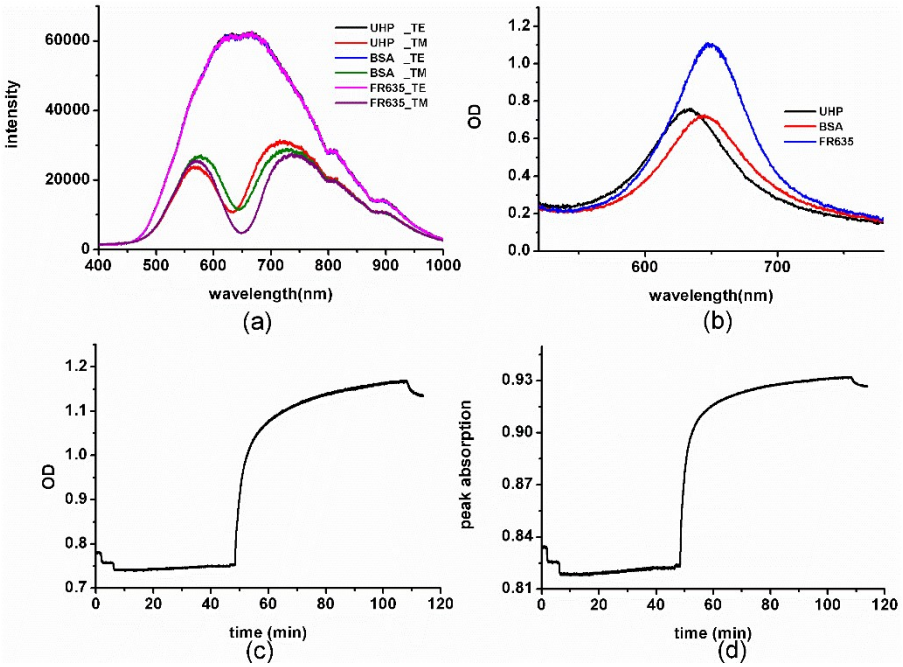


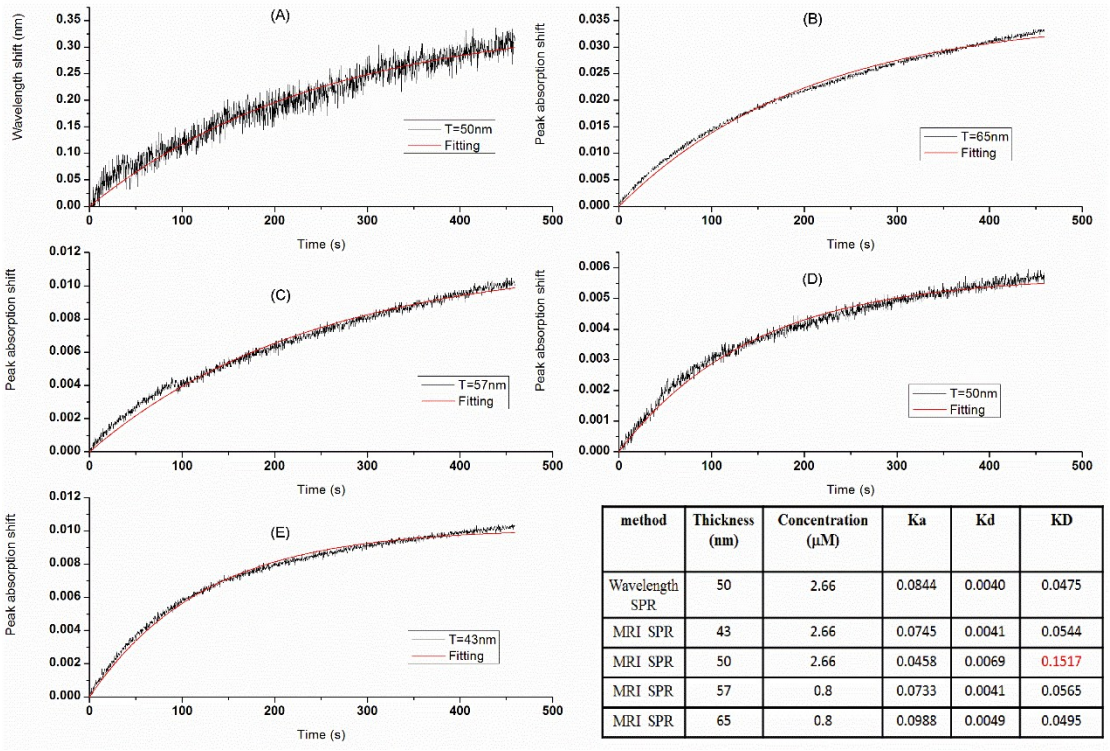
Figure S-2. Peak absorption calculated from optical density(OD). (a) Reflection spectrum with different deposition when illuminated by perpendicular polarization (TE) or parallel polarization (TM); (b) Optical density obtained from (a); (c) Real time OD recording data; (d) Peak absorption calculated from OD.

3. Nonlinear least squares fitting the sensorgram

SPR detection method holds the advantage to determine the kinetics of the binding. Based on the different ligate concentrations be analyzed, a single value for the association and dissociation rate constants can be determined by linear transformation. Further Daniel [18] developed the kinetics analysis by nonlinear least squares fitting the sensorgram. The sensorgram was directly analyzed in terms of the integrated form of the rate equation as the following,

$$R_t = \frac{Ck_a R_{max}\left[1 - e^{-(Ck_a + k_d)t}\right]}{Ck_a + k_d}$$

The kinetics KD is calculated as Kd/Ka, which are the nonlinear fitting results of the sensorgram.



method	Thickness (nm)	Concentration (μM)	Ka	Kd	KD
Wavelength SPR	50	2.66	0.0844	0.0040	0.0475
MRI SPR	43	2.66	0.0745	0.0041	0.0544
MRI SPR	50	2.66	0.0458	0.0069	0.1517
MRI SPR	57	0.8	0.0733	0.0041	0.0565
MRI SPR	65	0.8	0.0988	0.0049	0.0495

Figure S-3. Sensorgram measured by wavelength and MI SPR methods together with their nonlinear least squares fitting. (A) Wavelength SPRMethod, gold film thickness=50nm; (B)-(E): MI method, gold film thicknesses are 65nm,57nm, 50nm,43nm respectively. The table is the fitting result of each method.