Oscillatory Behavior of the Long-Range Response of Localized Surface Plasmon Resonance Transducers

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Supporting Information

Asymmetric etalon fitting model

The reflectance data for experimental and simulated systems were fitted using the equation:

$$I_R = \frac{\left(A - 2cos\left(\frac{2\pi nt}{\omega} + p\right)\right)R}{1 + R^2 - 2Rcos\left(\frac{2\pi nt}{\omega} + p\right)} \qquad (1)$$

$A = (r_{air/SiOx}{}^2 + r_{SiOx/glass}{}^2)\,/R$

$R = r_{air/SiOx} \times r_{SiOx/glass}$

where I_R is the measured reflection intensity, $r_{air/SiOx}$ is the reflection coefficient amplitude at the air and SiO_x coating interface, $r_{SiOx/glass}$ the reflection coefficient amplitude at the SiO_x coating and glass interface (including the plasmonic layer), n is the coating refractive index (constant, 1.46), t is the coating thickness, ω is the periodicity, and p is the phase.

Similarly, transmission data can be fitted to the following function:

$$I_T = \frac{B}{1 + R^2 - 2Rcos\left(\frac{2\pi nt}{\omega} + p'\right)} \qquad (2)$$

$B = (t_{air/SiOx}{}^2 \times t_{SiOx/glass}{}^2)$

where I_T is the reflection intensity, $t_{air/SiOx}$ is the transmission coefficient amplitude at the air and SiO_x coating interface, and $t_{SiOx/glass}$ is the transmission coefficient amplitude at the SiO_x coating and glass interface (including plasmonic layer).

Supplementary figures

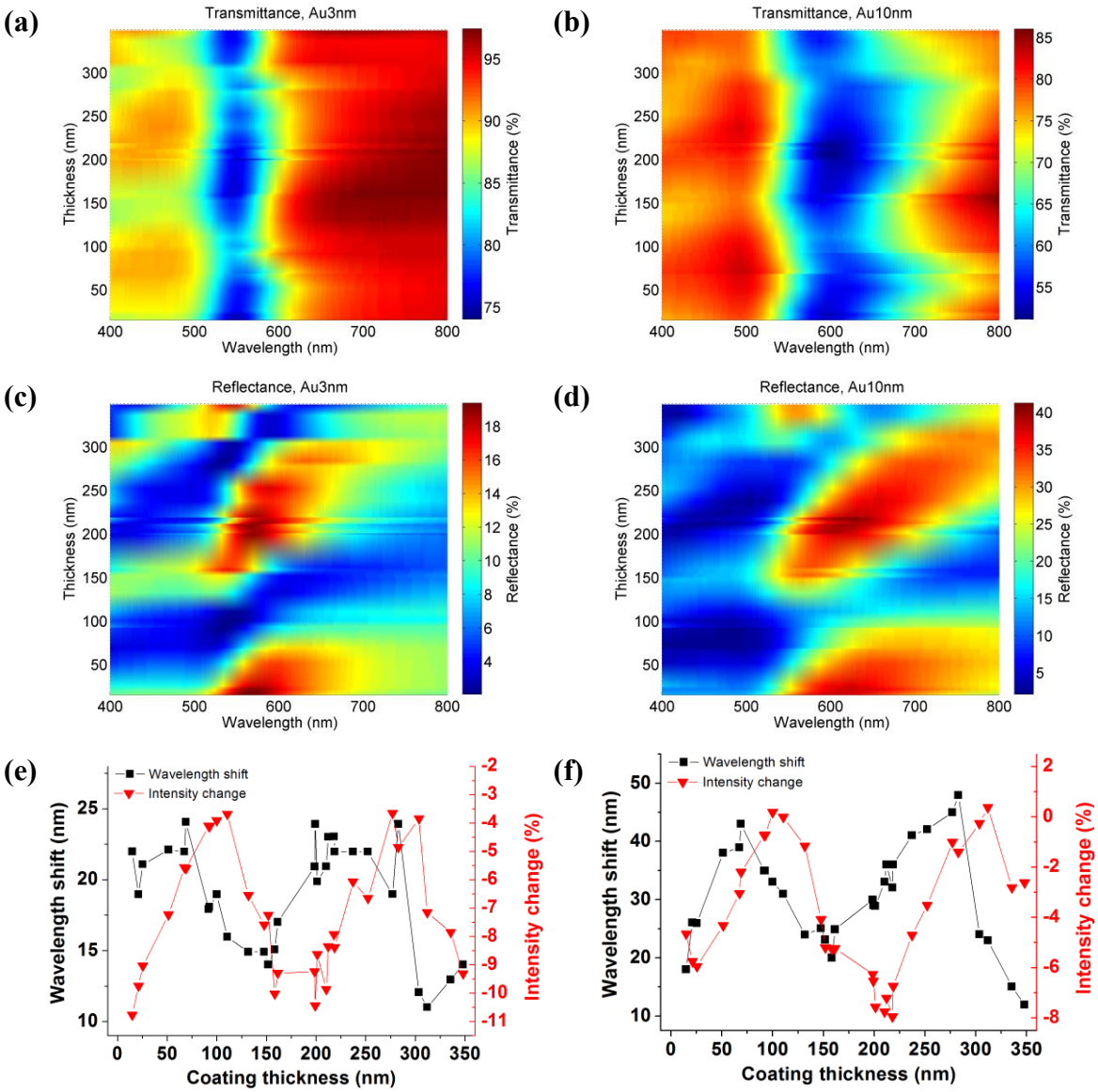

Figure S1. Experimental transmission (a,b) and reflection (c,d) spectra, and peak wavelength shift and intensity change of the transmission minimum (e,f), for Au3nm (a,c,e) and Au10nm (b,d,f) samples coated with 13-348 nm SiO_x films, shown using a color map.

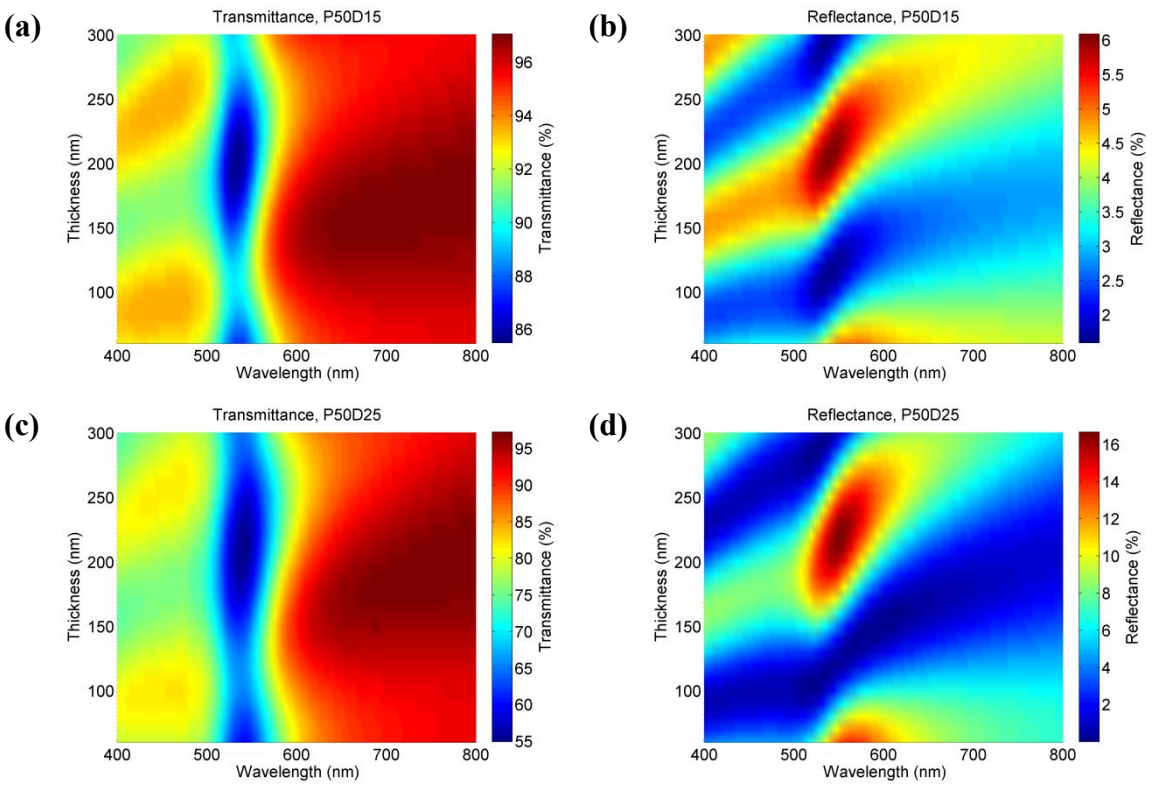

Figure S2. Calculated transmission (a,c) and reflection (b,d) spectra for the P50D15 (a,b) and P50D25 (c,d) models coated with 60-300 nm SiO_2, shown using a color map.

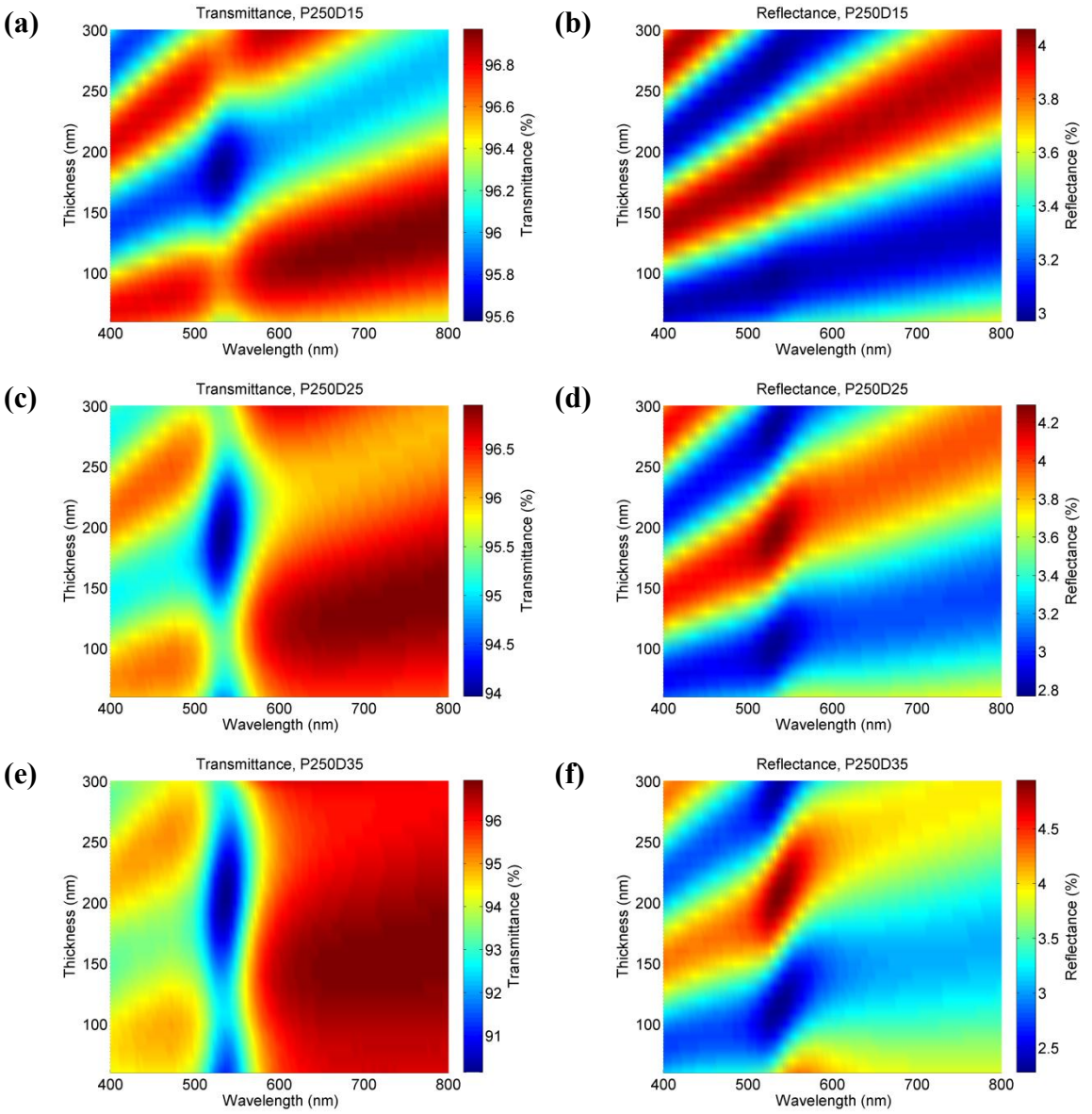

Figure S3. Calculated transmission (a,c,e) and reflection (b,d,f) spectra for the P250D15 (a,b), P250D25 (c,d) and P250D35 (e,f) models coated with 60-300 nm SiO_2, shown using a color map.

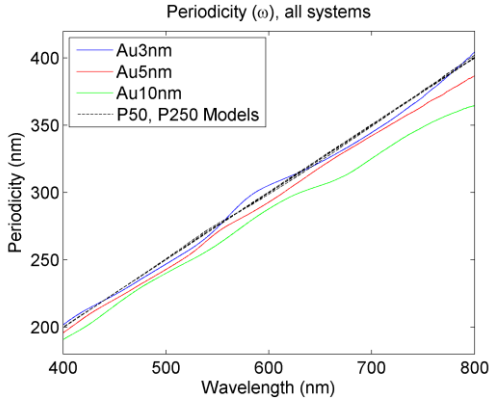

Figure S4. Oscillation periodicity (ω) for all the studied systems, determined using the etalon model (Equation 1); the plots for the various models practically overlap, with the experimental systems showing some deviations from the diagonal.

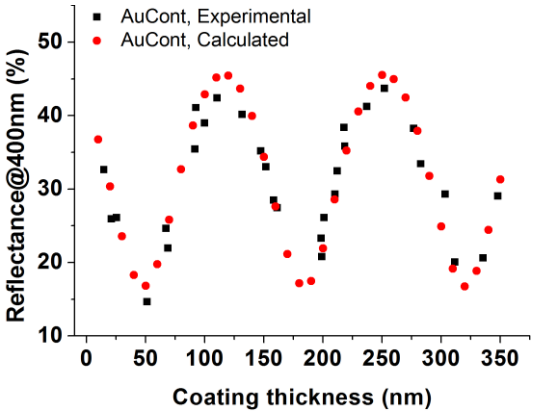

Figure S5. Experimental and calculated (using FilmWizard software) reflectance at a wavelength of 400 nm for AuCont slides coated with SiO_x films of increasing thickness. The agreement between the two plots provides further confirmation of the ellipsometrically determined coating thicknesses.