Supplementary material

1. Refractive index of BSA-CF680

From the measured Ψ and Δ ellipsometry spectra of BSA-CF680 (**Fig. 2(a)** in the manuscript), the refractive index of BSA and CF680 complex was modeled. The structure was modeled using effective media approximation (EMA), where two materials were used to describe the CF680 dye labelled BSA biomolecules. The BSA (Material 1) was modelled using Cauchy function, with coefficients: A=1.47, B=0.01037, C=0, where it substituted 89.4% of EMA. Meanwhile the CF680 dye (Material 2) was described by a 1.748 eV Lorentz oscillator with a 0.387 amplitude and broadening 0.1379, where it was 10.6% of the EMA. The refractive index and extinction of the modelled BSA-CF680 is shown in **Fig. S1**.

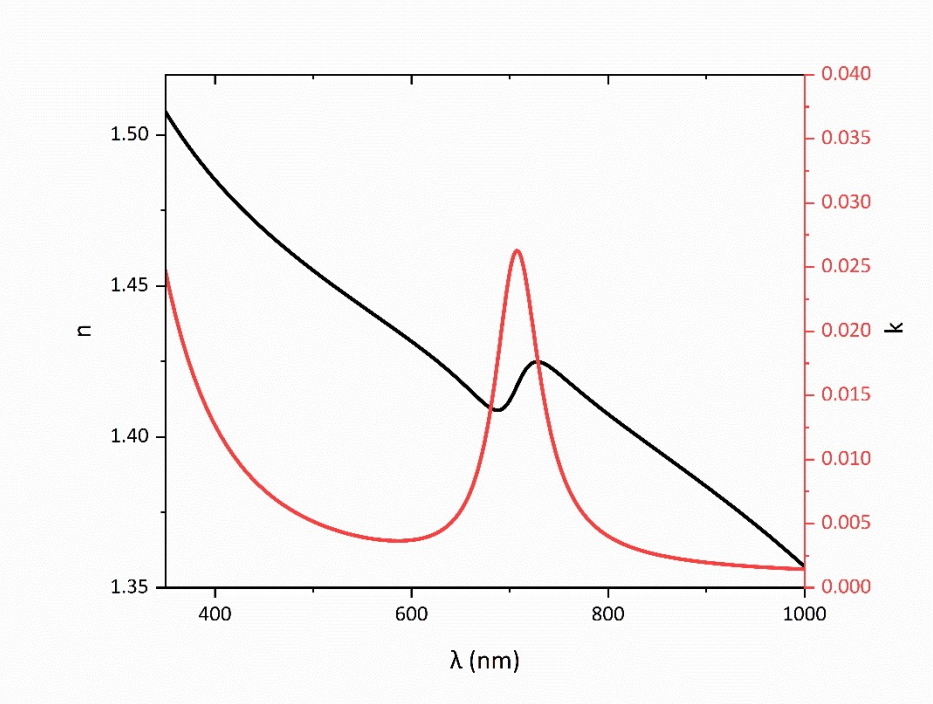

Figure S1. The modelled refractive index of BSA-CF680 obtained by fitting the measured Ψ and Δ ellipsometry parameters.

2. Dispersion relations of SPP

The dispersion relations of SPP (**Fig. S2**) generated in CS/Au sample were measured using TIRE method. The CS/Au sample base was attached to a 70° prism and the sample was placed in a liquid chamber and further deionized water was injected into the chamber. The measurements were performed at angles of incidence ranging from 68.2° to 71.7°, where these angles

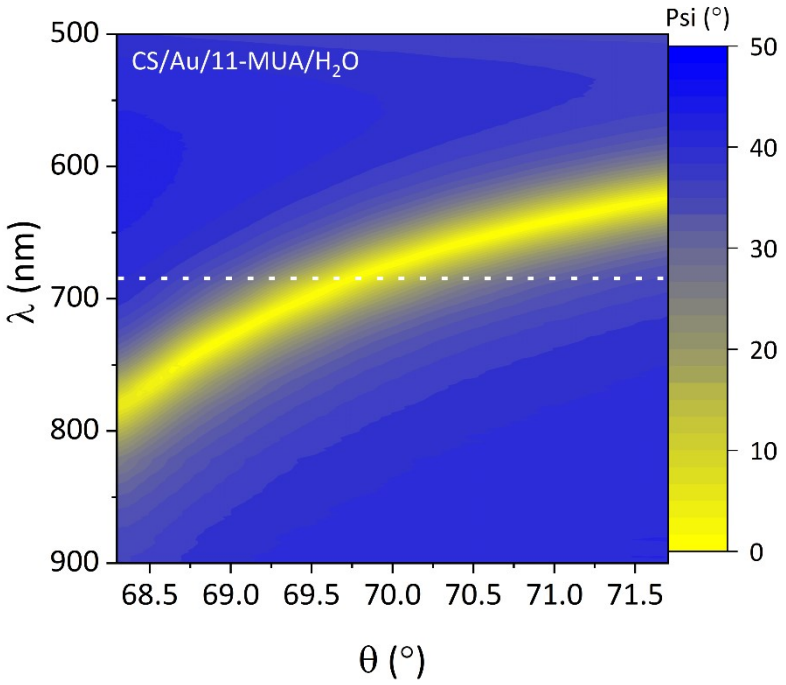

Figure S2. Dispersion map of the SPP excitation in water on CS/Au/11-MUA sample. The white dashed line marks the absorption of BSA-CF680.

correspond to angle in the prism. It can be seen from **Fig. S2**, that the SPP resonance can be excited from 620 nm to 780 nm in the range AOI=[68.2°-71.7°]. The BSA-CF680 absorption (white dashed line) intersects with SPP dispersion in water at around 70° angle of incidence, thus the 70° AOI is used in the experiment.

3. Fluorescence lifetime

The measured fluorescence lifetime data was fitted with a model function, that is the convolution of the instrument response function (IRF) and the molecular decay described by a two-exponent function. To determine the IRF a sample with DASPI dissolved in water, whose typical lifetime is tens of picoseconds. The fitting coefficients are presented in **Table S1**.

Table S1. The fitting parameters of the BSA-CF680 fluorescence lifetime for two different sample structures. A_1 – amplitude, τ_1 and τ_2 – lifetime of the two exponential components, R^2 – is the fitting coefficient of determination.

Sample	A_1	τ_1	τ_1	R^2
CS/BSA-CF680	0.686 (±0.003)	0.381 (±0.005)	3.314 (±0.03)	0.996
CS/Au/BSA-CF680	0.777 (±0.0002)	0.143 (±0.002)	3.03 (±0.027)	0.992