Electronic Supplementary Information

Induced internal conversion as a probe of enhanced energy transfer in a plasmonic field

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Characterisation of PDAOM monolayers

To assess the morphological uniformity of the PDAOM spacer layers, AFM measurements were performed (JSPM-5400, Jeol). AFM images were acquired over a 2×2 μm² scan area for three different regions of several samples. The AFM images showed (see ESI, Fig. S1) that the PDAOM films exhibit a uniform morphology without any significant aggregates, cracks, or breaks within the examined area. The root-mean-square surface roughness was equal to R_q = 0.95 nm, and the average roughness was R_a = 0.58 nm. These values are significantly smaller than the nominal distance defined by the PDAOM layers; therefore, possible local variations in thickness were considered a source of distance distribution but not a factor altering the overall nature of the observed energy transfer efficiency dependencies.

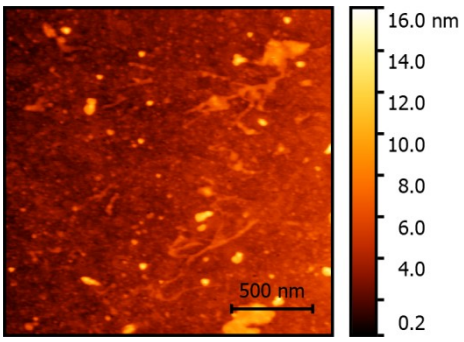

Fig. S1. AFM images of PDAOM LB film, deposited onto glass substrate.

The thickness of the PDAOM monolayer was estimated based on data previously published in Refs. [1s, 2s]. In particular, based on an analysis of data obtained from compression isotherms of the PDAOM monolayer, the specific molecular area of the polyampholyte monomer unit was estimated according to the Adamson [3s]. Next, the geometric dimensions of the PDAOM monomer unit were estimated using molecular mechanics method (HyperChem). Subsequently, taking into account the value of the specific molecular area in the monolayer, the orientation of the monomer molecules on the subphase surface was estimated, which at a transfer pressure of π = 28 ± 0.03 mN/m was equal to ~2.1 nm.

Thus, any roughness in the layers may lead to some variation in the local distances. However, these variations are accounted for in the experimental measurements and signal averaging, and do not alter the general trend of the energy transfer as a function of the number of PDAOM layers.

Fluorescence decay kinetics

Fluorescence lifetimes were evaluated using SPCImage software (Becker&Hickl) according to $I(t) = \sum_{i=1}^{n} \alpha_i \exp(-t/\tau_i)$, where τ_i is the decay time and α_i is the amplitude, or fractional contribution, of the i th decay component, with $\sum_i \alpha_i = 1$. The instrument response function was automatically accounted for during the fitting procedure in the software. The quality of the fits was assessed using the χ^2 parameter and adjusted R-square parameters. For the representative decay curves, the adjusted R-square values were in the range of 0.97–0.99, while the χ^2 values were on the order of 10^{-4}**,** indicating good agreement between the experimental decay curves and the fitting results.

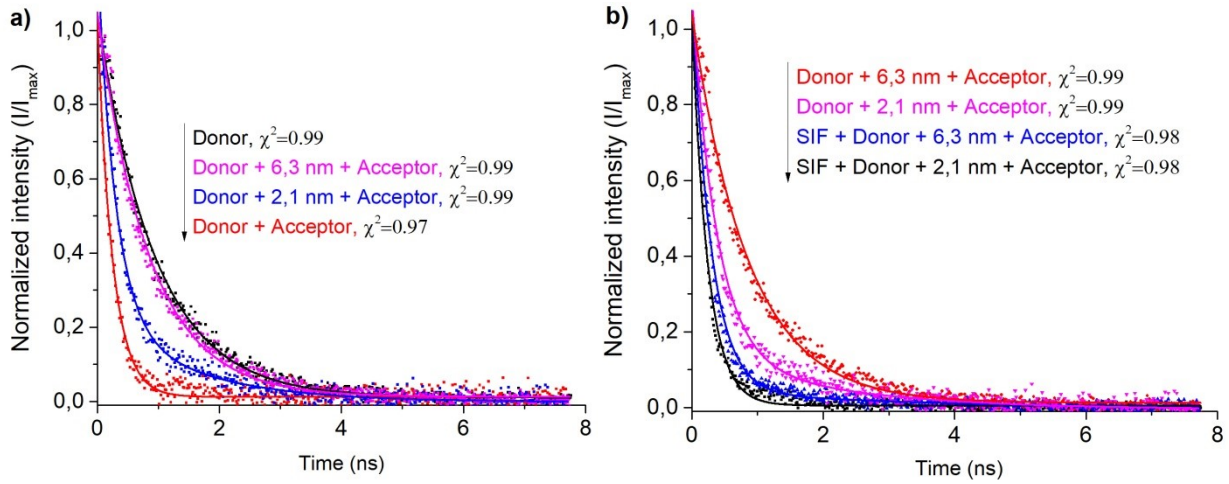

Fig. S2. Normalized fluorescence decay kinetics of LB films of energy donor (**D**) and donor-acceptor (**DA**) samples at various distances between them: (a) on the surface of glass substrates, (b) on the surface of SIF

1s. S. A. Yeroshina, N. Kh. Ibrayev, S. E. Kudaibergenov, F. Rullens, M. Devillers, A. Laschewsky, Thin Solid Films, 2008, **516**, 8, 2109–2114.

2s. D. A. Temirbayeva, N. Kh. Ibrayev, M. G. Kucherenko, J. Lumin., 2022, **243**, 118642.

3s. A.W. Adamson, Physical chemistry of surfaces (3rd Ed.), Wiley-Interscience, New York, 1976, 698 p.