

Supplementary Information for

Photocurrent Enhancement of Porphyrin Molecules over a Wide-Wavelength Region Based on Combined Use of Silver Nanoprisms with Different Aspect Ratios

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1. Detailed experimental procedures of preparation of SAgPRs and LAgPRs covered with silica layers.

Firstly, a colloidal aqueous solution of the SAgPRs (200 μ L) was centrifuged (15,000 rpm, 15 min) twice and then redispersed in an aqueous solution of trisodium citrate (0.3 mM, 1 mL). Next, an ethanol solution of MHA (1 mM, 35 μ L) was slowly added to the colloidal solution, followed by stirring for 15h to protect the SAgPRs with MHA. After the solution was centrifuged once (15,000 rpm, 15 min), the precipitates was redispersed in an ethanol solution of tetraethyl orthosilicate (TEOS, Tokyo Chemical industry, 0.84 mM, 2 mL). Then an ethanol solution of dimethylamine (Tokyo Chemical industry, 20 wt%, 312 μ L) was added to the colloidal solution under stirring for 3h.

The resultant solution of silica-coated SAgPRs was centrifuged three times (15,000 rpm, 15 min) and redispersed in ethanol (1 mL). The preparation process of the colloidal solution of silica-coated LAgPRs was same as that of the silica-coated SAgPRs.

2. Figure S1-S5.

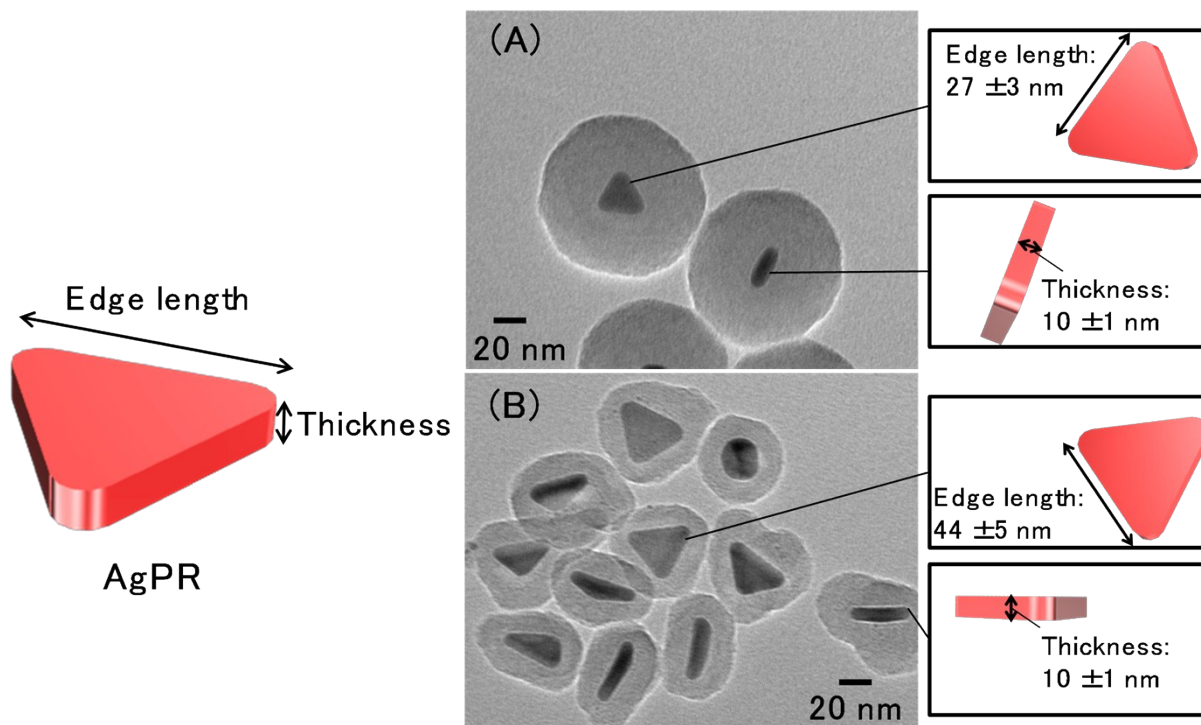


Figure S1. TEM images of (A) SAgPRs and (B) LAgPRs covered with silica layers.

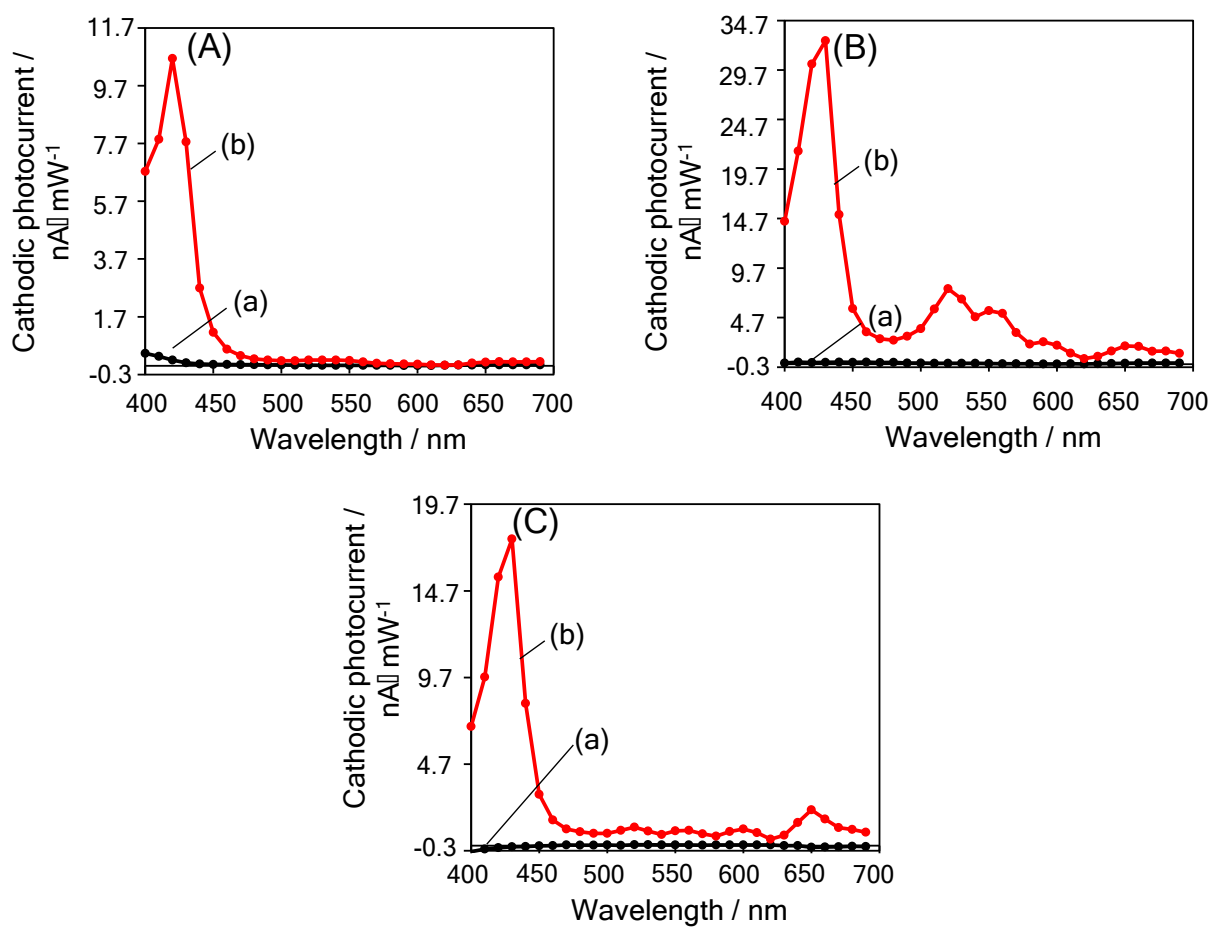


Figure S2. Photocurrent action spectra of (a) Ti(O)-modified sample electrodes (without TCPP) and (b) TCPP-immobilized sample electrodes for (A) AgP/ITO, (B) SAgPR/ITO, and (C) LAgPRs/ITO.

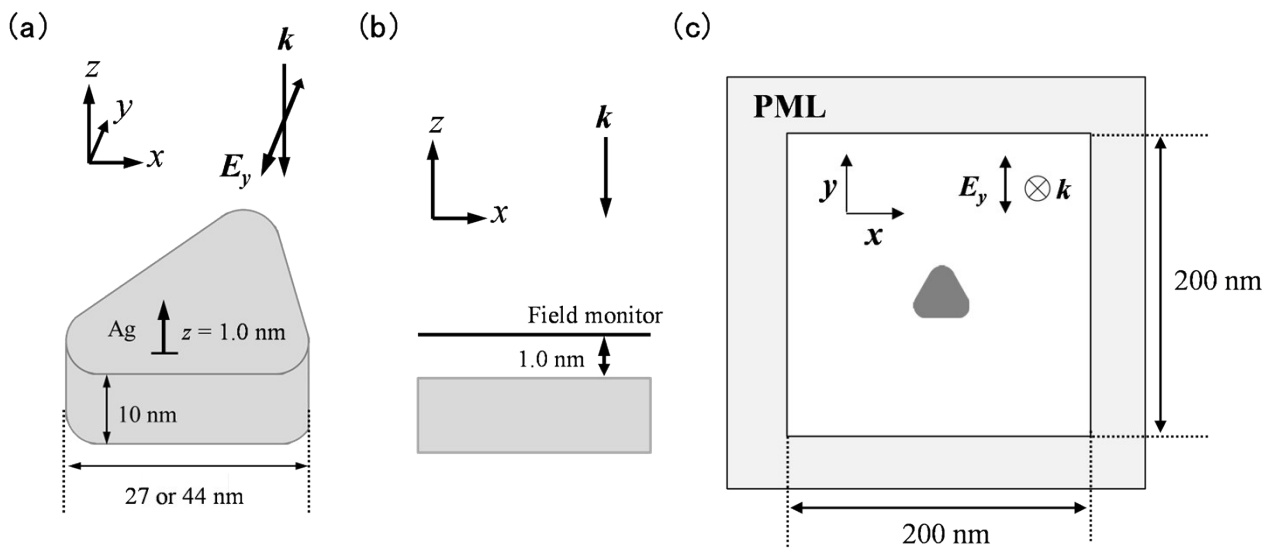


Figure S3. The geometric model of the AgPRs used in the FDTD simulation. The refractive index of the background is 1.333. The spatial deviations (Δx , Δy , Δz) are 1.30, 1.30, and 0.267 nm, respectively. The time step reduced by speed of light ($c\Delta t$) is 0.25 nm. The perfectly matched layers (PMLs) are put on the x , y , and z boundaries.

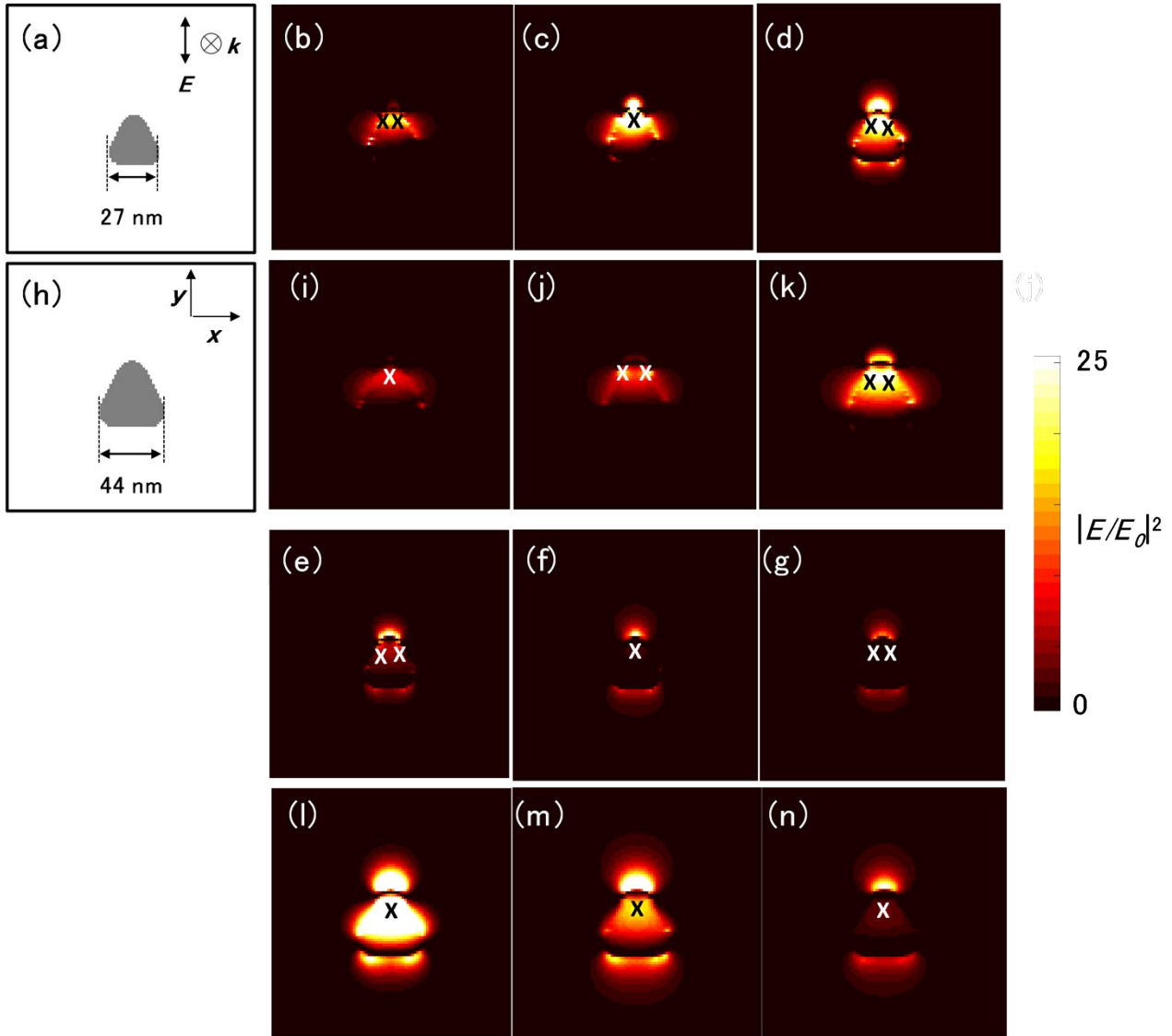


Figure S4. Electromagnetic field distributions of SAgPRs (edge length: 27 nm, aspect ratio: 2.7) and LAgPRs (edge length: 44 nm, aspect ratio: 4.4) in water ($n = 1.333$). The geometric front views of SAgPR (a) and LAgPR (h), and their electromagnetic field distributions at the wavelength of 520 nm ((b), (i)), 560 nm ((c), (j)), 600 nm ((d), (k)), 650 nm ((e), (l)), 700 nm ((f), (m)), and 750 nm ((g), (n)) at the point 1 nm distance from the surfaces of SAgPR and LAgPR, respectively. The field strengths are normalized by the incident electromagnetic field strength. The area in white color means $|E/E_0|^2 \geq 25$. The points of maximum field strength are indicated by “x” mark.

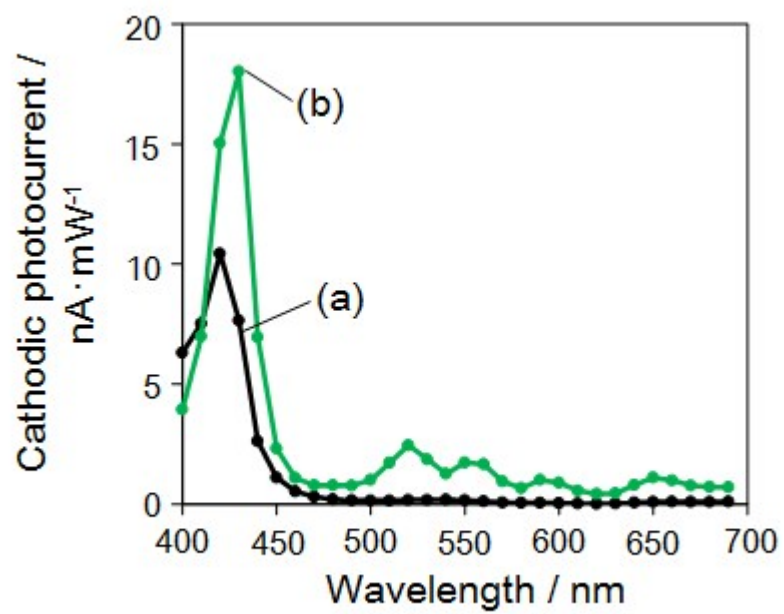


Figure S5. Photocurrent action spectra for (a) TCPP/AgP/ITO (same as (a) in Figure S2) and (b) TCPP/MAgPRs/ITO after subtraction of the photocurrents of Ti(O)-modified AgP/ITO and MAgPRs/ITO, respectively.

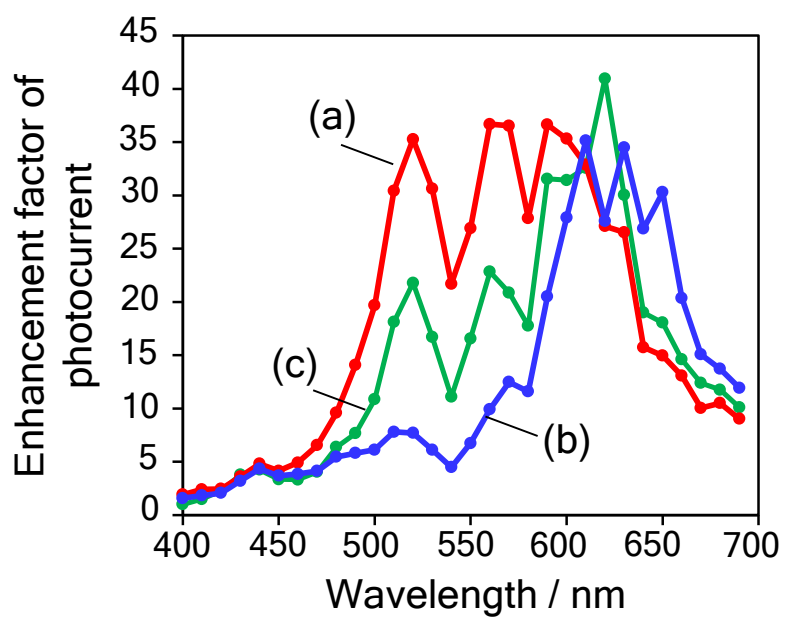


Figure S6. EFs of photocurrents of (a) TCPP/SAgPRs/ITO, (b) TCPP/LAgPRs/ITO, and (c) TCPP/MAgPRs/ITO against TCPP/AgP/ITO.