Supporting information

Efficient optical coupling between dielectric strip waveguides and a plasmonic trench waveguide

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Fabrication methods of the proposed input and output plasmonic couplers

Figure S1 presents the fabrication methods of the proposed input and output plasmonic couplers. In the first step, a photolithography, a dry etching, a thermal evaporation, and a lift-off processes can be used to fabricate gold embedded in silicon wafer (see **Figure S1 (a)** and **(h)**). In the second step, a photolithography, a dry etching, and lift-off processes can be used to reduce the thickness of the silicon substrate (see **Figure S1 (c)** and **(i)**). In the 3rd step, a photolithograph, a dry etching, and lift-off processes can be used to fabricate the gold substrate (see **Figure S1 (d)** and **(j)**). In the 4th step, a thermal oxidation method can be used to form a SiO_2 dielectric layer in the top region of the silicon substrate. In the 5th step, an electron beam lithography, a sputtering deposition, and a lift-off processes can be used to fabricate the rectangular TiO_2 waveguides (see **Figure S1 (f)** and **(l)**).

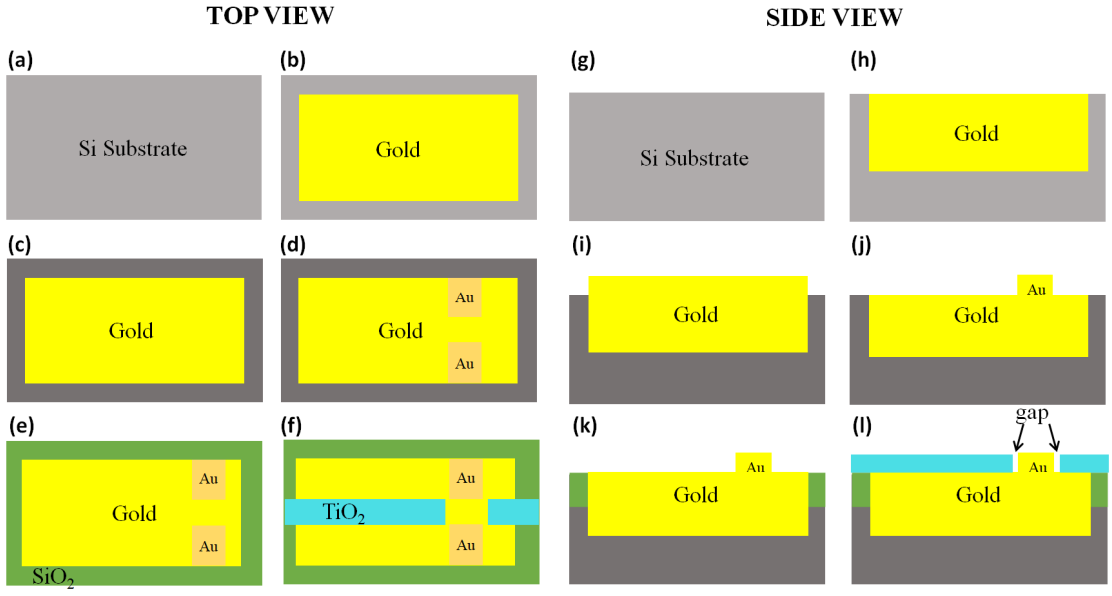

Fig. S1. Fabrication methods. (a)-(f) are top view. (g)-(l) are side view. (b) and (h) contain photolithography, dry etching, and thermal evaporation. (c) and (i) contain photolithography and dry etching. (d) and (j) contain photolithography and dry etching. (e) and (k) contain oxidation. (f) and (l) contain photolithography and sputter.

Attenuation coefficients of the two waveguides

Figure S2 presents the instantaneous $|E_x|^2$ distributions of the TiO_2 strip waveguide loaded on top of the Au substrate and the Au plasmonic trench waveguide. The attenuation coefficient (α) of the waveguide can be computed by using the relation: $|Ex(z)|^2=|Ex(0)|^2\exp(-\alpha z)$. In the TiO_2 strip, the $|E_x|^2$ values are 18.27 and 10.58 at z=5.07 mm and z=10.35 mm, respectively, which results in the attenuation coefficient of 10.35×10^4/m. In the Au trench, the $|E_x|^2$ values are 4.71 and 4.28 at z=3.99 mm and z=11.85 mm, respectively, which results in the attenuation coefficient of 1.22×10^4/m.

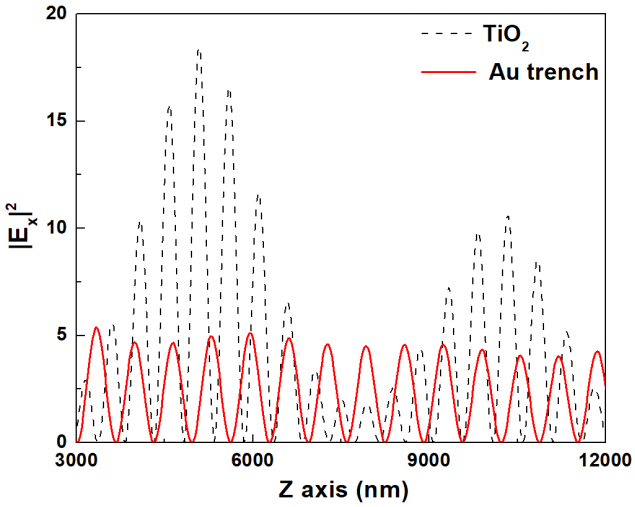

Fig. S2. $|E_x|^2$ distributions of the TiO_2 strip waveguide loaded on top of the Au substrate and the Au plasmonic trench waveguide at the wavelength of 1550 nm.