Supporting Information

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SI Materials and Methods

For estimation of the relative coupling efficiency, the amount of photons lost from the SnO_2 nanoribbon at the metal-dielectric junction either couples nonradiatively as surface plasmon polaritons (SPPs) into the Ag nanowire, or lost radiatively as free space photons through scattering. And the relative coupling efficiency η_c denotes the percentage of photons coupled into the Ag nanowire in the total output from SnO_2 nanoribbon due to the presence of the metal-dielectric junction. So η_c can be expressed as $\eta_c = I_{in,Ag}/(I_{in,Ag} + I_{scatter})$.

With the micromanipulator, we are able to change the orientation of a single Ag nanowire with respect to the SnO_2 nanoribbon. And η_c of a given coupling angle and input photon frequency can be estimated from the corresponding waveguiding images which gives the spacial intensity map of the free-space photons given out from the coupling system. The scattering loss $I_{scatter}$ can be measured directly from integrating the scattering spot at the junction. The integrated tip emission intensity $I_{out,Ag}$ relates to $I_{in,Ag}$ through $I_{out,Ag} = \eta_{out} \cdot I_{in,Ag}\, e^{-x/L}$, where η_{out} is the out-coupling factor from the guided SPP modes to free space photons at the tip of the Ag nanowire, L is the propagation length, and x is the distance from the junction to the distal end of the Ag nanowire, which can be measured from the images. Plugging $I_{out,Ag} = \eta_{out} \cdot I_{in,Ag}\, e^{-x/L}$ into $\eta_c = I_{in,Ag}/(I_{in,Ag} + I_{scatter})$, the relative coupling efficiency can be expressed as $\eta_c = \dfrac{I_{out,Ag} \cdot e^{x/L}}{I_{out,Ag} \cdot e^{x/L} + \eta_{out} I_{scatter}}$. Here, the η_{out} can be considered as a constant for a given Ag nanowire at a given wavelength, and we assume η_{out} to be 100% in our calculation to give a lower bound estimation of η_c. Using the average propagation lengths measured from a number of Ag nanowires for 980, 650, and 532 nm, we can back out the $I_{in,Ag}$ for each wavelengths and coupling angles, and subsequently calculate the relative coupling efficiency η_c.

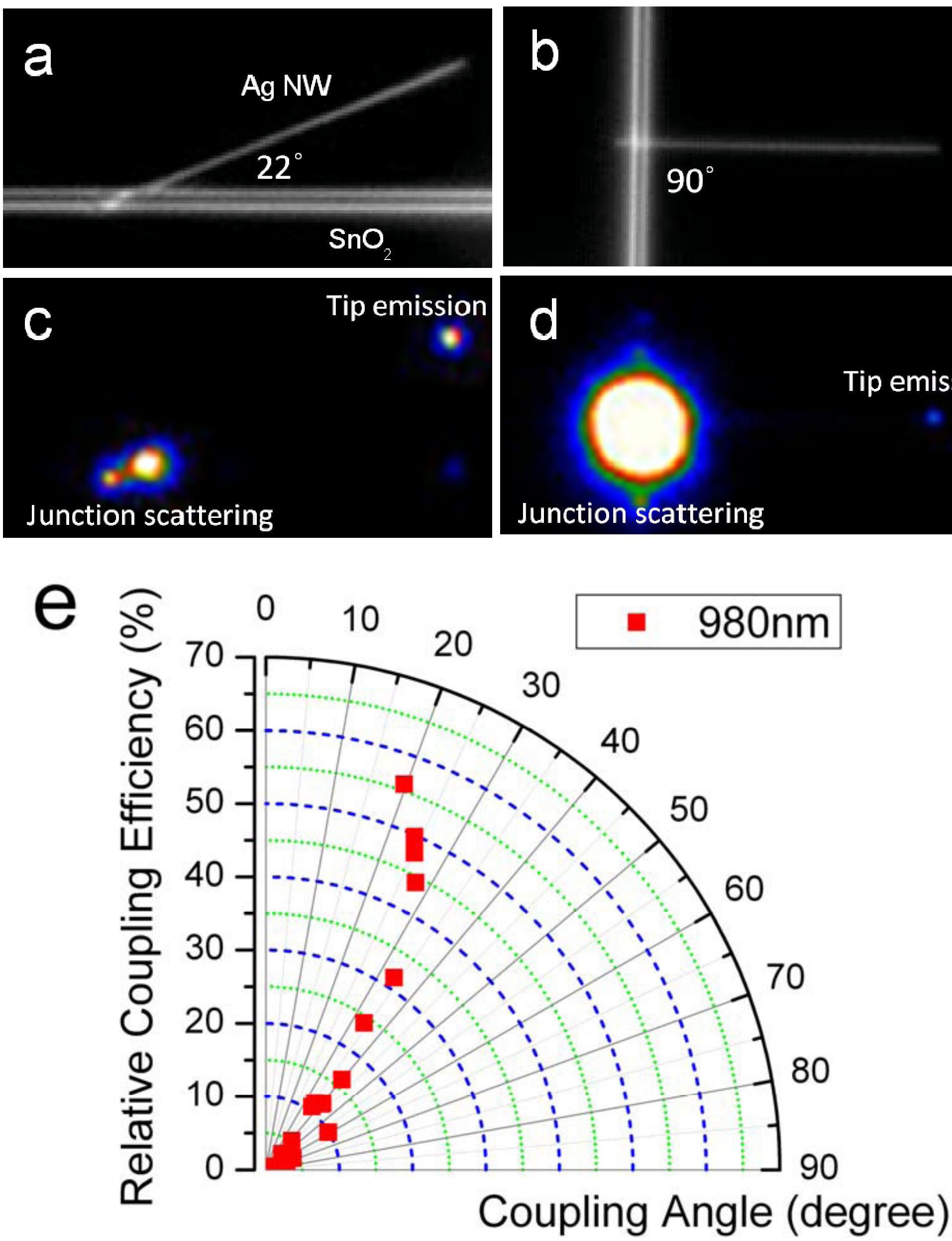

Fig. S1. Angle dependence of Ag nanowire-SnO_2 nanoribbon coupling. (*a* and *b*) Dark field images of a single Ag nanowire coupling to a SnO_2 nanoribbon at 22° and 90° angle, respectively. The distances of propagation were the same for the two geometries. (*c*) Waveguiding image corresponding to the coupling setup in a with a 22° coupling angle. The bright spots on the lower left corner were the scattering at the Ag-SnO_2 junction, and spot on the upper right was the tip emission from the distal end of the Ag nanowire. (*d*) Waveguiding image corresponding to the coupling setup in b with a 90° coupling angle. The big bright spot on the left was the scattering loss at the Ag-SnO_2 junction, and faint spot on right was the tip emission from the distal end of the Ag nanowire. All images in this figure were taken by a false-color camera that gives only the intensity profiles in the view. (*e*) Angular dependence of Ag nanowire-SnO_2 nanoribbon coupling efficiency at 980 nm.

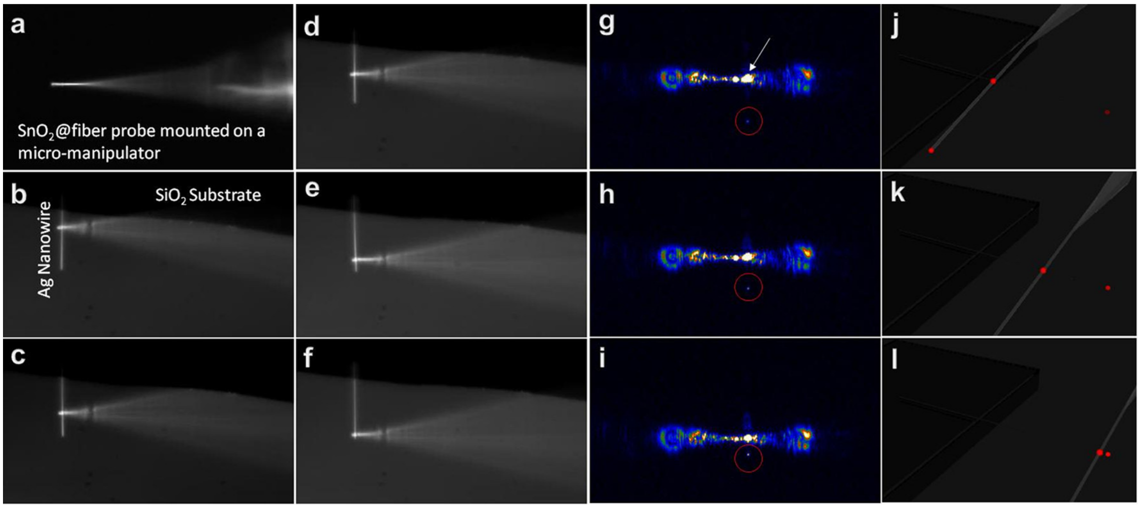

Fig. S2. Optical image of the propagation loss measurement setup. (*a*) Dark field image of the SnO_2 nanoribbon probe mounted on an x-y-z stage. The probe was ≈30° to the focal plane of the camera. (*b*–*f*) Dark field images taken when the probe was gliding along a perpendicular silver nanowire that protrude from the edge of a SiO_2 substrate. The probe glided along the nanowire without deforming the nanowire or disturbing the coupling angle. (*g*–*i*) Optical intensity map of the setup when the laser was coupled to the Ag nanowire through the SnO_2-Ag junction. The silver nanowire end emission intensity increased as distance of propagation decreased. (*j*–*l*) Three-dimensional representations of the measurement corresponding to *g*–*i*.