Electronic Supplementary Material (ESI) for Nanoscale.


## Supporting information for:

# Remote activation and detection of up-converted luminescence via surface plasmon polaritons propagating in a silver nanowire

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**P. 1. Positioning of the nanocrystals**

Nanocrystals have been positioned on one end of the nanowire utilizing precise micro-pipetting technique. We used a microinjection capillary tips (Femtotip®, Eppendorf) connected to a syringe. Capillary tips with inner diameters of 500 nm allow to inject very small volume of a fluid – depending on the operation parameters – down to several femtoliters. Tip has been mounted on a needle holder and fastened to a XYZ piezo manipulator, installed on top of the inverted optical microscope stage. The tip, previously loaded by 1 μl solution of colloidal nanocrystals, has been positioned over the sample (a few microns from the surface) and centered over a particular nanowire. By optimizing the pressure of the syringe we were able to reproducibly eject small portion of the colloid and form a small droplet, suspended under the tip. Finally, we slowly approached the tip towards the sample until the droplet was transferred to the surface/nanowire. Spots prepared using our micro-pipetting technique feature typically diameters below 1 μm.

**P. 2. Geometry of the nanostructure**

We used both optical microscopy and scanning electron microscopy (SEM) to visualize the sample and demonstrate accuracy of micro-pipetting technique. The exemplary nanostructure has been prepared on a transparent and conducting substrate (ITO), in order to fulfill SEM requirements. Optical image of the initial nanowire is presented in Fig. 1S(a). The same nanowire with nanocrystals deposited on its top end is shown in Fig. 1S(b). Surface of the nanowire, observed under SEM microscope, is rather homogenous, except the top end, where deposited nanocrystals form local protuberance (Fig. 1S(c)). High resolution SEM images of the decorated end show the nanowire embedded within tightly packed group of nanocrystals, which form quite regular drop with diameter of about 1-1.5 μm (Fig. 1S(d-f)).

We used confocal fluorescence microscopy to verify optical properties of the discussed nanostructure on ITO. First, we visualized the nanowire by analyzing back scattered laser light (Fig. 1S(g)). Then, we performed photo-luminescence intensity map, which confirms presence of the nanocrystals exclusively near top end of the nanowire (Fig. 1S(h)). Eventually, focusing laser spot on free (bottom) end of the nanowire we remotely activate nanocrystals at the distant end. The luminescence detected from free end confirms 2-way polariton-mediated process, where remotely (via $SPPs^{exc}$) activated nanocrystals launch polaritons ($SPPs^{lum}$), which transport the luminescence energy back to the starting point. The process is sensitive to polarization of light and is most efficient for laser polarized along the nanowire (Fig. 1S(i,j)). From experimental point of view, the nanostructure prepared on ITO has same functionality as on glass. Therefore, presented SEM images, demonstrating functionality of micro-pipetting technique, have a more universal character.

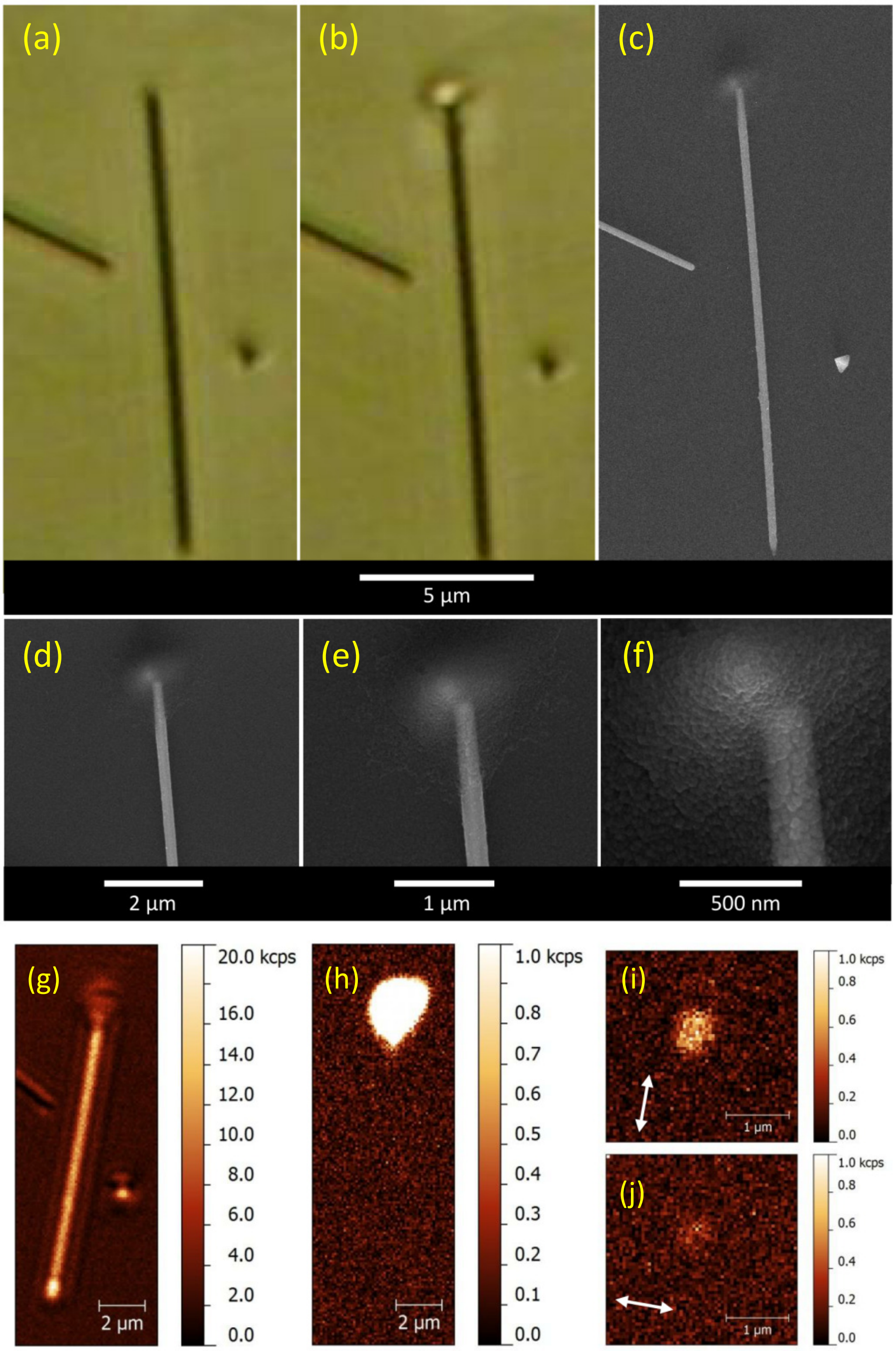


Fig. 1S. Silver nanowire on ITO substrate observed under optical microscope before (a) and after (b) micro-pipetting procedure. Detailed SEM images presenting nanowire end embedded within nanocrystals, are shown in sections (c-f). Nanowire visualized by back scattered light is seen in section (g). Photo luminescence image of the nanostructure confirms localization of the nanocrystals exclusively near top end of the nanowire. Red luminescence collected from free end of the nanowire, activate remotely by a laser (980 nm) polarized parallel (i) and perpendicular (j) to the nanowire. The polarion mediated processes (i-j) have been observed using maximal available laser power (about 10 mW).