Wavelength-dependent surface plasmon polariton propagation in a single nanowire waveguide

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We have constructed a two-objective fluorescence microscope that enables efficient excitation of Surface Plasmon Polaritons (SPPs), which we can then observe using wide-field imaging of emitter fluorescence. Such an experimental configuration can be used to study long distance SPP propagation [1,2], its dependence on a particular synthesis method of silver nanowires (AgNWs), as well as to probe the influence of the AgNWs dimensions, their surroundings and surface modifications on this effect in the context of molecular recognition.
In this work we studied the excitation wavelength dependence of the efficiency of the SPP propagation. For a structure composed of CdTe quantum dots (QDs) embedded in thin PVA film deposited onto AgNWs. In Fig. 1 we show a 25 μm long AgNW embedded in a PVA polymer containing CdTe QDs and excited with three different wavelengths. The results demonstrate that we are able to excite QDs fluorescence along the nanowire and at its end using light wavelengths of 635 nm, 532 nm, and 488 nm. The propagation distance depends upon the excitation wavelength with the longest distances achieved for the red light excitation. The analysis of the results will provide insight into the effect of the SPP propagation in silver nanowires.

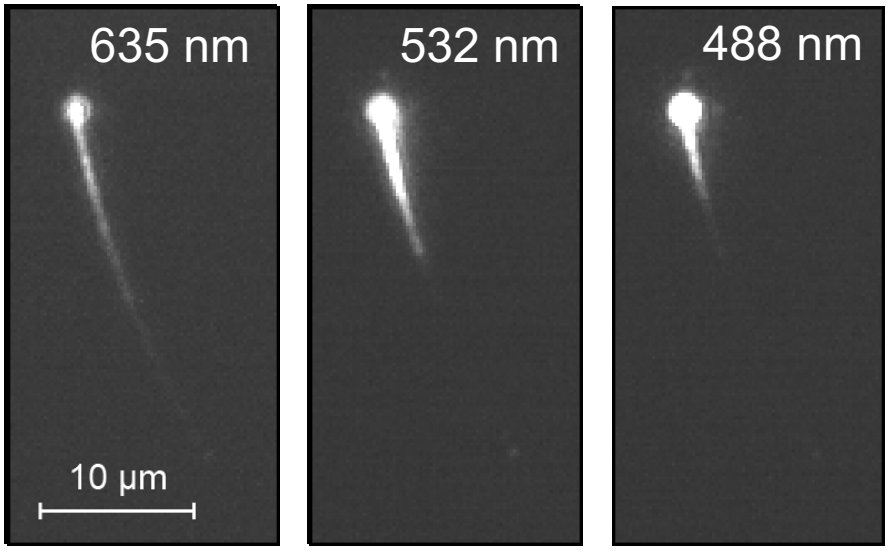

Fig.1: Fluorescence of CdTe QDs excited via plasmons propagating in the AgNW. Excitation wavelength is indicated in each image.

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[2] A. Prymaczek et al., Nanoscale 10 (2018) 12841-12847.