Electronic Supplementary Material (ESI) for Nanoscale.

SUPPORTING INFORMATION

Mapping Plasmon-Enhanced Upconversion Fluorescence of Er/Yb-doped KYF Nanocrystals Near Gold Nanodisks

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NANOCRYSTAL SYNTHESIS, TIP FABRICATION AND EXPERIMENTAL SET-UP:

The up-converting nanocrystals are made of KY_3F_{10} codoped with Er^{3+} (2%) and Yb^{3+} (8%). They have been obtained by hydrothermal method at 180°C (filling rate 60%) for two days starting from a mixture of solution of potassium, yttrium, erbium and ytterbium nitrates ($K(NO_3)$, $Y(NO_3)_3$,$6H_2O$, $Er(NO_3)_3$,$5H_2O$, $Yb(NO_3)_3$,$5H_2O$) in stoichiometric amount dissolved in a solvent constituted of excess of 40% hydrofluoric acid % and water. The nanoparticles are then washed by at least four dispersion/centrifugation cycles in water and dried at low temperature (60 – 80°C) in a laboratory oven. The size of the nanocrystal is in the range 50-150 nm. A single UCN was glued at the end of a sharp tungsten tip using a homemade nanomanipulation system. The tip is then placed on a homemade AFM / SNOM setup. To perform scans, the tip is operated in the tapping mode, with oscillation amplitudes close to 20 nm. It is possible to measure the topography and the optical signal simultaneously. To avoid damaging the tip and the nanodisks, we performed the scans in a non-contact mode, just above the disk surface. The sample was set on an XYZ stage for scanning (Physics Instruments). To excite the sample, we used a 975 nm laser diode, whose beam was linearly polarized prior to illuminating the sample. The intensity of the diode was internally modulated at 420 Hz. The sample was illuminated in a transmission mode with a long working distance microscope objective (Olympus x20) and the spot size was a few tens of microns. The fluorescence was collected on the other side of the sample with another objective (Olympus X100), and sent to a photomultiplier tube connected to a lock-in amplifier. The fluorescence was filtered with two band-pass filters centered around 550 nm. The signal from the lock-in amplifier was recorded with a homemade Labview code as well as other scanning parameters (sample displacement).

REPRODUCIBILITY OF THE RESULTS:

We performed the fluorescence mapping with several tips to check the reproducibility of the results. We show in Fig. S1 the fluorescence images obtained with 4 different tips on structures D200 and D350. For each tip, the same behavior is observed. The two-lobe pattern is well visible for D200, but the two lobes are much less visible for D350.

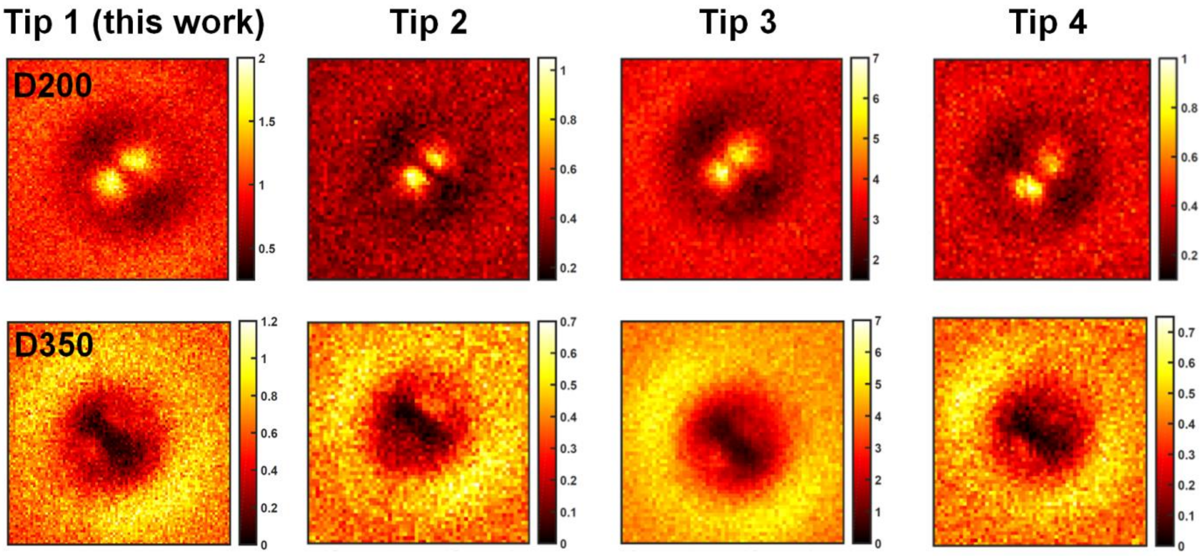

Figure S1. Fluorescence images measured with four different tips for D200 (top) and D350 (bottom). The intensity scales are in arbitrary units and cannot be compared from one tip to the other. The size of the images is 1.8 × 1.8 µm^2.