Plasmon-nanofocused broadband light source

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Plasmon nanofocusing is a phenomenon in which plasmons propagate on a tapered metallic structure towards its apex and generate strong near-field light as the nanoscale light source[1]. The background suppression is the strong and obvious advantage as it does not require the direct illumination of the incident light to the apex, but the illumination to a plasmon coupler on the taper shaft. In addition to this, the plasmon nanofocusing has another unique property, which is that it can be excited at arbitrary wavelengths. The plasmon nanofocusing is broadband because it is based on the plasmon propagation, which is totally different from the localized plasmon resonance of a plasmonic nanostructure that usually occurs only at a certain resonance wavelength. This unique broadband property allows to generate broadband nanolight source spanning over the wide wavelength range, which holds great potentials to a vast variety of plasmonic applications.

In this talk, we focus on the broadband property rather than the background suppression ability of the plasmon nanofocusing to discuss its potential and possible applications [2][3]. We show some fundamental studies on the broadband property of the plasmon nanofocusing, in which we investigated the broadband property of different plasmonic materials such as silver, gold and aluminum. We found the extremely broad response of the plasmon nanofocusing over the visible to the near-infrared regions from 400 to 2,000 nm. Furthermore, we show some actual applications of the broadband nanolight source including super-resolution spectral imaging and broadband absorption sensing.

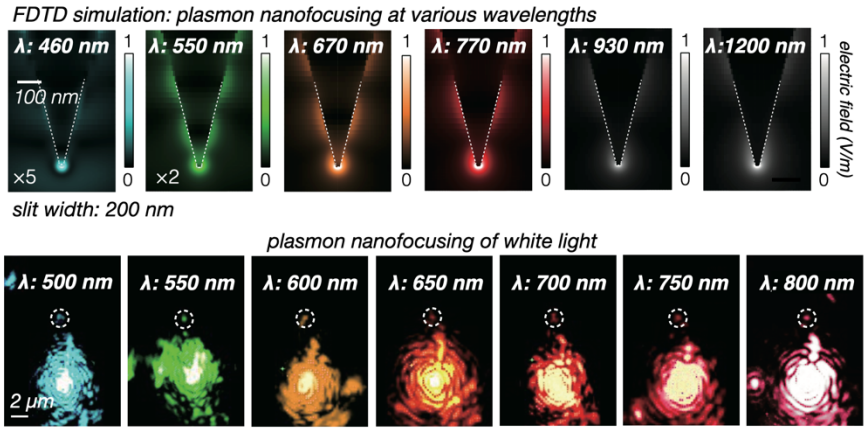

Figure 1. Broadband plasmon nanofocusing observed in simulations and optical images

[1] C. Ropers et al., *Nano Lett.*, **7(9)**, 2788 (2007).

[2] T. Umakoshi et al., *Sci. Adv.*, **6(23)**, eaba4179 (2020).

[3] T. Umakoshi et al., *Nanoscale*, **8**, 5634 (2016).