

課題番号 : F-16-HK-0051
 利用形態 : 共同研究
 利用課題名(日本語) :
 Program Title (English) : Spatial evolution of the near-field distribution on planar gold nanoparticles with the excitation wavelength across dipole and quadrupole modes
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1. 概要(Summary)

We investigate the superposition properties of the dipole and quadrupole plasmon modes in the near field experimentally by using photoemission electron microscopy (PEEM). The results of PEEM measurements show that the evolutions of the asymmetric near-field distributions are different between the excitation with s-polarized and p-polarized light. Moreover, we hypothesize that the electrons collected by PEEM are mainly from the plasmonic hot spots located at the plane in the interface between the Au particles and the substrate.

2. 実験(Experimental)

【利用した主な装置】

超高精度電子ビーム描画装置

【実験方法】

Samples used in the experiments are the gold (Au) nanodisk arrays fabricated on ITO-coated glass by electron-beam lithography (Elionix ELS-F125-U). And then PEEM with different light sources (UV light, wavelength tunable fs-laser) are used to investigate the near-field properties of samples.

3. 結果と考察(Results and Discussion)

The UV light source can be used to image the structure topography, via the linear photoemission process. The pulsed laser source can be used to obtain the near-field mapping of LSPR via the multiphoton photoemission process. At normal incidence, the field distribution of the dipole mode has two symmetric hotspots around the nanodisk. When using the oblique incident laser, the near field of the LSPR is redistributed with the

additional excitation of the quadrupole mode. The distribution with the s-polarized laser results from the superposition of the dipole mode and the odd symmetric quadrupole mode. The distribution with the p-polarized laser results from the superposition of the dipole mode and the even symmetric quadrupole mode. Moreover, the simulation results show different variation trend between the distribution on the upper and lower plane of structures. The PEEM images correspond to the simulation results on the lower plane. Therefore, we hypothesize that the photoelectrons are mainly from the plasmonic hot spots located at the lower plane in our PEEM experiments.

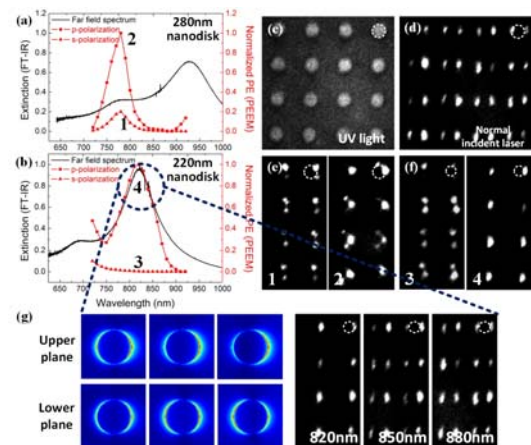


Fig 1. Near-field intensity spectra and PEEM images with different light sources.

4. その他・特記事項(Others)

Collaborators: Quan Sun, Han Yu, Kosei Ueno and Hiroaki Misawa

5. 論文・学会発表(Publication/Presentation)

Jinghuan Yang, Quan Sun, Han Yu, Kosei Ueno, Hiroaki Misawa and Qihuang Gong, *Photonics Research*, **5** (2017) 187.

6. 関連特許(Patent) N/A