Hybridization models of gold nanoantennas arrays in polarization dependent evanescent waves (Presentation Recording)

Kuo-Ping Chen, Yi-Hsun Chen, Che-Yuan Chang, Yu-Lun Kuo, Zhen-hong Yang, National Chiao Tung Univ. (Taiwan)

ABSTRACT

The plasmonic coupling of nanoantennas could be explained by the plasmon hybridization model introduced. For symmetric nanoparticles pairs, the coupled mode can be shifted to higher or lower frequencies, depending on the phase of the fields from each nanoparticle. In p-polarization, the in-phase response is called bonding mode and out of phase response is called antibonding mode, which are analogous to the molecular orbital theory. The bonding mode, located at a lower energy level, could be strongly excited by normal incidence, but antibonding mode, located at a higher energy level, could hardly excited by normal incident plane wave and which is not easy to be observed. In literatures, the antibonding mode could only be excited by highly focused laser beams, the radiation from a local emitter, and the evanescent field produced by total internal reflection9. Although the observation is not easy, the antibonding mode has brought a lot of attention because of the slower radiative decay and narrower linewidths. However, there are not many researches discussing the sensor application of the plasmonic antibonding mode of nanoantenans arrays.

In this work, gold nanoantennas antibonding mode in TM and TE polarized evanescent field is investigated and the sensitivity to the refractive index change of surrounding medium is compared to bonding mode in normal incidence. Furthermore, in normal incidence, due to the impedance mismatch between the dielectric and substrate, strong reflectance happens at the resonance in bonding mode which could reduce the coupling efficiency. In order to achieve higher energy coupling efficiency, total internal reflection could be used to minimize the impedance mismatch and transfer the input energy into antibonding mode plasmonic resonance.

View presentation video on SPIE's Digital Library:
http://dx.doi.org/10.1117/12.2187223.4519370336001

Plasmonics: Metallic Nanostructures and Their Optical Properties XIII, edited by Allan D. Boardman, Din Ping Tsai,
Proc. of SPIE Vol. 9547, 954720 · © 2015 SPIE · CCC code: 0277-786X/15/$18 · doi: 10.1117/12.2187223