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利用形態　　:共同研究
利用課題名（日本語）　　:
Program Title (English)　　:Spectral properties of nanogap dimer structures showing dipole-dipole interaction and charge transfer plasmon
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1. 概要（Summary）

In this collaborative study, spectral properties of charge transfer plasmon were studied. A pair of dimer-type of gold nanoblocks were fabricated on a glass substrate, and subsequently its scattering spectrum was measured. The gap distance was controlled by high resolution lithographic technique precisely. When gap distance was set around 0 nm, spectrum property was obviously changed because gap is formed accidentally. Especially, we elucidated spectral properties of dimer nanostructure with nanogap and nanocontact between two particles.

2. 実験（Experimental）

·Apparatus

Helicon sputtering system (MPS-4000C1 /HC1, ULVAC), High-resolution electron beam lithography system (ELS-F125-U, Elionix), FE-SEM (JSM-6700FT, JEOL)

·Method

Planar patterns of dimer type of nanogap gold structures with a thickness of 30 nm were fabricated by electron beam lithography and lift-off techniques on a glass substrate. Each pair of nanostructures were separated 10 μm not to generate near-field interaction. Dar-field scattering spectroscopy was used for the measurement of each pair of nanostructures in this study. After spectral measurements, high-resolution scanning electron microscopy was employed for the measurement of which nanostructure shows which spectral properties one by one.

3. 結果と考察（Results and Discussion）

Fig. 1 shows typical example of scanning electron microscope images of dimer-type of nanogap structures and their corresponding scattering spectra, respectively. The designed gap distance was set at 0 nm. Therefore, gap is sometimes formed because there is a size distribution in electron beam lithography system about 3 nm as a standard deviation. Importantly, Fig.1 (a) shows small nanogap and Fig. 1(b) shows nanocontact between two particles. Therefore, the spectrum property under the incident polarization parallel to dimer structure is completely different. When gap is formed, the dipole resonance band shows red shift due to near field interaction. On the other hand, when the nanocontact is formed, spectrum divided into two-peaks; one is red-shift and the other is blue-shift. The red-shift can be considered due to dipole coupling. On the other hand, the blue-shift should be clarified. To study further more in detail, we will study spectrum of charge transfer plasmon in near-infrared wavelength and electromagnetic simulation.

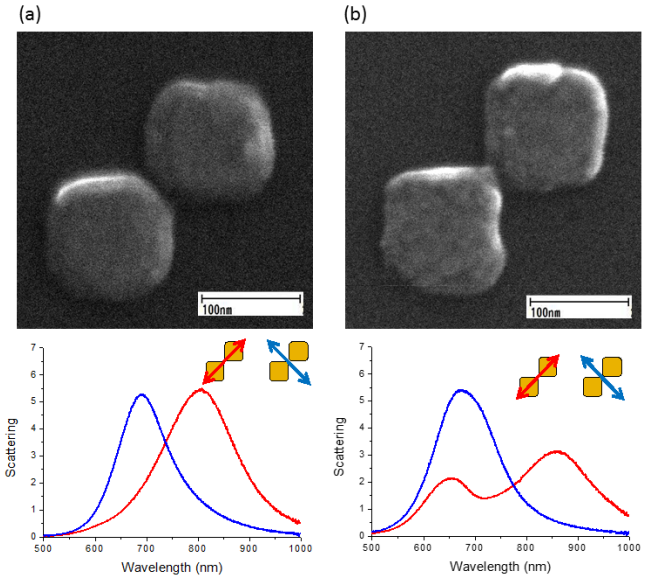

Fig. 1. SEM images of dimer-type gold structures with (a) and without gap (b) and their corresponding scattering spectra under incident polarization parallel and perpendicular to dimer structures, respectively.

4. その他・特記事項（Others）

・ Collaborators: (RIES, Hokkaido Univ.)Y. Mori, H. Uehara, K. Ueno, H. Misawa

5. 論文・学会発表（Publication/Presentation）

なし

6. 関連特許（Patent）

なし