課題番号　　:F-16-HK-0043
利用形態　　:共同研究
利用課題名（日本語）　　:
Program Title (English)　　:Reveling charge transfer plasmon on bridged dimer nanostructures
利用者名（日本語）　　:
Username (English)　　:Wei-Shun Chang, Man-Nung Su, Stephan Link
所属名（日本語）　　:
Affiliation (English)　　:Rice University, USA

1. 概要（Summary）

In FY2016, we continued the collaborative study about the spectral properties of charge transfer plasmon on bridged dimer nanostructures. In particular, we have correlated the SEM images and single particle scattering spectra individually, and found the that junction width or height can significantly affect the charge transfer plasmon.

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、ヘリコンスパッタリング装置、高分解能電界放射型走査型電子顕微鏡

【実験方法】

Planar patterns of dimer type of nanogap gold (Au) structures with a thickness of 30 nm were fabricated by EBL and lift-off techniques on glass substrates. The pitch size was set at 10 μm to avoid near-field interaction between neighbor dimer. Dar-field scattering spectroscopy was used for the measurement of each pair of nanostructures and the spectra were correlated to high-resolution scanning electron microscopy (SEM) images one by one.

3. 結果と考察（Results and Discussion）

We found that when the designed gap is smaller than 6 nm, the two building blocks of the dimer are always touched. But due to a slight size distribution in EBL system ~3 nm as a standard deviation. Figure 1 shows typical example of SEM images of dimer-type of nanogap structures with the same design (side length: 110 nm, gap size: 4 nm) and their corresponding scattering spectra, respectively. All the three dimers are connected. Importantly, when the connected junction is wide or high, the scattering spectra exhibit two peaks (panels b and c). The long-wavelength peak is thought to be the charge transfer plasmon mode. However, in case of panel a, the junction is narrow, the charge transfer plasmon mode might be weaker and locate at the longer wavelength outside of our spectral range. To study further more in detail, we will study spectra of charge transfer plasmon in near-infrared wavelength and perform electromagnetic simulations based on finite-difference time-domain (FDTD) method.

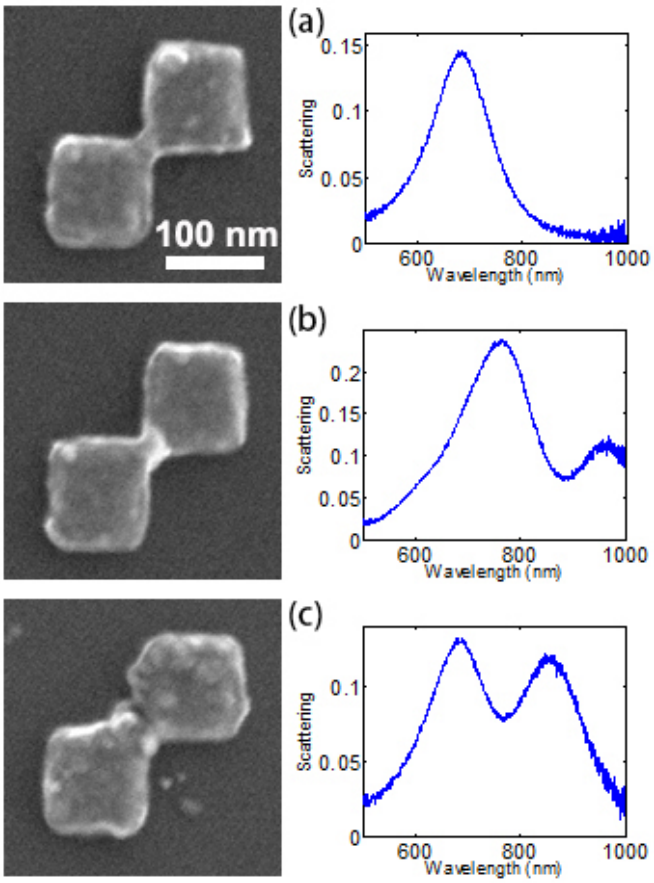

Fig. 1. SEM images (left column) and the corresponding scattering spectra (right column) under incident polarization to dimer axis of the bridged dimers with the same design (110 nm block and 4 nm gap).

4. その他・特記事項（Others）

・Collaborators: Y. Mori, Q. Sun, K. Ueno, H. Misawa

5. 論文・学会発表（Publication/Presentation）

なし

6. 関連特許（Patent）

なし