

課題番号 : F-21-HK-0041
利用形態 : 共同研究
利用課題名(日本語) :
Program Title (English) : Study the Plasmonic Corner States using Photoemission Electron Microscopy
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Affiliation (English) : Institute of modern optics, college of physics, Peking University
キーワード/Keyword : 成膜・膜堆積, Plasmon, topological photonics, Photoemission electron microscopy,

1. 概要(Summary)

We study the two-dimensional topological photonics of plasmonic corner states, and demonstrate how the corner states can affect the plasmonic near-field enhancement and the dephasing time by fabrication nanoarrays with shrink and expand square lattices.

2. 実験(Experimental)

【利用した主な装置】

時間分解光電子顕微鏡システム (PEEM-III), 高精度電子ビーム描画装置 125KV(ELS-F125-U), ヘリコンスパッタリング装置 (MPS-4000C1/HC1), 電界放射型走査型電子顕微鏡 (JSM-6700FT),

【実験方法】

Topological nanoarrays composed of gold nanoparticles were fabricated on the substrate of Indium tin oxide (ITO) by using EBL and Helicon Sputtering. 50-PA current was used in EBL, 2-nm adhesion layers and 30-nm gold nanoparticles were used in Helicon Sputtering. The gold nanoparticles were arrayed as shrink and expand square lattices with each diameter of 110nm. The gaps are determined by the topological properties in order to support the corner states.^[1] The topological nanoarrays were observed by SEM and Photoemission Electron Microscopy (PEEM).

3. 結果と考察(Results and Discussion)

Figure 1 demonstrates the SEM image of the shrink square lattices (a) and normal square lattices (b) with diameter of 110nm. The gaps are 30 nm and 100 nm in shrink lattices and is 30 nm in normal lattices. The scale bars represent 200 nm. Furthermore, the plasmon hotspots

excited by femo-second laser with PEEM indicated that by combing the shrink and expanded square lattices, the corner states can be observed. To be specific, different shape of the corner states, including right angle type, triangle type, can have different dephasing times. The results show that the right-angle type corner state have longer dephasing time, which can be used in the quantum system to obtain high Purcell factor.

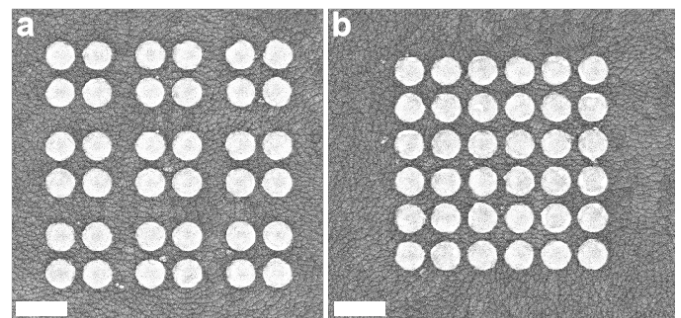


Figure 1 Schematic of plasmonic nanoarrays with shrink square lattices (a) and normal square lattices (b). The scale bars represent 200 nm.

4. その他・特記事項(Others)

Main collaborators: H. Misawa (RIES-Hokkaido University).

共同研究者: 三澤弘明、石旭(北海道大学)

・参考文献:

[1] Kim, Minkyung and Rho, Junsuk., *Nanophotonics* **2020**, 9(10):3227-3234;

5. 論文・学会発表(Publication/Presentation)

1. Yan Q *et al.*, *Nano Lett.* **2021**, 21(21): 9270-9278.

6. 関連特許(Patent)

なし