

課題番号 : F-14-HK-0071
利用形態 : 共同研究
利用課題名(日本語) :
Program Title (English) : Dynamics of exciton-plasmon strong coupling system of J-aggregate and metal hybrid nanostructure
利用者名(日本語) :
Username (English) : Qi-Dai Chen, Hong-bo Sun
所属名(日本語) :
Affiliation (English) : Jilin University

1. 概要(Summary)

Recently, strong coupling between localized surface plasmon (LSP) and excitons have been studied in hybrid systems of metallic nanostructures and dye J-aggregates. In this study, strong coupling was induced in hybrid systems of gold nanostructures and porphyrin J-aggregate and its spectral properties were elucidated. Furthermore, ultrafast dynamics of these hybrid-states were studied by using a femtosecond transient absorption measurement system.

2. 実験(Experimental)

• Apparatus

Helicon sputtering system, High-resolution electron beam lithography system, Atomic layer deposition, ICP plasma etching, Scanning electron microscope

• Method

Planar patterns of square-shaped gold nanoblocks with thickness of 50 nm were fabricated by high-resolution electron beam lithography on the porphyrin J-aggregate film and an alumina layer with thickness of 1.5 nm by atomic layer deposition formed on a glass substrate. Then plasma etching was performed with the mask of nanoblocks to remove uncoupled molecules. Transient absorption spectroscopy were performed to elucidate the dynamics of relaxation process of the strong coupling states.

3. 結果と考察(Results and Discussion)

In this hybrid system, we have successfully demonstrated the spectral property of a

plasmon-exciton strong coupling states with Rabi-splitting energy of 200 meV. A typical extinction spectrum of a hybrid system and the transient absorption spectra were shown in Fig. 1. We have successfully observed the formation of hybrid-states and its relaxation within several hundreds of femtosecond under resonant excitation.

4. その他・特記事項(Others)

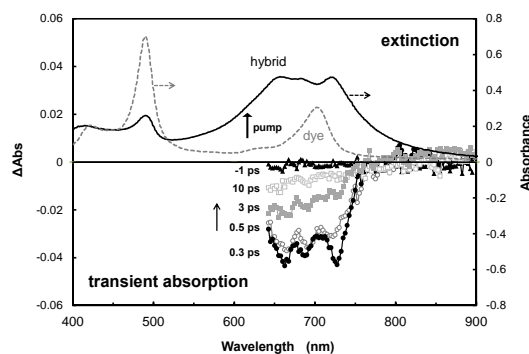


Fig. 1 Extinction and transient absorption spectra of a hybrid system under 620 nm wavelength excitation.

•共同研究者等 (Coauthor): (北大電子研) H. Uehara, T. Oshikiri, K. Ueno, H. Misawa

5. 論文・学会発表(Publication/Presentation)

なし

6. 関連特許(Patent)

なし