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利用形態　　:共同研究
利用課題名(日本語)　　:アルミニウムナノロッドの作製とエキシトンポラリトンの光学特性
Program Title(English)　　:Fabrication of aluminum nanorods and spectral properties of plasmon-exciton hybrid states
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1. 概要(Summary)

We report on spectral properties of strong coupling between localized surface plasmon resonances (LSPRs) and J-aggregate molecules. With a wide spectrum range of LSPR bands from ultraviolet to near-infrared wavelength, Al nanostuctures can realize strong coupling not only in Q band but also Soret band of TPPS J-aggregates by controlling the structural size or polarization of incident light.

2. 実験(Experimental)

【利用した主な装置】

電子ビーム描画装置(ELS-F125-U)、原子層堆積装置(Picosun SUNALE-R)、反応性イオンエッチング装置(RIE-101iPH)、電界放射型走査型電子顕微鏡(JSM-6700FT)

【実験方法】

Patterns of Al nanostructures on glass substrates were designed by using electron-beam lithography system (ELS-F125-U) operating at 125 kV. After development, a 35 nm thick Al layer was deposited by thermal evaporation, and then the residual resist was removed by lift-off process. TPPS molecules were dissolved in methanol with a concentration of 3 mM and then spin-coated onto the Al nanostructures to form a TPPS J-aggregate film with thickness about 20 nm.

3. 結果と考察(Results and Discussion)

Scanning electron microscope (JSM-6700FT) images of Al nanostructures are shown in Figure 1. Two kinds of Al nanostructures, nanodisks and nanorods, were fabricated, which can be used to realize strong coupling with the two excitons of TPPS J-aggregates.

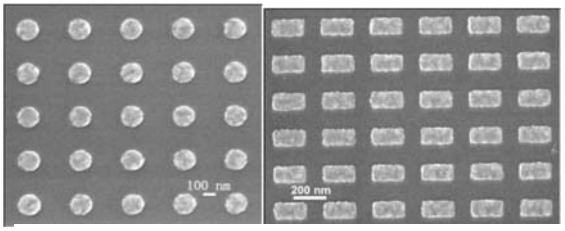

Fig. 1 SEM images of Al nanostructures.

Al nanodisks can realize strong coupling not only in Q band but also Soret band of TPPS J-aggregates by controlling the structural size. On the other hand, in Al nanorod system, we can also realize strong coupling with Soret band and Q band of TPPS by just turning the polarization of the incident light. Therefore, Al nanostructures enable a good platform, in which we can further investigate the molecular energy redistribution pathways between different excited states under strong coupling.

4. その他・特記事項(Others)

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北海道大学: 李 洁、上原日和、押切友也、上野貢生、三澤弘明

・参考文献　(1) P. Torma et *al.*, Reports on Progress in Physics 78, (2015) 013901.

5. 論文・学会発表(Publication/Presentation)

(1) J. Li et *al.*, the 16th RIES-Hokudai international symposium, Sapporo, November (2015).
(2) J. Li et *al.*, The 2015 International Chemical Congress of Pacific Basin Societies (Pacifichem), Honolulu, USA, December (2015).
(3) JJ. Li et al., The 96th annual meeting of the chemical society of Japan, Kyoto, March (2016).

6. 関連特許(Patent)

なし.