

課題番号 : F-21-HK-0028
 利用形態 : 機器利用
 利用課題名(日本語) :
 Program Title (English) : Photocurrent Generation on Gold Nanoparticles Loaded Ga₂O₃
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 キーワード/Keyword : 成膜・膜堆積, Plasmon-induced photocurrent, Strong coupling

1. 概要(Summary)

Ga₂O₃ could be applied in the water splitting due to its more negative conduction band than potential of H⁺/H₂ [1]. We have reported that the photocurrent generation by loading Au-NPs on Ga₂O₃ under visible light. Strong coupling between optical cavity and plasmon mode has been proven that could efficiently enhance the light absorption and carrier separation. When the film was deposited on Au film which could act as a mirror layer, optical cavity could form due to the Fabry-Pérot interference. When the cavity wavelength overlaps with the LSPR wavelength, energy level could be split into upper and lower branch which is called the strong coupling. In our previous work, Ga₂O₃ film with good conductivity and mobility has been fabricated by investigating the deposition condition using Pulse Laser Deposition. In this work, different thickness of Ga₂O₃ was deposited to adjust the cavity wavelength achieving the tuning structure.

2. 実験(Experimental)

【利用した主な装置】

半導体薄膜堆積装置(PLD) (PAC-LMBE), 電界放射型走査型電子顕微鏡 (JSM-6700FT), 原子層堆積装置(ALD) SUNALE-R, 電子ビーム蒸着装置(EB-580), 多元スパッタ装置(QAM-4-ST).

【実験方法】

100 nm Au film was deposited on SiO₂ by sputtering system. Then, very thin TiN film was deposited on Au film by multi-sputter. The Ga₂O₃ film was fabricated by PLD on TiN film. Au-NPs

were loaded on Ga₂O₃ film by annealing the Au film. Finally, the Au-NPs were inlaid by very thin TiO₂.

3. 結果と考察(Results and Discussion)

To adjust the cavity wavelength, different thickness of Ga₂O₃ were deposited on the substrate. The absorption peak wavelength of the fabricated sample was red shifted as the Ga₂O₃ thicknesses were increased from 135 nm to 293 nm (Figure 1). When the thickness of Ga₂O₃ was 210 nm, tuning structure was formed with two distinct bands as shown by the green line because the cavity wavelength was overlapped with the LSPR of Au-NPs loaded on as shown by purple dash line.

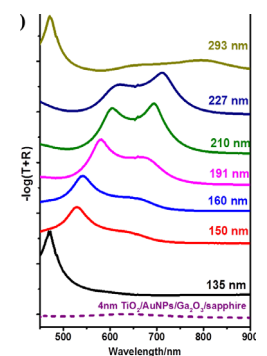


Figure 1. Absorption spectra of samples with different Ga₂O₃ thicknesses.

4. その他・特記事項(Others)

・参考文献

[1] K. Maeda, K. Domen, *J. Phys. Chem. C*, 111 (2007) 7851-7861.

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5. 論文・学会発表(Publication/Presentation)

なし

6. 関連特許(Patent)

なし