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 利用形態 : 機器利用
 利用課題名(日本語) :
 Program Title(English) : Exploring the Near-Field of Strongly Coupled Waveguide-Plasmon Modes by Plasmon-Induced Photocurrent Generation Using a Gold Nanogratings-Loaded Titanium Dioxide Photoelectrode
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1. 概要(Summary)

We investigated the near field properties of Au nanogratings on 250 nm TiO₂ thin film and silica glass substrate by photocurrent measurement. The plasmon-induced photocurrent generations of periodic Au nanogratings loaded on TiO₂ photoelectrode can reveal the near field properties and give a good understanding of strongly coupled waveguide-plasmon modes.

2. 実験(Experimental)

【利用した主な装置】

原子層堆積装置 (Picosun SUNALE-R), 超高精度電子ビーム描画装置 (ELS-F125-U), 高分解能電界放射型走査型電子顕微鏡 (JSM-6700FT)

【実験方法】

250 nm TiO₂ thin film was deposited onto quartz substrate by atomic layer deposition (ALD) system. Periodic Au nanogratings loaded on TiO₂ thin film were designed by using electron-beam lithography system (ELS-F125-U) operating at 125 kV and lift-off techniques. The characterization of topography of Au nanogratings loaded on TiO₂ thin film structures was verified by Scanning electron microscope (SEM) measurement.

3. 結果と考察(Results and Discussion)

SEM image of periodic Au nanogratings with 300 nm pitch size on 250 nm TiO₂ thin film is shown in Figure 1(a). The extinction spectra

(Figure 1b) represent the strongly coupled waveguide-plasmon modes with different pitch sizes. The coupling strength can be modulated by changing the period of Au nanogratings loaded TiO₂ structures. The near field properties of the strong coupled waveguide-plasmon modes can be probed by measuring the plasmon-induced photocurrent. The calculated internal quantum efficiency (IQE) action spectra have good response to the near-field enhancement.

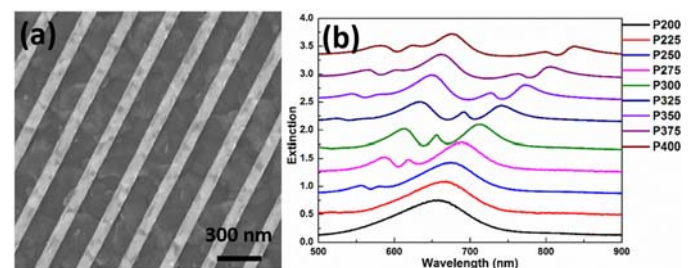


Fig. 1 SEM image (a) and extinction spectrum (b) of Au nanogratings on TiO₂ thin film with different pitch sizes.

4. その他・特記事項(Others)

- ・共同研究者 三澤弘明、上野貢生(北大電子研)
- ・参考文献

- (1) Christ, A et *al.*, Phys Rev Lett. 91, (2003) 183901.
- (2) Christ, A et *al.*, Phys Rev B. 70, (2004) 125113.
- (3) Zeng, P et *al.*, Nano Lett. 16, (2016) 2651-2656.

5. 論文・学会発表(Publication/Presentation)

- (1) Jingchun Guo et *al.*, Analytica Chimica Acta, 957, (2017), 70-75.