

課題番号 : F-15-HK-0058
 利用形態 : 共同研究
 利用課題名(日本語) :
 Program Title (English) : Improvement of Plasmon-Enhanced Photocurrent Generation by Femtosecond Laser Surface Modification of TiO₂
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1. 概要(Summary)

A three-dimension nanostructured surface of TiO₂ was fabricated by femtosecond laser irradiation to increase the photon harvest and chemical reaction surface. The surface modified TiO₂ decorated with gold nano-islands has potential to improve the visible light photocurrent generation.

2. 実験(Experimental)

Hurricane Femtosecond laser system, Helicon Sputter, JSM-6700FT SEM,

【実験方法】

Three-dimension nanostructured surface of TiO₂ was fabricated by scanning circular polarized femtosecond laser with an area of 2.5 mm×2.5 mm. A 3-nm gold film was firstly sputtered on the laser modified TiO₂ substrate using Helicon sputter, then annealed at 800 degree Celsius in nitrogen atmosphere, leading the gold film to transform to nano-islands. The IPCE of Au-NIs/TiO₂ were measured with a three electrode system using a SCE as reference electrode and a platinum wire as counter electrode.

3. 結果と考察(Results and Discussion)

The LSPR induced by gold nano-islands on TiO₂ substrate can increase the photocurrent generation in visible light region. Nanostructured surface can further increase the photon harvest and reaction surface, resulting in an improvement of photocurrent generation. The absorbance measurement confirmed that the light harvest was increased about three times. With the surface

modification, the IPCE of visible light region was notably increased from 0.05% to 0.124%, as shown in Figure 1. The XRD and Raman spectra were further studied and no evidence of TiO₂ phase transformation after the femtosecond laser irradiation and annealing process was observed.

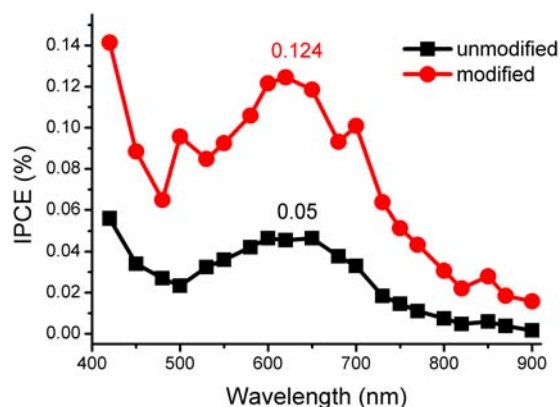


Figure 1. IPCE of Au-NIs/TiO₂ with and without surface modification

4. その他・特記事項(Others)

・参考文献

- (1) Y. Nishijima et al., J. Phys. Chem. Lett. (2012), 3, 1248-1252.
- (2) X. Shi et al., J. Phys. Chem. C, (2012) 117(47), 24733-24739.

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5. 論文・学会発表(Publication/Presentation)

なし

6. 関連特許(Patent)

なし