

課題番号 : F-15-HK-0068
利用形態 : 機器利用
利用課題名(日本語) :
Program Title (English) : Biomolecule-Modified Au Nanoislands Decorated TiO₂ Photoelectrode for in situ Measurement of Biotin-Streptavidin Binding Kinetics under Visible Light Irradiation
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1. 概要(Summary)

Here we propose and develop a surface plasmon-mediated visible light-activated photoelectrochemical (PEC) biosensor by biomolecule modified gold nanoislands (AuNIs) decorated titanium dioxide (TiO₂) substrate for in situ measurement of biotin-streptavidin (STA) association. As a proof of concept, self-assembled thiol-terminated biotin (TTB) on AuNIs/TiO₂ photoelectrode has been successfully utilized to explore the photocurrent response to different concentrations of STA-modified gold nanoparticles (STA-AuNPs) conjugate solutions with high sensitive measurement.

2. 実験(Experimental)

• Apparatus

Helicon sputtering, Compact sputtering, Scanning electron microscopy

• Method

The AuNIs/TiO₂ photoelectrode was fabricated by depositing 3 nm Au film on the surface of TiO₂ substrate (rinsed with acetone, methanol, and deionized water in an ultrasonic bath for 5 minutes separately) with subsequent annealing at 800 °C for 1 h under N₂ atmosphere. The AuNIs/TiO₂ photoelectrode was then immersed into 1 mg/mL TTB solution with a sealed vessel for 2 h at room temperature. In situ measurement of biotin-streptavidin association was achieved by step-by-step injecting different amounts of 0.47 μM STA-AuNPs solution into the reaction chamber equipped with TTB modified AuNIs/TiO₂ photoelectrode with 150 μL KClO₄ solution under the irradiation of 600 nm monochromatic light.

3. 結果と考察(Results and Discussion)

Good concentration-dependence of photocurrent response was observed. Moreover, direct investigation of the binding kinetics of biotin-STA association can be achieved by exploring the PEC sensing feature.

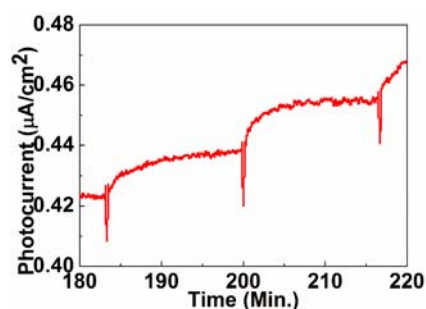


Fig. 1 The representative in situ photocurrent response to different concentrations of STA-AuNPs with irradiation of 600 nm monochromatic light.

4. その他・特記事項(Others)

•Reference

X, Shi et al., *J. Phys. Chem. C* **117**, 2494 (2012).

•Coauthor

Xu Shi, Tomoya Oshikiri, Kosei Ueno, Hiroaki Misawa

5. 論文・学会発表(Publication/Presentation)

(1) J. Guo et al., Annual Meeting on Photochemistry 2015, Osaka, Sep. 2015.

(2) J. Guo, K. Ueno, T. Oshikiri, H. Misawa, Pacificchem 2015, Honolulu, USA, Dec. 2015.

(3) J. Guo, T. Oshikiri, K. Ueno, H. Misawa, The 16th RIES-Hokudai International Symposium, Sapporo, Nov. 2015.

6. 関連特許(Patent)

None