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利用形態　　：共同研究
利用課題名（日本語）　：金ナノ粒子を担持した酸化チタン／FTO 電極の光電変換特性
Program Title (English)　：Plasmon-enhanced photocurrent generation on gold nanoparticles loaded TiO_2/FTO electrode
利用者名（日本語）　：
Username (English)　：Sandra Peglow, Volker Brüser, Angela Kruth
所属名（日本語）　：
Affiliation (English)　：Leibniz-Institut für Plasmaforschung und Technologie e. V.

1. 概要（Summary）

Plasmon-enhanced photocurrent generation has been demonstrated on gold nanoparticles loaded titanium dioxide photoelectrode. Thin film semiconductor is promising for the next generation photovoltaic and photochemistry. It is highly perspective to employ TiO_2 thin film for plasmon-enhanced photocurrent generation study. In the present study, TiO_2 thin film was prepared by physical vapor deposition and gold nanoparticles (Au-NPs) was decorated on the surface of TiO_2 by gold thin film annealing method.

2. 実験（Experimental）

To form Ohmic contacts, In-Ga alloy film was pasted and connected to the electrochemical analyzer (ALS/CH Instruments 852C, ALS Co., Ltd.) with a lead wire. A platinum wire and a saturated calomel electrode (SCE) were used as the counter electrode and reference electrode, respectively. To obtain the IPCE action spectrum, bandpass filters with a bandwidth of less than 15 nm full width at half-maximum (FWHM) were employed. An aqueous $KClO_4$ (0.1 mol/L) solution was used as a supporting electrolyte solution without certain electron donors.

3. 結果と考察（Results and Discussion）

The surface morphology of Au-NPs loaded TiO_2 thin film that deposited on FTO glass by PVD was shown in Fig.1(a). It shows the TiO_2 thin film consisted with obvious aggregated TiO_2 particles, which might cause by the crystallization of TiO_2 thin film during the deposition process. The I-V curves in dark and with 350 nm light irradiation are shown in Fig.1 (b). Anodic photocurrent was generated under UV light irradiation. Fig.1 (c) shows the remarkable extinction spectrum of the Au-NPs. The plasmon resonance band center at around 650 nm with a bandwidth about 150 nm. However, the IPCE action spectrum merely shows a tiny photocurrent increased hump at around 600 nm. The less efficiency of plasmon-enhanced photocurrent generation might due to the low charge mobility of TiO_2 thin film. The photocurrent conversion efficiency in UV region are less than 1.5% (as indicated in the inserted panel of Fig.1 (d)). To fabricate high charge mobility TiO_2 thin film, pulsed laser deposition (PLD) will be employed for further study the plasmon-enhanced photoactivities on TiO_2 thin film system.

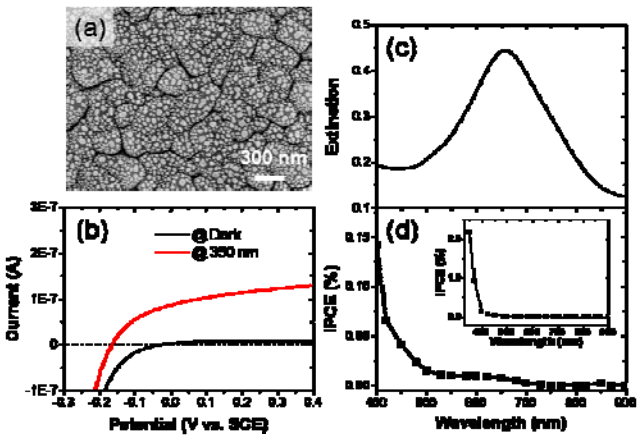

Fig.1. (a) Top-view SEM image, (b) I-V curves, (c) Au-NPs extinction spectrum, (d) IPCE action spectrum of Au-NPs loaded TiO_2 thin film.

4. その他・特記事項（Others）

・共同研究者等（Coauthor）: X. Shi, T. Oshikiri, K. Ueno, H. Misawa

5. 論文・学会発表（Publication/Presentation）

なし。

6. 関連特許（Patent）

なし。