

課題番号 : F-19-HK-0057
 利用形態 : 共同研究
 利用課題名(日本語) :
 Program Title (English) : In-situ Surface Enhanced Raman Scattering Observations of Water Oxidation Reactions Enhanced by the Modal Strong Coupling
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 キーワード/Keyword : Modal strong coupling, Graphene, Raman spectroscopy, Fermi level, Water oxidation, 成膜・膜堆積

1. 概要(Summary)

We have attempted to probe the Fermi level of Au film/TiO₂/AuNPs (ATA) electrode during OER reaction using graphene-based Raman measurements. Significant information such as structure and charge separation efficiency could be detected from Raman spectra and how these factors influence the catalysis performance was discussed.

2. 実験(Experimental)

【利用した主な装置】

原子層堆積装置(Picosun SUN-R), ヘリコンスパッタリング装置 (ULVAC MPS-4000C1/HC1), 高分解能電界放射型走査型電子顕微鏡 (JEOL JSM-6700FT)

【実験方法】

Firstly, Au film with the thickness of 100 nm was sputtered on the surface of silica glass. The TiO₂ layer of 30 nm thickness was deposited using atomic layer deposition. Then, Au film with 3 nm was evaporated and annealed in air at 300 °C to obtain Au NPs. In order to embed Au nanoparticles into the TiO₂ layer to enhance the interaction between LSPR and Fabry-Pérot cavity, additional TiO₂ was deposited to the electrode.¹

3. 結果と考察(Results and Discussion)

During Raman measurements of the electrode under electrochemical potential control, we have also monitored the photocurrent generated by the incident laser. As the results, the generated photocurrents strongly depend on the site of ATA electrode. In addition, the Fermi level of the Au

nanoparticles sensitively depended on the electrode catalytic performance. From the quantitative analysis of the Fermi level, it was found that the higher photocurrent values result in more positive Fermi level of the electrode, as shown in Fig. 1. This would be the intrinsic reason for the higher catalysis performance.

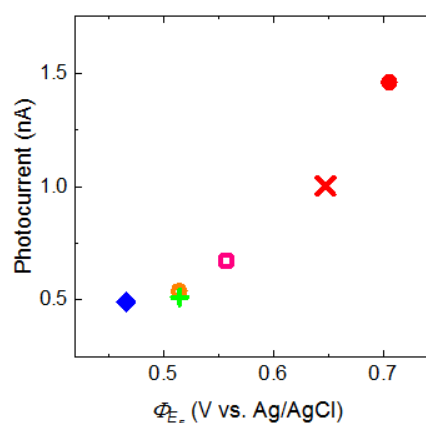


Fig. 1 Relationship between the photocurrent and the estimated Fermi level of ATA electrodes.

4. その他・特記事項(Others)

・参考文献

[1] X. Shi, K. Ueno, T. Oshikiri, Q. Sun, K. Sasaki, H. Misawa, *Nat. Nanotechnol.*, 13, 953-958 (2018).
 ・共同研究者: X. Shi, T. Oshikiri, and H. Misawa(北海道大学)

5. 論文・学会発表(Publication/Presentation)

N/A

6. 関連特許(Patent)

N/A