Renewable Energy and Energy Storage
Room Naupaka Salon 4 - Session RE1-MoM

Electrochemistry and Photocatalysis I

Moderator: Craig Perkins, National Renewable Energy Laboratory

8:40am **RE1-MoM-3 Hot Carrier-Driven Plasmonic Photoelectrochemical Processes*, Jeong Young Park,*** KAIST, Republic of Korea **INVITED**

The detection of hot electrons and understanding the correlation between hot electron generation and surface phenomena are challenging questions in the surface science and catalysis community. Hot electron flow generated on a gold thin film by photon absorption (or internal photoemission) appears to be correlated with localized surface plasmon resonance. It has been found that the hot electron flux generated under photon absorption and exothermic chemical reaction is the major mediator of energy conversion process [1-3]. In this talk, I introduce the research direction to attempt to detect the surface plasmon driven hot carrier at the nanometer scale by using scanning probe microscopy. To detect and utilize the hot electron flows at the macroscale level, the metal-semiconductor nanodiodes were constructed. At the nanometer scale, we utilized photoconductive atomic force microscopy to observe photoinduced hot electrons on a triangular Au nanoprism on n-type TiO2 under incident light. This is the direct proof of the intrinsic relation between hot electrons and localized surface plasmon resonance. We observed surface plasmon induced hot hole by using the system of Au nanoprism on p-type GaN [4]. I will discuss the impact of hot carriers in the photocatalytic activity under photoelectrochemical water splitting by using Au-based plasmonic nanostructures [5].

References

[1] K. Song et al. Advanced Materials Interfaces, 2400273 (2024).

[2] H. Lee et al. of Chemical Research 55, 24, 3727 (2022).

[3] S. W. Lee et al. Surface Science Reports 76 100532 (2021).

[4] H. Lee et al. Advanced Science 7, 2001148 (2020).

[5] K. Song et al. ACS Energy Lett. 6, 4, 1333–1339 (2021).

9:20am **RE1-MoM-5 Next-Generation Electrocatalysts Derived from Metal-Organic Frameworks for Hydrogen Production and Conversion*, Di-Jia Liu,*** Argonne National Laboratory

Metal-organic frameworks (MOFs) have found their ever growing applications in today's economy and industrial applications. In this presentation, I will discuss some of the recent technological breakthroughs in applying MOFs for green hydrogen applications. I will focus on the discussion on our recent progresses in applying MOFs for a) platinum group metal free (PGM-free) and ultralow platinum metal cathodic catalysts in the proton exchange member fuel cell (*Science*, 2018) and b) new application of PGM-free catalyst as the replacement for iridium for hydrogen production operated in proton exchange membrane water electrolyzer (*Science*, 2023). The talk will cover rational catalyst design, electrocatalytic performance, understanding of the catalytic mechanism, and prospects of these emerging technologies in green hydrogen production and application.

Author Index

Bold page numbers indicate presenter