6th edition of the International Conference on Materials & Environmental Science, ICMES-2023
June 7-11, 2023, Saïdia – Morocco

Controllable Synthesis of One-dimensional Nanoarrays Photoanodes based CdS or $BiVO_4$ and MoS_2 towards solar hydrogen evolution

Mohamed Siaj[1], Zhiyuan Peng[1], Yilu Su[1], Maziar Jafari[3]

[1]Department of Chemistry and Biochemistry, Université du Québec à Montréal, Montréal QC, H3C 3P8, Canada

Abstract

Photoelectrochemical (PEC) water splitting for hydrogen evolution is a highly efficient and eco-friendly technology in solar energy conversion that needs to develop photoconversion efficiency. Photoactive materials as the basic component for PEC systems have been extensively studied due to their distinct structure features. Among them, one-dimension (1D) oriented cadmium sulfide (CdS) and bismuth vanadate ($BiVO_4$) nanoarray has attracted considerable attention and is regarded as a promising candidate for PEC hydrogen production due to its suitable narrow bandgap around 2.4 eV, excellent electrical/optical properties, larger aspect ratio and confined charge transfer path for lower carrier loss. Here, the rational design of CdS or $BiVO_4$ nanojunctions, like Plasmon-enhanced, Z-scheme, and p-n scheme heterostructure, was employed to enhance their solar light utilization and superior photoconversion efficiency. Specifically, a series of novels and highly-efficiently CdS-based composite photoanodes based (i) Au NPs on carbon-wrapped oriented CdS nanoarray; (ii) Novel Z-scheme core-shell CdS/SnO_2 with Au NPs and (iii) 1D CdS nanorod/MoS_2 heterostructure (Figure 1); (iv) Nanopyramid-shaped E-$BiVO_4$ modified MoS_2 as a heterojunction will be discussed.

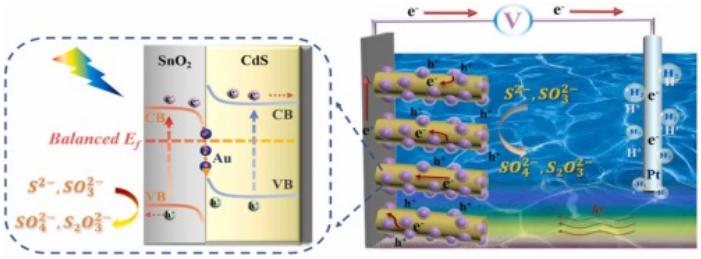

Figure 1. An innovative pure Z-scheme heterostructure, composed of one-dimensional (1D) oriented CdS nanorods modified with SnO_2-wrapped Au nanoparticles (NPs), is well fabricated as the photoanode for highly efficient PEC hydrogen evolution

Recent Publications (maximum 5)

1. Peng, Z., Zhang, J., Liu, P., Claverie, J., Siaj, M. One-Dimensional CdS/Carbon/Au Plasmonic Nanoarray Photoanodes via in Situ Reduction-Graphitization Approach toward Efficient Solar Hydrogen Evolution. *ACS Applied Materials and Interfaces*. 13(29) (2021) 34658–34670
2. Peng, Z., Su, Y., Siaj, M. Encapsulation of tin oxide layers on gold nanoparticles decorated one-dimensional CdS nanoarrays for pure Z-scheme photoanodes towards solar hydrogen evolution. *Applied Catalysis B: Environmental*, 330 (2023) 122614

Biography

Mohamed Siaj received his Ph.D. in Chemistry at Laval University, Quebec, Canada. Following postdoctoral training at Columbia University, New York, USA. Siaj is holding the rank of full professor since 2018 at université de Quebec à Montréal, Chemistry Department. He is the holder of the Canada Research Chair Tier-2 in 2D-Materials for Bio and Chemical Sensing (2016-2026). Since 2017, he is the director of the institutional nanomaterials and energy research center (NanoQAM). He is the director of the Quebec Centre for Advanced Materials (QCAM), since 2023. QCAM is an FRQNT (Fonds de recherche du Québec – Nature et Technologies) funded strategic cluster. Siaj's group activities focus on the growth, synthesis, processing and characterization of advanced nanostructured electroactive materials and their integration into the chemical and biosensors. Siaj's research activities generated a total of +100 peer-reviewed articles in prestigious international journals. He has given over +78 talks worldwide, including 42 as invited talks and 16 as keynotes.

Email: siaj.mohamed@uqam.ca