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Advancing Hydrogen Production: Developing High-Performance Catalysts for Photoelectrochemical Water Splitting

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Date: Thursday, January 9, 2025 16:00-17:00
Venue: Faculty of Engineering Bldg. 2, Room 232

Abstract: Hydrogen is a clean and versatile energy carrier essential for reducing carbon emissions and mitigating climate change. Photoelectrochemical (PEC) cells are clean and promising technology for hydrogen production. PEC cells convert solar energy into chemical energy through water splitting, producing hydrogen and oxygen. By integrating light absorption, charge separation, and catalysis in a single system, PEC cells simplify the process and offer a sustainable solution for the future. The presentation will emphasize the critical role of catalysts and photoelectrode materials in enhancing PEC efficiency, with a particular focus on overcoming the challenges of the oxygen evolution reaction (OER), which involves high activation energy and complex reaction mechanisms. Bismuth vanadate ($BiVO_4$) will be highlighted as one of the most promising photoanode materials for OER, owing to its strong visible light absorption and suitable bandgap (around 2.4 eV). Strategies for improving the catalytic performance of $BiVO_4$ will be explored, such as morphology design, heteroatom doping, heterojunction and co-catalyst deposition. These modifications can significantly improve charge carrier dynamics, boost reaction kinetics, and enhance the stability of the photoanode. Future perspectives on PEC technology such as innovations in material design, surface engineering, and scalable production methods are essential for achieving large-scale clean hydrogen production. These advancements will not only address current limitations but also pave the way for PEC systems to become a reliable and sustainable solution for global energy needs. Ultimately, these efforts are key to realizing the potential of PEC cells in driving the transition to a sustainable hydrogen economy.

Keywords: Bismuth vanadate; co-catalysts; heterojunction; hydrogen production; oxygen evolution reaction; photoelectrochemical cell

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Biography: Dr. Lu-Yin Lin earned her B.S. and Ph.D. in Chemical Engineering Department from National Taiwan University and completed one-year postdoctoral research in Chemistry Department at UC Berkeley. She joined the Department of Chemical Engineering and Biotechnology at National Taipei University of Technology in 2014 and became a full Professor in 2020. Dr. Lin has published 225 SCI papers with an H-index of 47 and an i-10 index of 158. Her research has also earned global recognition, including inclusion in the "Top 100,000 Most Influential Scholars" and the "Top 2% of Scientists Worldwide" lists from 2022 to 2024.

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