Plenary Lecture
Room Town & Country A - Session PL-MoM

Plenary Lecture

Moderator: Jyh-Wei Lee, Ming Chi University of Technology, Taiwan

8:00am **PL-MoM-1 Plenary Lecture: Recent Trends in Artificial Photosynthesis: Atomistic/Surface Design and Probing of Nano-Photocatalysts*, Li-Chyong Chen,*** National Taiwan University, Taiwan **INVITED**

Photocatalytic CO_2 conversion to hydrocarbon fuels, which makes possible simultaneous solar energy harvesting and CO_2 reduction reaction (CO_2RR), is considered a killing-two-birds-with-one-stone approach to solving the energy and environmental problems. However, the development of solar fuels, or the so-called artificial photosynthesis, has been hampered by the low photon-to-fuel conversion efficiency of the photocatalysts and lack of the product selectivity. Recent advances in development of integrated nanostructured materials have offered unprecedented opportunity for photocatalytic CO_2RR, as depicted in my recent invited review article [1]. Here, selective cases in nanomaterials, especially, atomistic design and synthesis of highly functioning nano-photocatalysts, will be illustrated [2-4]. Ascertaining the function of in-plane intrinsic defects and edge atoms is necessary for developing efficient photocatalysts. A perfect planar layer is usually inactive to catalysis. Vacancy clusters, as well as the reconstructed and imperfect edge configurations enable CO_2 binding to form linear and bent molecules. To make the energy conversion techniques towards practical solutions, some key questions need to be addressed. For instance: **What are the determining steps for CO_2RR?** Advancements in the *in situ* and *operando* synchrotron radiation-based spectroscopies, including X-ray absorption [5] and X-ray photoelectron spectroscopy (XPS), *etc.*, along with various vibrational spectroscopies, such as Raman and Fourier transform infrared spectroscopy (FTIR), and scanning electrochemical microscopy [6], have enabled scientists to probe the geometric, bonding and electronic information of the catalyst and obtain atomistic insights into the catalytic surfaces and reaction mechanisms. Selective cases utilizing these probing techniques will be illustrated.

References

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