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Electrochemistry Meets Metal–Organic Frameworks - Toward Energy Conversion and Storage

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Date: Friday, February 7, 2025 16:00-17:00
Venue: Faculty of Engineering Bldg. 2, Room 31A

Abstract: The development of clean energy has gained more and more attention in recent years, and electrochemical technologies play an important role in a range of clear-energy applications. The design and synthesis of highly active electrode materials, namely, the active thin film modified on the electrode surface that can facilitate the desired electrochemical reaction, are thus crucial for the development of high-performance electrochemical devices toward energy and environmental applications. Metal–organic frameworks (MOFs), also known as porous coordination polymers (PCPs), are thus highly attractive for electrochemical systems owing to their ultrahigh specific surface area, tunable pore structure in the molecular scale, and tunable chemical functionality within the nanopores. However, the electrically insulating nature and relatively poor chemical stability of most MOFs strongly limit the use of pristine MOFs in electrochemical applications.

Since 2018, our research group has worked on the design and synthesis of chemically robust MOFs and their composite materials with electronically and/or ionically conducting properties, aiming for utilizing such highly porous and stable MOF-based materials in electrocatalysis, electroanalysis, and electrochemical energy storage. This talk will cover our cutting-edge findings in the fundamentals and applications of highly water-stable group(IV) metal-based MOFs, including the Zr(IV)-based MOFs and Ce(IV)-based MOFs, toward the use in electrochemical systems. The topics will include the use of postsynthetic modifications to render redox-reaction-based charge hopping for electrocatalytic reactions, the design of electrically conductive and highly porous MOF-carbon nanocomposites, and the unique roles of electrochemically “inactive” MOFs in electrochemical energy-conversion systems.

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Biography

Chung-Wei Kung obtained his B.S. and Ph.D. degrees in Chemical Engineering from National Taiwan University, Taiwan in 2011 and 2015, respectively. During 2013-2014 and 2016-2018, he worked as a visiting scholar and postdoctoral researcher in Department of Chemistry at Northwestern University. He joined Department of Chemical Engineering at National Cheng Kung University, Taiwan to launch his independent research group in August 2018 and was promoted as associate professor in 2021. He is currently the Advisory Board Member of Chemical Society Reviews. His research focuses on materials chemistry of metal–organic frameworks (MOFs)-based materials and their electrochemical applications.

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