****

臺灣大學應用力學研究所

演 講 公 告

****

主 講 人：官韋帆 助理教授
長庚大學化工與材料工程學系

講　　題：奈米結構材料於能源與催化之應用

摘　　要：　如附件

主 持 人：　陳建彰教授

時　　間：　113年10月28日（星期一）下午2時20分開始

地　　點：　臺灣大學應用力學研究所國際會議廳

☆☆ 歡 迎 聽 講 ，敬 請 張 貼 ☆☆

NANOSTRUCTURED MATERIALS FOR ENERGY AND CATALYSIS APPLICATIONS

Wei-Fan Kuan

Department of Chemical and Materials Engineering, Chang Gung University

ABSTRACT

Reduction of carbon dioxide (CO_2) is an appealing approach toward tackling climate change associated with atmospheric CO_2 emissions. In this presentation, I will discuss two major strategies in my research group to reduce the CO_2 emission for the goal of net zero around 2050. Firstly, we are working on the development of solid-state lithium batteries as next-generation energy storage devices in order to lower the need of fossil fuels. Secondly, we apply CO_2 as a carbon feedstock and transform CO_2 into a value-added multi-carbon product, which can decrease the carbon footprint by circumventing traditional carbon intensive process. In the first study, we propose an asymmetric design of polymer membrane with tailored pore structure in order to promote the transport of lithium ions while stabilizing the lithium metal anode. Under the optimal conditions, we successfully fabricated polymer membranes with a bi-continuously nanoporous top layer with increasing pore sizes toward bottom surface. This unique structure provides the membranes exciting transporting properties including high ionic conductivity and high transference number. Additionally, the Li/$LiFePO_4$ battery tests demonstrate that the cell with asymmetric membrane outperforms the cell with commercial separator and symmetric membrane in terms of specific capacity, rate capability, and cycling stability, revealing a promising potential for applications in high-energy-density lithium metal batteries. For the work on CO_2 conversion, we developed a rapid reflux process for the preparation of ceria nanorods, which induced the formation of a defective mesoporous structure on the surface of ceria catalysts. Such defective structures enriched the surface with abundant trivalent Ce ions and oxygen vacancy sites, significantly promoted the catalytic activity of ceria nanorod in synthesizing dimethyl carbonate (DMC) from CO_2 and methanol. Overall, the nanostructured materials offer a promising opportunity for designing cost-effective and highly-efficient devices in sustainable research, and the interfacial/surface modification provides a unique avenue to tune the nanostructural features that can improve materials energy and catalytic properties to meet future demands.