Department of Materials Science and Engineering Seminar Series 2025

RATIONAL DESIGN OF MICROENVIRONMENT FOR CO_2 ELECTROREDUCTION TO MULTICARBON PRODUCTS

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Date and time: 14th October 2025 (Tuesday) 3:00pm - 5:00pm

Venue: Seminar room E2-03-32

Abstract

Electrochemical carbon dioxide reduction reaction (CO_2RR) provides a promising pathway for sustainable generation of fuels and chemicals. The preparation of multi-carbon (C_{2+}) products with high energy density via CO_2RR holds great promise but requires overcoming the competition from side reactions. Controlling the local conditions in the microenvironment remains a crucial challenge for enhancing CO_2 conversion rates and minimizing competitive reactions.

In our works, several effective strategies for regulating the reaction microenvironment were proposed and discussed. First, a 3D tandem catalyst electrode was prepared. Through this design, the local concentration and CO diffusion path length are increased, promoting the occurrence of C-C coupling. Second, three naturally abundant polysaccharide molecules have been proposed for modifying the surface of Cu catalysts. These biopolymer coatings optimize local CO_2/CO concentration while modulating local water activity and local pH to promote C-C coupling. Third, biopolymers were further used to act as catalyst binders in acidic CO_2RR. Mechanistic studies reveal that those binders can effectively inhibit proton transfer to the electrode surface and induces high local CO_2 concentration and *CO coverage. Finally, Hydroxyapatite (HAP)-based catalysts were prepared and found to have adjustable CO_2RR products selectivity and have good performance under low-concentration CO_2 reduction. These works are expected to provide new insights into the CO_2RR microenvironment, and potentially accelerating progress in this field towards the scale-up of CO_2RR for large-scale CO_2 conversion to sustainable fuels and chemical feedstocks from renewable energy.

Biography

Wei Chaolong received his bachelor's degree from Jiangsu University of Science and Technology in 2018 and earned his master's degree from Nanchang University in 2021. He is currently a Ph.D. candidate under the supervision of Assistant Prof. Andrew Barnabas Wong and Prof. He Chunnian (TJU). His research focuses on electrochemical CO_2 reduction reaction.

Please join us!

HOST: Assistant Prof Zhu Di