



Department of
Biomedical Engineering

香港城市大學
City University of Hong Kong

Hosted by Prof. Bing FU, BME
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Unveiling dynamic biotic-abiotic interactions in photosynthetic biohybrids

Dr. Xianwen Mao

Assistant Professor
Department of Materials Science and Engineering
National University of Singapore



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Time: 3:00 pm - 4:00 pm

Venue: YEUNG-P4704, 4/F

Yeung Kin Man Academic Building

Abstract

Microbe–semiconductor biohybrids have recently emerged as a promising system for solar-to-chemical conversion due to the combination of high-selectivity chemical production by microbes and the efficient light-harvesting capabilities of inorganic semiconductors. Optimal performance of these biohybrids requires a mechanistic, quantitative understanding of dynamic biotic/abiotic interactions at the biotic/abiotic interface. However, these aspects are challenging to study through ensemble-averaged bulk measurements due to the ubiquitous heterogeneities of both constituents.¹ In this work, we developed a multimodal functional imaging platform that combines super-resolution imaging and photocurrent mapping to probe biotic/abiotic interactions at single-cell and subcellular levels for an emerging type of photosynthetic biohybrids that consist of nitrogen-fixation bacteria and membrane-intercalating conjugated oligoelectrolytes. We uncover that the spatial distribution of conjugated oligoelectrolyte semiconductors in single bacterial cells can dynamically affect the aggregation state of biohybrids and their overall electron uptake capability. Our imaging tools and associated analytical frameworks provide a design principle to optimize the spatiotemporal distribution of photocatalytic materials in a nitrogen-fixation bacteria, enabling efficient and stable solar-to-chemical conversion.

Biography

Dr. Xianwen Mao is an assistant professor of Materials Science and Engineering with Presidential Young Professorship at National University of Singapore. He obtained a Bachelor in Polymer Materials and Engineering from Tsinghua University and a PhD in Chemical Engineering from Massachusetts Institute of Technology. During his PhD, Xianwen also worked as a research intern at Novartis Vaccines and Diagnostics in Italy and National Renewable Energy Laboratory in the US. The goal of the Mao research group is to engineer mesoscale functional heterogeneities in artificial materials. We design high-performance materials based on insights from operando functional imaging tools that elucidate the functional roles of mesostructures and their relations to atomic/molecular information and macroscopic properties. Dr. Mao's research works and technological innovations have been frequently featured in news media such as New York Times and Chemical & Engineering News.