



Department of Materials Science
& Engineering
College of Design and Engineering

Department Seminar

Dear Colleagues & Students,

You are cordially invited to a special seminar

Precision synthesis of high-entropy alloy nanomaterials for enhanced catalysis

Presented by:



Assistant Professor Ming Zhao

Department of Materials Science and Engineering, National University of Singapore

Date: **7th Oct 2026, Wednesday** Time: **10:00am-11:00am**

Venue: **Block EA, Level 6, EA-06-02 Seminar Room** ([Map](#))

Hosted by: **Associate Professor Daria Andreeva-Baeumler**

Abstract:

High-entropy alloy (HEA) nanomaterials are reshaping the landscape of electrocatalysis by harnessing structural complexity and multielement synergy. Unlike conventional catalysts, HEAs offer exceptional opportunities to engineer nanoscale architectures, defect sites, and surface compositions, thereby enabling new reaction pathways and enhanced catalytic performance. However, the elevated temperatures typically required for HEA synthesis often favor thermodynamically stable, spheroidal nanoparticles with Wulff-type structures, substantially limiting structural diversity and surface engineering. Here, we develop a series of facile synthetic strategies to precisely tailor the surface structure (e.g., {111} facets and twin boundaries), morphology (e.g., octahedra and icosahedra), nanoscale architecture (e.g., nanocages and nanoframes), and crystal structure (e.g., amorphous and crystalline phases) of HEA nanomaterials. These structural degrees of freedom provide additional knobs for tuning and amplifying their electrocatalytic performance. The resulting library of structurally diverse HEA nanomaterials further enables us to establish structure-property relationships across representative catalytic reactions, including water electrolysis and alcohol oxidation. Together, these synthetic advances, structurally well-defined HEA nanomaterials, and mechanistic insights deepen our fundamental understanding of multielement nanocatalysts and provide design principles for next-generation sustainable catalysts.

Biography:

Dr. Ming Zhao is an Assistant Professor in the Department of Materials Science and Engineering at the National University of Singapore since 2023. He received his B.S. and M.E. degrees from Nanjing University and his Ph.D. in Chemistry from the Georgia Institute of Technology under the supervision of Prof. Younan Xia. He subsequently conducted postdoctoral research with Prof. Peng Chen at Cornell University before joining NUS in 2023. His research focuses on the precision design and chemical imaging of advanced nanocatalysts for sustainability applications. His work has been published in leading journals, including *Nature Catalysis*, *Nature Reviews Materials*, *Nature Communications*, *JACS*, *Angewandte Chemie*, and *Advanced Materials*. His honors include the Sigma Xi Best Doctoral Dissertation Award, *Journal of Materials Chemistry A* Emerging Investigators, and Rising Stars in Materials and Interfaces. He also serves as a Subject Editor for *Progress in Engineering Science* and a member of the *Nano Letters* Early Career Board.

Looking forward to seeing all of you!