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應用物理及材料工程研究院
INSTITUTO DE FÍSICA APLICADA E ENGENHARIA DE MATERIAIS
INSTITUTE OF APPLIED PHYSICS AND MATERIALS ENGINEERING



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IAPME Seminar

Celebrating the 45th Anniversary of the University of Macau: Design and Failure Regulation Mechanisms of High-Energy- Density Batteries under Extreme Operating Conditions



15 April 2026

Prof. Zhenbo WANG

Harbin Institute of Technology

Venue: N23-4018

Time: 10:00 - 11:00

Hosted by: Prof. Kwun Nam HUI

Abstract

To meet the demand for high-power traction and energy storage across a wide temperature range, we take structural-interfacial synergistic regulation as the guiding thread, leveraging advanced characterization and multiscale analysis to track degradation evolution and establish an application-oriented materials design paradigm. For LNMO, we focus on morphology/grain-boundary stabilization and defect-interface coupling to enhance structural tolerance and suppress parasitic reactions; for Li-rich Mn-based cathodes, addressing voltage hysteresis and heterogeneous degradation, we integrate local-structure analysis, structural-unit design, and optimization of surface/interfacial functional layers and conductive networks to achieve controllable evolution and stable performance; for LFP, we regulate the electronic structure and interfacial behavior to improve charge-mass transport and stability. At the cell level, we co-optimize electrolytes and manufacturing processes and conduct joint validation under ultra-high-temperature, ultra-low-temperature, and ultra-high-power conditions, enabling deployment in UAVs, automotive, and energy-storage applications; we further propose a closed-loop pathway of *characterization-mechanism-design-cell validation* to provide methodological support for the industrialization of cathode materials.

Biography

Prof. Zhenbo WANG is a Tenured Professor and Ph.D. supervisor at Harbin Institute of Technology and a Foreign Member of the Russian Academy of Engineering. He has been recognized through National High-Level Talent Programs and the Ministry of Science and Technology's Young and Middle-Aged Scientific and Technological Innovation Leader Program. He has also been appointed as a Distinguished Professor under the "Longjiang Scholars" Program of Heilongjiang Province, "Double-Innovation" Talent of Jiangsu Province, and Taishan Industrial Leading Talent of Shandong Province. His research focuses on cathode materials for hydrogen energy and fuel cell, sodium-ion and lithium-ion batteries and their engineering applications. In terms of research achievements, Prof. Wang has published over 350 SCI-indexed papers in leading international journals, including Nature Catalysis, Nature Communications, Adv. Mater., and Angew. Chem. Int. Ed., with an H-index of 75. He has been continuously listed as an Elsevier Highly Cited Chinese Researcher for 12 consecutive years. He holds 68 authorized domestic and international invention patents, of which 33 have been successfully commercialized. His honors also include one First-Class Award of National Defense Science and Technology Progress and two First-Class Natural Science Awards of Heilongjiang Province.

Enquiry: iapme.enquiry@um.edu.mo