澳門大學
UNIVERSIDADE DE MACAU
UNIVERSITY OF MACAU

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

IAPME Newsletter

https://iapme.um.edu.mo/

ISSUE 31

23 April 2025

✧ Content

❖ Publications (IF≥8, and/or Nature Index; *corresponding author)

1. **Chunfa Liu**, Haoyun Bai, Jinxian Feng, Keyu An, Lun Li, Zhichao Yu, Lulu Qiao, Di Liu, Shuyang Peng, **Hongchao Liu***, **Hui Pan***. Electrodeposited Ternary Metal (Oxy)Hydroxide Achieves Highly Efficient Alkaline Water Electrolysis Over 1000 h Under Industrial Conditions. *Carbon Energy*. E684 (2025). DOI: 10.1002/cey2.684. [2023 IF=19.5]

RESEARCH ARTICLE OPEN ACCESS

Electrodeposited Ternary Metal (Oxy)Hydroxide Achieves Highly Efficient Alkaline Water Electrolysis Over 1000 h Under Industrial Conditions

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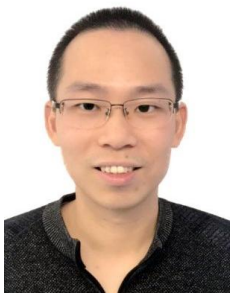
❖ Research Stories

UM research team successfully developed ternary metal (oxy)hydroxide catalyst for highly efficient alkaline water electrolysis over 1000 h under industrial conditions

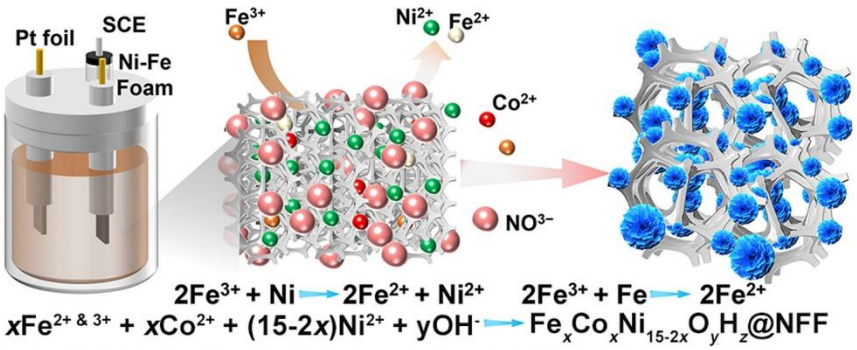
- A facile strategy that utilized electrochemical deposition to fabricate Fe, Co, and Ni (oxy)hydroxide for low cost, highly efficient, and stable water oxidation in industry is reported.
- After composition optimization, $Fe_{2.5}Co_{2.5}Ni_{10}O_yH_z$@NFF not only exhibits ultra-low overpotentials 185 mV at 10 mA cm^{-2} (1M KOH, RT) and 308 mV at 500 mA cm^{-2} (6 M KOH, 60 °C), but also shows ultra-high stability for more than 1100 hours under industrial working conditions (6 M KOH, 60 °C, 500 mA cm^{-2}). The AEC device can operate stably over 200 hours under practical conditions (6 M KOH, 80 °C, 500 mA cm^{-2}).
- Our combined experimental and computational investigation reveals the surface-reconstructed γ-NiOOH with a high valence state is the active layer, where the optimal (Fe, Co) co-incorporation tunes its electronic structure, changes the potential determining step, and reduces the energy barrier, leading to ultrahigh activity and stability.

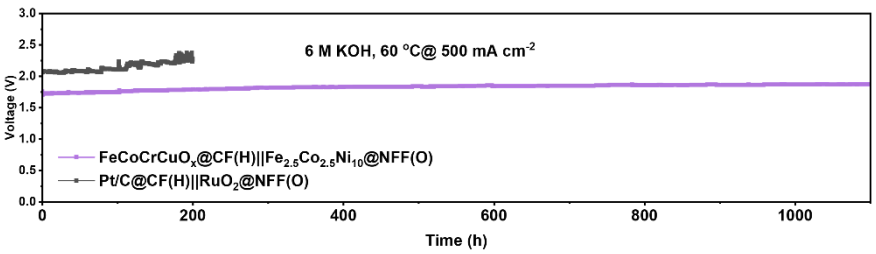
Mr. Chunfa Liu (劉春發)

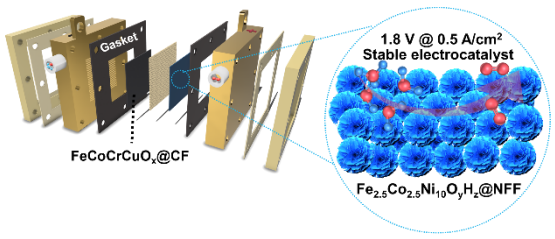


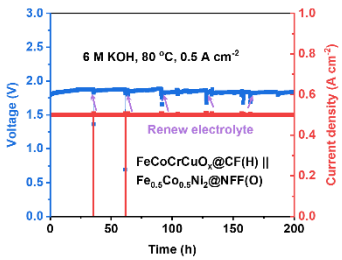
Prof. Hongchao Liu (劉宏超)

Prof. Hui Pan (潘暉)









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The first author is Mr. Chunfa Liu, a Ph.D. student in the IAPME. This work was supported by the Science and Technology Development Fund (FDCT) from Macau SAR (0050/2023/RIB2, 0023/2023/AFJ, 006/2022/ALC, 0111/2022/A2, 0105/2023/RIA2), UM (MYRG-GRG2023-00010-IAPME, and MYRG2022-00026-IAPME) and Shenzhen-Hong Kong-Macao Science and Technology Research Programme (Type C) (SGDX20210823103803017) from Shenzhen.

❖ Cutting-Edge Research Takes Center Stage at the IAPME Student Seminar Series 2025

The Institute of Applied Physics and Materials Engineering organized the IAPME Student Seminar Series 2025 on March 27, 2025, showcasing innovative research by our graduate students. Five PhD students presented their research findings to an audience composed of over 30 students and academic staff members.

Xiangyue Cui (崔湘粵) opened with theoretical insights into phonon transport and electron-phonon coupling in 2D materials, followed by Ting Ding's (丁汀) work on making stabler quantum dot LEDs. Qingbin Jiang (江慶斌) explored innovative designs for lithium-sulfur batteries, while Rui Li (李蕊) demonstrated how ferroelectricity boosts ion migration in potassium-ion battery anodes. Xue Li (李雪) concluded with strategies to improve freeze-thaw resilience in cementitious materials. The event highlighted the institute's interdisciplinary focus on solving pressing challenges in energy, electronics, and sustainable materials.

❖ Delegation from Companies visited IAPME

On April 2, 2025, a delegation from Inner Mongolia Tangu Technology Ltd. (內蒙古碳谷科技有限公司) and Guangdong Fuhai Group (廣東富海實業集團有限公司) visited IAPME. The group was led by Mr. Yongqing Sun (孫永青), President of Tangu Technology, and Mr. Zhiliang Long (龍致良), President of Fuhai Group.

During the visit, Prof. Handong Sun gave a brief introduction to IAPME. Prof. Guoxing Sun and Prof. Songnan Qu then presented their research, emphasizing industrial applications. Prof. Pengzhan Sun also participated and engaged in discussions with the guests. The delegation expressed strong interest in IAPME's research and shared ideas for potential future collaboration.