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

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✧ Content

❖ Publications (IF≥10; *corresponding author)

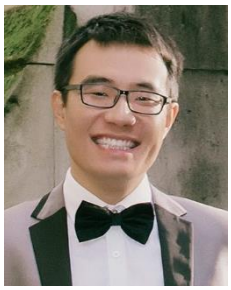
1. **Yu Ji**, Guang-Ping Hao*, Yong-tao Tan, Wenqi Xiong, Yu Liu, Wenzhe Zhou, Daiming Tang, Renzhi Ma, Shengjun Yuan, Takayoshi Sasaki, Marcelo Lozada-Hidalgo*, Andre Geim*, and **Pengzhan Sun***. High proton conductivity through angstrom-porous titania. *Nature Communications, accepted.* DOI: 10.48550/arXiv.2410.06489. [2023 IF=14.7]

❖ Research Stories

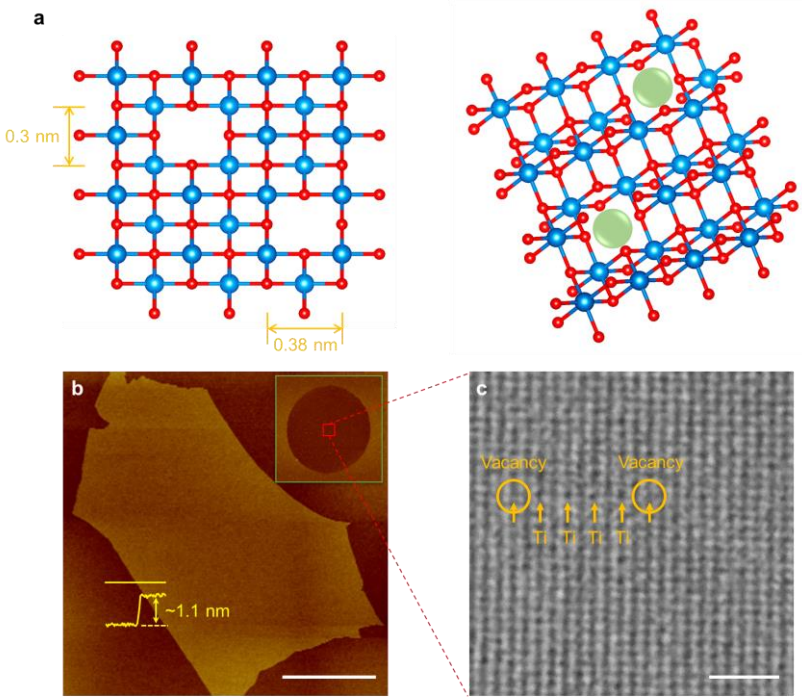
UM research team explored the high proton conductivity through angstrom-porous titania

- The proton transport properties through titania monolayers were investigated. The material consists of a 2D array of TiO_6 octahedra and inherits its 3D parent's stability in aqueous, oxidizing and reducing environments at elevated temperature.
- Protons can permeate through monolayer titania crystals whereas helium atoms are excluded. At room temperature, the observed areal conductivity of protons in monolayer titania is orders of magnitude higher than that of graphene and hBN monolayers.
- The titania conductivity exceeds 100 S cm^{-2} at 200◦C, making it an attractive proton conductive material within the infamous proton materials gap.
- Titania monolayers can be prepared via scalable routes involving soft-chemistry procedures and assembled over large areas to form quality membranes via techniques such as layer-by-layer electrostatic assembly and Langmuir-Blodgett deposition. Furthermore, the density of monovacancies in 2D titania can be changed if required from ~9% up to ~18% using different compositions of the original bulk compound used for expoliation

Dr. Yu Ji



Prof. Pengzhan Sun



Studied monolayer titania.

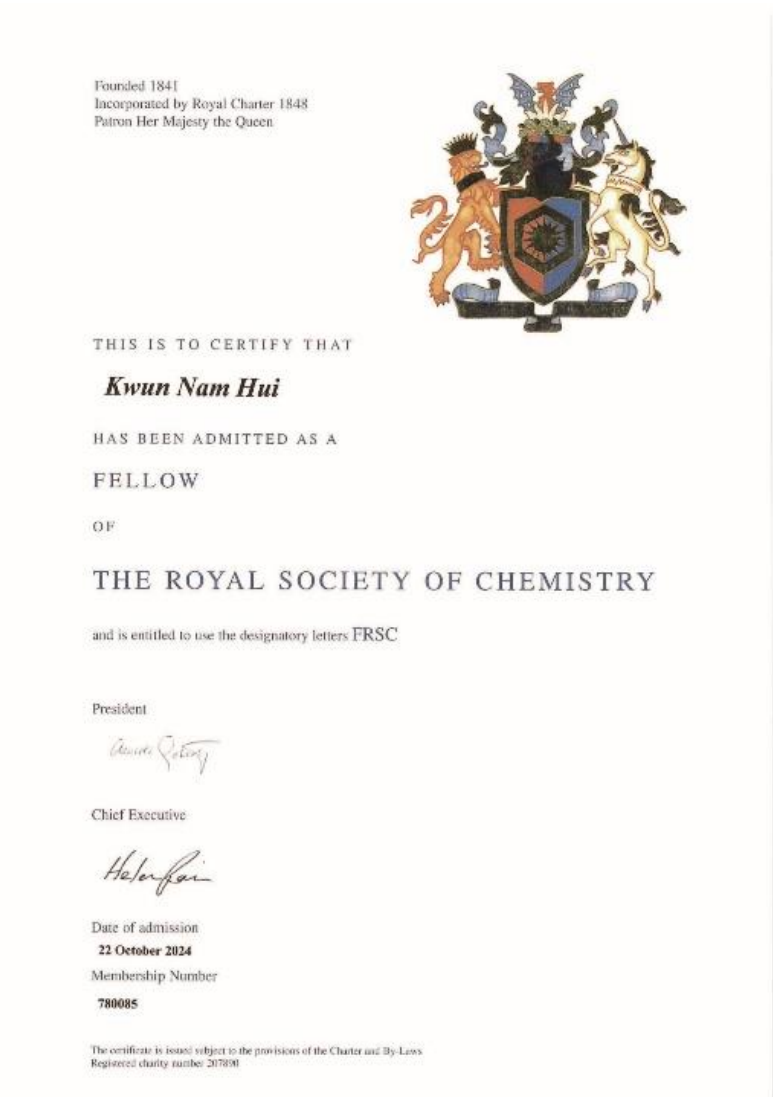
Yu Ji, Guang-Ping Hao, Yong-tao Tan, Wenqi Xiong, Yu Liu, Wenzhe Zhou, Daiming Tang, Renzhi Ma, Shengjun Yuan, Takayoshi Sasaki, Marcelo Lozada-Hidalgo*, Andre Geim*, and **Pengzhan Sun***. High proton conductivity through angstrom-porous titania. *Nature Communications, accepted.* DOI: 10.48550/arXiv.2410.06489. [2023 IF=14.7]

Prof. Pengzhan Sun, Prof. Andre Geim, Prof. Marcelo Lozada-Hidalgo, and Prof. Guang-Ping Hao are the corresponding authors of this study. The first author is Dr. Yu Ji, who got PhD from IAPME. This work was supported by the Science and Technology Development Fund (FDCT), Macao SAR (0063/2023/RIA1), the Natural Science Foundation of China (NSFC, 52322319), UM research grant (SRG2022-00053-IAPME), UM and UMDF research grant (MYRG-GRG2023-00014-IAPME-UMDF), the European Research Council (grant VANDER), the Lloyd's Register Foundation (grant Designer Nanomaterials), UKRI (EP/X017745: M.L.-H), the Royal Society (URF\R1\201515: M.L.-H.) and Directed Research Projects Program of the Research and Innovation Center for Graphene and 2D Materials at Khalifa University (RIC2D-D001: M.L.-H. and A.K.G.).

❖ IAPME professor has been appointed as a Fellow of the Royal Society of Chemistry (FRSC)

We are thrilled to announce that Prof. Kwun Nam Hui, the associate professor of IAPME, has been appointed as a Fellow of the Royal Society of Chemistry (FRSC) in recognition of his outstanding contributions to electrochemistry and energy storage and conversion. Since 2021, Prof. Hui has also been named among the top 2% of scientists globally by Stanford University/Elsevier.

To date, Prof. Hui has published over 250 articles in leading, peer-reviewed journals, with more than 60 as the corresponding author in prestigious titles such as Angewandte Chemie International Edition, Advanced Energy Materials, Advanced Functional Materials, Advanced Powder Materials, ACS Catalysis, Nano Energy, ACS Nano, Applied Catalysis B: Environmental and Energy, and Carbon Energy. His work has garnered over 13,600 citations and an impressive H-index of 65 on Google Scholar, and he holds 36 patents.



Founded 1841
Incorporated by Royal Charter 1848
Patron Her Majesty the Queen

THIS IS TO CERTIFY THAT

Kwun Nam Hui

HAS BEEN ADMITTED AS A

FELLOW

OF

THE ROYAL SOCIETY OF CHEMISTRY

and is entitled to use the designatory letters FRSC

President

Chief Executive

Date of admission
22 October 2024
Membership Number
780085

The certificate is issued subject to the provisions of the Charter and By-Laws
Registered charity number 207890

Prof. Hui has served as Associate Editor for Frontiers in Materials, Smart Materials and Devices, and Material Science & Engineering International Journal. He is also on the advisory board of Materials, Chemistry and Physics: Sustainability and Energy, and is an Editorial Board Member for several other journals, including Journal of Energy Science and Technology, Journal of Energy and Sustainability, Catalysts, and Crystals. Additionally, he has acted as Guest Editor for special issues such as Research and Applications of Supercapacitors and Advanced Research in 2D Materials for Crystals.

Prof. Hui's groundbreaking research focuses on the development of innovative materials that significantly improve the performance and stability of energy storage and conversion devices. His work spans a wide range of topics, including hybrid sodium-air batteries, Li-S batteries, K-ion batteries, and water electrolyzers. One of his notable discoveries is the amorphous structure of zinc phosphate, which acts as a buffer material and desiccant, helping to reduce volume expansion in amorphous zinc phosphide/phosphorus-based anodes for K-ion batteries. This breakthrough has led to devices with high-rate and high-stability performance (Advanced Energy Materials, 2021). He has also advanced the design of next-generation solid electrolyte interphases (SEI) with dynamic stability, expanding possibilities for high-performance batteries (Advanced Functional Materials, 2022).

Prof. Hui’s contributions to developing novel electrocatalysts for sulfide reduction reactions in lithium-sulfur batteries, metal-air batteries, and water electrolyzers have been widely recognized in top journals, furthering progress in sustainable energy technologies. His team is currently conducting in situ experiments using techniques such as XRD, XAS, and Raman spectroscopy to investigate the deactivation mechanisms of catalysts in energy storage and conversion devices, with the goal of improving material stability.

We invite you to join us in congratulating Prof. Kwun Nam Hui on this well-deserved recognition and celebrating his remarkable achievements in the field of electrochemistry and sustainable energy.

❖ Peking University Delegation Visited IAPME

A delegation from Peking University including representatives from School of materials science and engineering and School of Advanced Materials visited IAPME of University of Macau on 25 Oct., 2024.

During the meeting, research and student collaboration were discussed. Both sides agreed to establish a Memorandum of Understanding for close collaboration in the future.

(From left) Prof. Qing Li, Prof. Guichuan Xing, Prof. Hui Pan, Prof. Yinguo Xiao(PKU), Prof. Handong Sun, Prof. Xiaoxu Zhao(PKU), Prof. Hai-feng Li, Ms. Yuanyuan Ding(PKU), Prof. Guoxing Sun and Dr. Tianhua Ren

The delegation from Peking University including Prof. Yinguo Xiao, Associate Dean of School of Advanced Materials, Prof. Xiaoxu Zhao of School of Materials Science and Engineering, and Ms. Yuanyuan Ding of School of Advanced Materials.

(From left) Prof. Yinguo Xiao(PKU) and Prof. Handong Sun

❖ UM Distinguished Visiting Scholar visited IAPME

Invited by Distinguished Professor Handong Sun, Prof. Hilmi Volkan Demir from Nanyang Technological University, Singapore, visited IAPME from 18 to 20 October 2024. Prof. Demir earned his PhD (2004) and MSc (2000) degrees from Stanford University, USA, and his BSc (1998) from Bilkent University, Ankara, one of the top engineering schools in Türkiye. His current research interests include the science and technology of semiconductor lighting and displays, nanocrystal optoelectronics, and smart metastructured implants. As a PI, Demir has contributed to commercialization and licensing of over 10 new enabling technologies, generating over 100 patent applications (granted and pending) as a principle inventor. His scientific and entrepreneurship activities resulted in several important awards including Nanyang Award for Research Excellence, NRF Investigatorship Award of Singapore, TÜBİTAK Science Award of Turkey, and EURYI Award of European Science Foundation. He is an elected IEEE Fellow'21 and OPTICA Fellow'20.

Prof. Demir delivered a seminar titled “Emerging Semiconductor Optoelectronics of Colloidal Quantum Wells”. His talk focused on atomically-flat, tightly-confined, quasi-2-dimensional quantum wells, also popularly nick-named ‘nanoplatelets’, particularly for use in lighting and displays. He also presented a powerful, large-area, orientation-controlled self-assembly technique for orienting these quantum wells either all face down or all edge up. He demonstrated three-dimensional constructs of their oriented self-assemblies with monolayer precision. By exploiting those materials and assembly technology, he showed record high efficiency from their colloidal LEDs and record high gain coefficients and record low lasing thresholds from their colloidal laser media using their heterostructures and/or oriented assemblies. In the Q&A session, Prof. Demir had zealous interaction with the audience.

During the visiting, Prof. Demir had a lab tour of IAPME. He has had close discussion with some professors and PhD students. He expressed deep impression on IAPME’s research facility and achievements.