IMWCN 2025

2nd International Meeting on Wetting and Carbon Neutralisation

PROGRAMME BOOK

18-24 August 2025, London


IMWCN 2025

Welcome Letter

Dear Friends and Colleagues,

It is our great pleasure to welcome you to the 2nd International Meeting on Wetting and Carbon Neutralisation (IMWCN 2025), taking place in London from 18th to 24th August 2025.

Building on the success of our inaugural meeting, IMWCN 2025 aims to explore and advance new solutions to global Net Zero challenges by harnessing cutting-edge knowledge in wetting science, functional surfaces/coatings, and advanced materials. The meeting will stimulate discussion across key areas including wetting (experimental and theoretical), bio-inspired functional materials, energy conversion and conservation, and carbon neutralisation technologies. We encourage multidisciplinary collaboration and provide a unique platform for leading researchers, professionals, and students worldwide to present and discuss groundbreaking findings.

We are deeply grateful for your participation and eagerly anticipate welcoming you to London for this vital exchange of ideas.

Yao Lu

Dr Yao Lu

Queen Mary University of London, UK

KEYNOTE SPEAKERS

Professor Glen McHale

The University of Edinburgh, UK

Professor Hongbo Zeng

University of Alberta, Canada

Professor Ivan Parkin

University College London, UK

Professor Lei Jiang

Chinese Academy of Sciences, China

Professor Robin Ras

Aalto University, Finland

Professor Zuankai Wang

The Hong Kong Polytechnic University, China

Schedule for IMWCN 2025

18 August		19 August	
8:30-9:00	Registration+ Morning Coffee	**8:30-9:00**	Morning Coffee
9:00-9:10	Opening Address	**9:00-10:00**	**Keynote Lecture**
9:10-10:10	**Keynote Lecture**	**10:00-10:30**	Coffee Break
10:10-10:30	Coffee Break	**10:30-11:30**	**Keynote Lecture**
10:30-11:30	**Keynote Lecture**	**11:30-13:00**	Lunch
11:30-13:00	Lunch	**13:00-13:40**	**Lecture**
13:00-15:00	**Lecture**	**13:40-14:40**	**Keynote Lecture**
15:00-15:30	Coffee Break	**14:40-15:00**	Closing Remarks
15:30-16:00	**Lecture**		
16:00-17:00	**Keynote Lecture**		
17:30-20:00	Dinner (Buffet)		
20-24 August			
All Day	Social Programme		

Presentation (Total duration including Q&A)

Keynote Lecture contains 50-min speak and 10-min discussion
Lecture contains 8-min speak and 2-min discussion

*Please wait in the presentation room at least 15 minutes before your slot starts.
**Please bring your presentation files in your own laptop or USB stick.

Meals

Complimentary meals will be provided as shown in the schedule.

18 August 2025		
Time	**Speaker**	**Session Chair**
8:30-9:00	**Registration + Morning Coffee**	
9:00-9:10	**Opening Address: Yao Lu**, Queen Mary University of London	
9:10-10:10	**Ivan Parkin**, University College London	**Yao Lu**
10:10-10:30	**Coffee Break**	
10:30-11:30	**Hongbo Zeng**, University of Alberta	**Yao Lu**
11:30-13:00	**Lunch**	
13:00-13:10	**Qunfeng Cheng**, University of Science and Technology of China	**Zhichao Dong**
13:10-13:20	**Xu Wu**, Guangzhou University	
13:20-13:30	**Ming Li**, Dalian University of Technology	
13:30-13:40	**Chen Ma**, The Hong Kong Polytechnic University	
13:40-13:50	**Jinfei Wei**, Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences	
13:50-14:00	**Yao Lu**, Queen Mary University of London	
14:00-14:10	**Bucheng Li**, Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences	**Ming Li**
14:10-14:20	**Jiaqi Miao**, The University of Hong Kong	
14:20-14:30	**Zhichao Dong**, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences	
14:30-14:40	**Miao Tang**, The Hong Kong University of Science and Technology	
14:40-14:50	**Jinju (Vicky) Chen**, Loughborough University	
14:50-15:00	**Mingzhu Li**, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences	
15:00-15:30	**Coffee Break**	

18 August 2025		
Time	**Speaker**	**Session Chair**
15:30-15:40	**Xiubin Xu**, Guangzhou University	**Yao Lu**
15:40-15:50	**Lei Wu**, Institute of Chemistry, Chinese Academy of Sciences	
15:50-16:00	**Xiaolong Yang**, Nanjing University of Aeronautics and Astronautics	
16:00-17:00	**Glen McHale**, The University of Edinburgh	**Yao Lu**
17:30-20:00	Dinner (Buffet)	

Time	Speaker	Session Chair
	19 August 2025	
8:30-9:00	**Morning Coffee**	
9:00-10:00	**Zuankai Wang**, The Hong Kong Polytechnic University	**Yao Lu**
10:00-10:30	**Coffee Break**	
10:30-11:30	**Robin Ras,** Aalto University	**Yao Lu**
11:30-13:00	**Lunch**	
13:00-13:10	**Guannan Zhang**, The University of Hong Kong	**Xiaolong Yang**
13:10-13:20	**Aditya Syamala**, Indian Institute Of Technology Hyderabad	
13:20-13:30	**Guangji Wang**, Tsinghua University	
13:30-13:40	**Siqi Sun**, The Hong Kong Polytechnic University	
13:40-14:40	**Lei Jiang**, Chinese Academy of Sciences	**Yao Lu**
14:40-15:00	**Closing Remarks**	
	20-24 August 2025	
All Day	**Social Programme**	

ABSTRACT

ABSTRACT

Droplet Friction on Liquid-like Surfaces

Glen McHale*

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Abstract

Frictional forces resisting droplet motion often appear to be separate to surface wettability and liquid adhesion. Here I will show how equilibrium surface wettability, representing normal adhesion, combines with hysteresis, representing surface heterogeneity, to produce static and kinetic contact line friction. I will show how an Amontons'-like liquid-on-solid law provides a unified view for the design of superhydrophobic, liquid-infused and liquid-like surfaces slippery to liquids. I will show how a contact line coefficient of friction, defined as the ratio of the frictional to normal component of surface tension forces, can be related to the Kawasaki-Furmidge equation. I will present experimental data from tilt angle experiments on liquid-like surfaces with low and high mobility for water droplets showing measurements are consistent with the predicted shape factor $k=\pi/4$. Finally, I will show how strong, but dilute, defects introduce pinning into near-perfect slippery surfaces.

Acknowledgements. Many collaborators contributed to this work, which was part-funded by the UK Engineering and Physical Sciences Research Council (EPSRC) and the Leverhulme Trust.

Short Biography

Glen is Chair of Interfacial Science & Engineering at The University of Edinburgh, and is a member of the Institute for Multiscale Thermofluids in the School of Engineering. He was previously Pro Vice Chancellor (REF) and PVC/Executive Dean of the Faculty of Engineering & Environment at Northumbria University, UK. His research is on how liquids interact with surfaces both smooth and textured, and with and without electric fields to control their wettability. This encompasses droplet-surface interactions, liquid-solid friction and nature-inspired surface engineering. The UK Engineering & Physical Sciences Research Council (EPSRC) has extensively supported his research. He has published over 240 original refereed journal papers together with invited reviews on topics from superhydrophobicity to liquid-infused surfaces. Glen is a Fellow of the Higher Education Academy (HEA), the Institute of Physics (IoP), the Royal Society for Arts, Manufactures and Commerce (RSA) and is a Senior Member of the Institute of Electrical and Electronics Engineers (SMIEEE).

Developing New Hydrophobic Energy Control Coatings - From Solar Panels To Radiative Cooling Paints

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Abstract

This talk will cover our recent work in making hydrophobic low energy coatings for use in photovoltaic modules. It will show the synthesis and characterisation of hydrophobic coatings based on lanthanide oxide materials. It will show how these materials behave in real world outdoor testing. It will also cover hydrophobic and superhydrophobic coatings from new paint formulations. These coatings enable radiative cooling - using outer space a heat sink and coatings that are designed to radiate at 8-13 microns. This work will include recent trials with transport for London using electric buses.

Short Biography

Prof. Ivan P. Parkin is Dean of the Faculty of Mathematical and Physical Sciences (MAPS) at University College London (UCL), a position held since 2016 following a six-year tenure as Head of the UCL Chemistry Department. With over 30 years at UCL, he has graduated more than 100 PhD students and pioneered transformative research in inorganic nanomaterials, notably films, superhydrophobic coatings, and energy materials. He is an elected Fellow of the Royal Society of Chemistry, Fellow of the Institute of Materials, Minerals and Mining, and Member of Academia Europaea.

Field Matching Principle For Energy Efficiency Enhancement

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Abstract

Fluid-solid interfaces play an important role in many cutting-edge fields, such as energy conversion, catalysis, heat and mass transfer, and microfluidics. In recent years, by introducing and regulating heterogeneous interfaces, we have achieved several exciting breakthroughs, including breaking the physical limit of solid-liquid contact time (force), realizing the liquid diode effect (force), boosting the efficiency of water energy harvesting (electricity), and conquering the century-old Leidenfrost physical effect (heat). Although the heterogeneity of the fluid-solid interface enables efficient energy conversion of various physical fields (force, heat, and electricity), the understanding of the underlying mechanism remains superficial, and each field is treated independently.

From the perspective of "field", the field-matching principle will be proposed based on the comprehensive analysis of several representative heterogeneous designs. This principle suggests that by tailoring the heterogeneous surfaces to reconstruct the fluid field and the physical gradient field, the two originally mismatched fields can be perfectly matched to maximize the energy output. Such a field-matching principle is also substantiated by introducing the matching coefficient, which serves as an important metric of interface design to mediate the transport and energy processes. The common feature of this principle across diverse fields allows us to establish a unified potential-energy equation, which complements the well-established theoretical framework of energy conversion and helps to guide the development of new materials and systems, even involving acoustic, optical, and magnetic fields.

Short Biography

Prof. Zuankai Wang is currently the Associate Vice President (Research and Innovation), Kuok Group Professor in Nature-Inspired Engineering, and Chair Professor of Nature-Inspired Engineering at The Hong Kong Polytechnic University. He received his B.S. degree from Jilin University, M.S. degree from Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, and Ph.D. degree from Rensselaer Polytechnic Institute. After one-year postdoc training at Columbia University, he joined the City University of Hong Kong (CityU) in 2009 and became a Chair Professor in 2021. Professor Wang is a member of Hong Kong Academy of Engineering and Fellow of International Society of Bionic Engineering (ISBE) and Royal Society of Chemistry. His work has been recognized by the Guinness Book of World Records and his innovations have won the International Exhibition of Inventions of Geneva Gold Medal with Congratulations of Jury and Gold Medal. He has received many awards including Nano Energy Award (2025), Micro flow and Transport Phenomena Prominent Research Award (2025), 2024 Nukiyama Memorial Award (the highest award conferred by the Heat Transfer Society of Japan), Falling Walls Science Breakthroughs of the Year 2023 (Engineering and Technology), Croucher Senior Research Fellowship, BOCHK Science and Technology Innovation Prize, the RGC Senior Research Fellow, Green Tech Award, Xplorer Prize, 35th World Cultural Council Special Recognition Award.

Slippery Liquid Infused Bacterial Cellulose For Anti-Fouling Applications And Wetting Ridge Studies

Aditya Syamala[1], Navya M[1,2], AS Deshpande[1]*, Mudrika Khandelwal[1]*

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[2]School of Chemical Sciences, Mahatma Gandhi University, Kottayam, Kerala, India

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Abstract

Slippery Liquid Infused Porous Surfaces (SLIPS) have gained interest in the last decade for their ability to repel a broad spectrum of liquids, self-healing, pressure stability and repairability. SLIPS were used for various applications including but not limited to anti-icing, anti-microbial, water harvesting. The substrate used for the fabrication of SLIPS plays a crucial role in locking the oil layer, providing structural support to the system, and other properties like transparency, flexibility, and environment friendliness, which are hard to find in a single substrate. In this study, we utilized siloxane resin modified Bacterial Cellulose (BC) with inherent porous structure as a substrate to fabricate Slippery liquid infused bacterial cellulose (SLIBC) system. BC provides a wide range of properties like transparency, flexibility, structural stability, ease of synthesis, environment friendliness. Transparent and opaque SLIBC can be obtained by varying the incubation period during the synthesis stage of BC. To study the implication of the viscosity of lubricant we have fabricated 5 different SLIBC with varying viscosity of infused lubricant by drop casting onto modified Bacterial Cellulose. All SLIBC systems restricted the biofilm formation, have retained oil layers after the 20 cycles of icing and de-icing, water immersion for 24 hours, and 100 water droplets impinging. SLIBC systems also. We have studied wetting ridge formation and its implications on performance of SLIBC systems. This study showcases BC as a versatile substrate for the fabrication of SLIPS.

Short Biography

Aditya Syamala is currently a PhD scholar at Indian Institute of Technology Hyderabad, under the supervision of Dr Atul Suresh Deshpande and Dr Mudrika Khandelwal. His thesis focuses on developing Functional Materials with Tunable Wettability for Anti-Fouling and Atmospheric Water Harvesting applications.

Liquid Impalement Resistance and Mechanically Robust Superhydrophobic Coatings with Anti-icing Performance

Bucheng Li, Junping Zhang*

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Abstract

Superhydrophobic coatings attract significant attention due to their unique wettability and broad application potential. However, the main challenges they face in practical applications are achieving excellent impalement resistance and mechanical robustness simultaneously. Here, we report the preparation of superhydrophobic coatings that integrate exceptional impalement resistance and mechanical robustness through the rational design of hierarchical micro-/nanostructures and systematic optimization strategies. The coatings exhibit good superhydrophobicity, outstanding impalement resistance (e.g., resisting water flow impacts of 7.8 m s^{-1} and immersion in 1 m of water for 30 d), high mechanical robustness (e.g., withstanding 2000 cycles of Taber abrasion and 400 cycles of tape-peeling), as well as excellent chemical durability, UV aging resistance, and outdoor stability. These performances are ascribed to the coating's hierarchical micro/nanostructure, the protective effect of the microstructure, and perfluoroalkyl-induced low surface energy. Consequently, the coatings show excellent anti-icing performance, e.g., significantly delaying icing, low ice adhesion strength (<70 kPa in the -10 ℃ and 60% RH environment), and high stability during repeated icing/deicing. Thus, this method provides a feasible way for enhancing the robustness of superhydrophobic coatings, and it will facilitate the potential application of superhydrophobic coatings in various environments.

Short Biography

Dr Bucheng Li is an Associate Professor at the Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences (LICP, CAS). Since 2012, he has been dedicated to research on bioinspired materials with special wettability. Dr. Li has published over 30 papers in prestigious journals such as *Small* and *Journal of Materials Chemistry A*, with more than 1000 citations.

Enhancing Phase-Change Efficiency via Coalescence-Induced Droplet and Bubble Departure

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Abstract

Phase change at solid-liquid/gas interfaces is a common process in both nature and industrial applications (e.g., boiling/condensation heat transfer, water electrolysis for hydrogen production), often involving the formation of dispersed phases such as droplets or bubbles. Interfacial adhesion and pinning lead to their attachment on solid surfaces, limiting phase-change efficiency. Traditional methods to enhance the departure of dispersed phases often rely on solid-liquid interfacial energy gradients, but their effectiveness is constrained due to insufficient driving energy. This work aims to fully exploit the underutilized gas-liquid interfacial energy associated with the coalescence of dispersed phases. We develop an interface design and fabrication technology that combines nanoscale superwetting properties with microscale control of dispersed-phase dynamics through hierarchical design. Specifically, a lattice structure with thin walls decorated with nanostructures induces out-of-plane motion of dispersed phases, enabling "coalescence-induced jumping" with high energy conversion efficiency from surface energy to kinetic energy. This mechanism promotes in-situ phase departure, leading to improved phase-change efficiency, with promising applications in boiling/condensation heat transfer and hydrogen production via water electrolysis.

Short Biography

Dr Chen Ma earned his bachelor's degree in Engineering Mechanics from Harbin Institute of Technology in 2019 and completed his PhD in the same field at Tsinghua University in 2024 under the supervision of Prof. Quanshui Zheng. He is currently a postdoctoral researcher at The Hong Kong Polytechnic University, working with Prof. Wanghuai Xu and Prof. Zuankai Wang. His research focuses on phenomena and applications at solid-liquid interfaces, with a particular emphasis on enhancing the energy and mass conversion efficiency of phase change processes by manipulating fluid dynamics through solid-liquid interface design and engineering.

Micro-oil Droplet and Microplastic Separation using Surface-charge-induced Water Waves

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Abstract

Micro oil droplets and microplastic contaminants severely threaten ecosystem health, and are difficult to remove. Conventional Taylor cones form and oscillate in situ, limiting their applications. By positioning a charged rod near the water, we induce a water Taylor cone wave motion with speeds up to ~300 mm s^{-1}. This motion of the liquid Taylor cone helps gather and separate micro-droplets and microplastics from the water surface. Our findings promote the use of a contactless electrostatic control method, innovating applications in water purification, liquid-liquid separation, and powering aquatic robots.

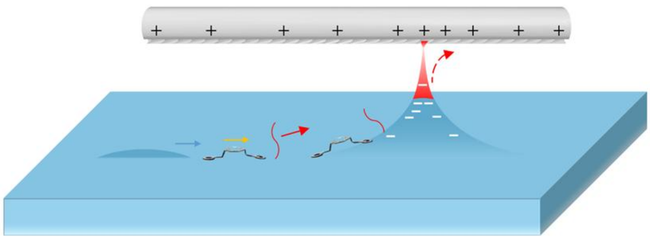

Figure 1. Taylor cone formation and movement on water surface [1]

References

[1] C. L. Yu, J. Ma, Z. D. Zhan, S. J. Liu, C. Q. Zhang, C. X. Li, L. Jiang, Z. C. Dong, *Device* 2, 100523 (2024).

Short Biography

Cunlong Yu is now an assistant professor. He received his BE degree at the North University of China, MD in Jilin Agricultural University under the supervision of Prof. Liying Cui, and PhD degree at Beihang University under the supervision of Prof. Lei Jiang. He joined the Technical Institute of Physics and Chemistry, Chinese Academy of Sciences (TIPC) in 2021. His scientific interest is focused on the design of novel wettability characterization devices for liquid overflow dynamics.

Quantifying Maximum Height of Confined Microdroplets Generated Via Surface Energy-Directed Assembly

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Abstract

Surface energy-directed assembly (SEDA) has been widely adopted as a facile method for generating microdroplets with no cross-contamination and high efficiency. Nevertheless, it remains hard to precisely regulate droplet volume since quantification of droplet height generated on general types of microscale hydrophilic pattern remains unclear. Here, we present theoretical and experimental quantification of maximum height of microdroplets generated on various rectangular hydrophilic patterns. A novel scaling relation with capillary number dependence relying on aspect ratio of pattern is revealed and theoretically accounted by competence between pinning force-induced volume and viscous force-induced volume. A long-wavelength description-based model exhibiting great consistency with experiments is adopted to quantify both kinds of volume, the results of which quantitatively verify the proposed mechanism explaining essence of the novel scaling relation. Finally, the influence of liquid bridge breakup on total deposited volume and its Ca dependence is quantified by the adopted model, whose results further demonstrate the validity of our mechanism for capillary number dependence of new scaling relation. The results of this research could help to achieve precise control of droplet volume generated by SEDA and optimizing uniformity of large-area DMA applied in electronics, etc.

Short Biography

Guangji Wang, doctoral student from State Key Laboratory of Tribology in Advanced Equipment, Tsinghua University.

Patterned Wettability Induced Growth of Perovskite Nano-Single-Crystal Arrays for Multi-color Display

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Abstract

Halide perovskite single crystals have exhibited enormous potential in next-generation integrated optoelectronic devices. [1-3] However, the controllable growth of large-scale, high-quality, and high-resolution perovskite single crystal arrays on diverse types of substrates remains challenging, hindering their application in practical scenarios. [4-6] This study introduces well-developed interference lithography and solution-processed blade coating to achieve stable, fast, and large-area patterning of perovskite single-crystal arrays at the nanometer scale. By optimizing the wettability contrast pattern on the substrate surface and the size of the photoresist pattern, remarkably high-resolution and size-controllable perovskite single crystal arrays can be directly realized and in situ crystallized in the ambient environment over wafer-scale area. All three typical halogen perovskites for multi-color luminescence, $CsPbX_3$ (X = Cl, Br, I) and their mixtures (Cl/Br or Br/I systems), are appliable to this fabrication process through the demonstration of complex RGB patterns with remarkable photoluminescence properties. In addition, various rigid substrates including SiO_2, Si, glass, and flexible substrates such as COC are compatible with this strategy. This work provides a reliable method to fabricate high-resolution, high-crystalline-quality, and large-scale perovskite arrays in a high-throughput manner, laying a solid foundation for future perovskite-based nano-optoelectronic devices and flexible full-color displays.

References

[1] X. Lin, L. Chen, C. He, Y. Wang, X. Li, W. Dang, K. He, Y. Huangfu, D. Wu, B. Zhao, *Adv. Funct. Mater*. 33, 2210278 (2023).
[2] B. Turedi, M. N. Lintangpradipto, O. J. Sandberg, A. Yazmaciyan, G. J. Matt, A. Y. Alsalloum, K. Almasabi, K. Sakhatskyi, S. Yakunin, X. Zheng, *Adv. Mater*. 34, 2202390 (2022).
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[6] M. Chen, Z. Zhou, S. Hu, N. Huang, H. Lee, Y. Liu, J. Yang, X. Huan, Z. Xu, S. Cao, *Adv. Funct. Mater*. 33, 2212146 (2023).

Short Biography

Guannan Zhang received her BS and MS degrees from Wuhan University of Technology and HUST, Wuhan, China, in 2019 and 2022, respectively. She is now a PhD candidate at the School of Engineering in the University of Hong Kong. Her research interests include wettability control, micro-/nano- patterning, printed display, and optoelectronic devices.

Smart Directional Liquid Manipulation on Structured Surfaces

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Abstract

Structured surfaces offer exciting opportunities for controlling liquid dynamics without external energy input, which is essential for applications in microfluidics, energy, and biomedicine. Yet, how exactly does the liquid-solid interfacial energy relationship govern the liquid behaviors? In this talk, using curvature-ratchet surfaces as a model, we uncover how subtle interfacial energy balance dictates complex directional liquid dynamics [1], including directional/reverse/fan-shaped spreading, gradient-induced redirection, and back-and-forth transport. We introduce a new dimensionless number, ζ—defined as the ratio of surface free energy to liquid surface tension—and reveal three distinct liquid control regimes: excessive ($\zeta \gg 1$), balanced ($\zeta \sim 1$), and insufficient ($\zeta \ll 1$). Notably, the balanced regime supports diverse and tunable liquid manipulation patterns. By matching structural designs with the proper ζ, we establish a new principle for manipulating small-volume liquids. We present an innovative liquid-based information encryption technique, where the liquid displays correct information on preprogrammed surfaces only at designated ζ values. This work lays the groundwork for smart directional liquid manipulation and broadens its application domains in functional interfacial engineering.

References

[1] J. Miao, A. C. H. Tsang, *ACS Nano* 19, 5829 (2025).

Short Biography

Jiaqi Miao received his bachelor's degree from Dalian University of Technology (DUT) in 2020. He is currently a PhD candidate at The University of Hong Kong (HKU). His research interests include interfacial phenomena, soft matter, microfluidics, and smart manufacturing. He has published 10+ papers as the first author in prestigious academic journals including *ACS Nano*, *Adv. Sci.*, *Adv. Funct. Mater.*, *Engineering*, etc. Moreover, he serves as a peer reviewer for 10+ academic journals. He is also an active member of the American Physical Society (APS), the International Society of Bionic Engineering (ISBE), and the Chinese Mechanical Engineering Society (CMES).

Research and Application of Durable Superhydrophobic/Superamphiphobic Coating

Jinfei Wei, Junping Zhang*

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Abstract

This study explores the development and application of durable superhydrophobic/superamphiphobic coatings. We employed a universal preparation method involving the spraying of a suspension containing silica nanoparticles decorated with perfluorodecyl polysiloxane and adhesive microparticles. This technique effectively creates a reentrant tri-tier hierarchical micro-/nano-/nanostructure, ensuring superior superhydrophobicity/superamphiphobicity, mechanical robustness and pressure resistance. Furthermore, these coatings show excellent anti-icing performance/prevention of rain attenuation of 5G/weather radomes, making them ideal for practical applications such as protecting high-voltage transmission towers in harsh winter conditions/decreases signal loss in the rain. The simple, cost-effective, and scalable production method underscores the potential for widespread industrial adoption, providing a durable solution for enhancing the longevity and efficacy of superhydrophobic surfaces across various sectors. This research contributes valuable knowledge to the field, paving the way for further innovations in the design and application of high-performance superhydrophobic coatings.

Short Biography

Wei Jinfei, born in December 1995, public, assistant researcher. In 2024, he graduated from the School of Petrochemical Engineering of Lanzhou University of Technology with a doctor's degree and joined the institute as an assistant researcher in the same year. A total of 29 papers were published, of which 14 were the first or corresponding author papers. The paper was cited 1055 times, the highest citation of a single paper was 169 times, and the H-factor was 16. 19 Chinese invention patents were applied for and 15 were authorized.

Dynamics of Droplets Impacting on Air-cushion-like Aerogel , Liquid Infused, and Liquid-Like Solid Surfaces

Jack Dawson[1,2], Samual Coaster[1,2], Rui Han[1,2], Johannes Gausden[2], Hongzhong Liu[3], Glen McHale[4], Jinju Chen[1,2]*

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Abstract

Superhydrophobic surfaces deliver substantial economic benefits by repelling water, reducing friction, and resisting contamination, with wide-ranging applications in aerospace, electronics, and microfluidics. A key performance indicator is the droplet impact response, particularly the onset of complete rebound, which depends sensitively on surface properties. We investigate droplet dynamics on three hydrophobic slippery surfaces with distinct adhesion and friction characteristics: the air-cushion-like Aerogel (low adhesion; low static and kinetic friction), SLIPS (high adhesion; low friction), and SOCAL (high adhesion; low static but higher kinetic friction). Complete rebound occurs at Weber numbers as low as ~2 on Aerogel, but only above We >10 on SLIPS, and is absent on SOCAL even up to We ~400. Aerogel supports 100% droplet ejection across all We values; SLIPS only above We 10–20; SOCAL never achieves full ejection. These results suggest Aerogel and SLIPS retain more kinetic energy during impact [1-2]. We also introduce an improved droplet spreading model that accounts for both negligible and significant viscous dissipation [1-2]. This model provides excellent fits across all surfaces and Weber numbers—outperforming existing models. Our findings highlight the critical interplay between normal adhesion and lateral friction in governing droplet dynamics, guiding the rational design of functional surfaces for applications like inkjet printing [3] and anti-icing [4].

References

[1] J. Dawson, et al., *ACS Appl. Mater. Interfaces*15, 2301 (2023).
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Short Biography

Professor Chen is a Full Professor of Bio-Interface Engineering and Director of Research for the Department of Materials at Loughborough University. Internationally recognised for her biophysics and biomechanics of bacteria, microbe-material interactions, biofilms, antimicrobial and slippery surfaces, she has over 85 peer-reviewed publications. She was a PGR Director/Deputy Research Director at Newcastle University, is a Fellow of the Royal Microscope Society and a UKRI Talent Panel College member, also serving on EPSRC panels. She is Principal Editor of the *Journal of Materials Research* and an Editorial Board Member for *Scientific Reports* and *Colloids and Surfaces B: Biointerfaces*. She has multiple clinical and industrial collaborations with clinicians and has supervised over 20 PDRAs and PhD students.

Ionic Neuromorphic Devices for Brain-Machine Hybrid Intelligence

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Abstract

The language of intelligent life is "ions", and the language of artificial intelligence is "electrons". To build a high-throughput and low-power brain-like computing system, the "Neuro-inspired Materials and Devices Lab" conducts interdisciplinary research of ionic energy and computing materials and devices involving chemistry, materials, information, and biology, which has the potential to break through the barriers of information exchange between intelligent life and artificial intelligence. We constructed a bioinspired multi-scale ion transport system, including nanofluidic system and soft ionic conductor system, revealed the interaction law between ion transport behavior and material structure/interface, fabricated a series of ionic energy devices (e.g., ion pump/ion-electron Coulomb drag energy generator) and ionic brain-like devices (e.g., ionic memristor/ionic neuromorphic chips). We hope the energy and neuromorphic devices using "ions" as language have the potential for realizing brain-machine hybrid intelligence.

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Short Biography

Dr Kai Xiao is an associate professor at the Department of Biomedical Engineering, Southern University of Science and Technology, China. Kai Xiao received his bachelor's degree from Jilin University (Changchun, China) in 2012, and his PhD from the Institute of Chemistry, Chinese Academy of Sciences (ICCAS, China) in 2017. After that, he moved to the Max Planck Institute of Colloids and Interfaces (MPIKG, Germany) working as an Alexander von Humboldt (AvH) Fellow. From 2021, he works as an Associate Professor at the Southern University of Science and Technology (SUSTech, China) and leads a research group in "Neuro-inspired Materials and Devices Lab." He has authored over 70 academic papers published in peer-reviewed journals and two book chapters, with citations of over 5000 and H-index 50. His research interest lies in Iontronics, Neuromorphic Devices, and Neuro-regulation.

Research and Application of Low-adhesive Continuous 3D Printing

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Abstract

3D printing is an additive manufacturing technology that is different from traditional subtractive (cutting, etching, etc.) manufacturing methods. Light-curing based 3D printing technology is currently widely used and investigated. However, the limitations arising from curing induced adhesion and step effect lead to a slow manufacturing speed, a low resin utilization efficiency, and poor structure-smoothness. Facing these issues, the applicant proposes to employ the biomimetic lubricant infused surface as the curing surface, from the perspective of solid-solid interface and corresponding adhesions, to eliminate the impact of curing induced adhesion on printing speed and precision during the printing process, which achieves the high-speed continuous 3D printing. Further optimizing the solid-liquid adhesion, we propose the one-droplet 3D printing strategy, which significantly improves the printing precision and suppresses the step effect. One-droplet molding is achieved with the current highest resin utilization efficiency. The continuous 3D printing prototype was successfully set up, and a series of 3D structures that were difficult to be manufactured by traditional techniques were constructed, which were applied in localized salt crystallization enhanced solar steam generation and high-efficiency seawater desalination.

Short Biography

Dr Lei Wu is an associate professor of physical chemistry from the Institute of Chemistry, Chinese Academy of Sciences. She received her BS from Sun Yat-sen University and PhD from the University of Chinese Academy of Sciences in 2016. She was elected as the member of the Youth Innovation Promotion Association of the Chinese Academy of Sciences, and the Distinguished Young Investigator of China Frontiers of Engineering. Her research focused on low-adhesive continuous 3D printing systems and their application in energy devices.

Self-pumping Dressings

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Abstract

Capillary adhesion and anti-adhesion problems caused by the interfacial fluid layer are hot issues in the area of interfacial research. In recent years, we have developed a series of self-pumping textiles/dressings and wet adhesives focusing on the problems of impeded healing caused by excessive exudate wetting and detachment caused by the interfacial liquid layer. 1) We propose a biofluid "self-pumping" model and develop a series of self-pumping dressings with unidirectional transportation of wound exudates to promote overhydrated wound healing, burns and diabetic wounds. 2) We construct bio-inspired "self-pumping" textiles with asymmetry wettability and structure, which effectively removes sweat from the skin surface and solves the problem of wet stickiness and coldness by the wetted conventional cotton textile; 3) Inspired by the wet adhesion and low-temperature toughness of spider silks, a series of core-sheath/side-by-side hydrophilic fibers are fabricated to achieve omni-wet adhesion on oil/water wetted surfaces and ultra-low temperatures tolerance (-196° C) for the storage of wet-adhesive materials at extremely low temperatures.

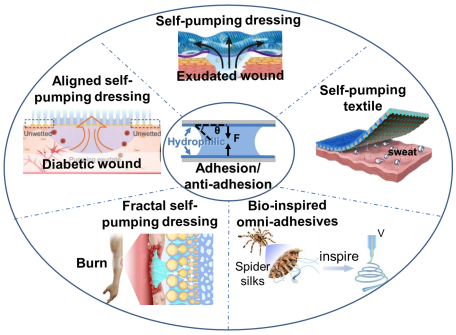

Figure 1. Self-pumping anti-adhesive wound dressings and bio-inspired omni-adhesives

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Short Biography

Lianxin Shi, an associate researcher of Technical Institute of Physics and Chemistry of the Chinese Academy of Sciences and a member of the Youth Promotion Association of the Chinese Academy of Sciences. In July 2019, he graduated from the Technical Institute of Physics and Chemistry of the Chinese Academy of Sciences with a doctor's degree in polymer chemistry and physics under the supervision of Professor Shutao Wang. He joined the Institute of Physics and Chemistry of the Chinese Academy of Sciences in July 2019 and is currently focused on self-pumping dressing and omni-adhesives research. He proposed the concept of the self-pumping model and applied it to dressings, clothing, etc. He is engaged in solving the problems of clamminess, wetiness, and overhydration caused by the continuous wetting of conventional textiles after wetting. He has published more than 20 SCI papers, including 5 *Adv. Mater.*, 1 *ACS Nano*, 1 *Nano Today*, 1 *Matter*, and 1 *Small Methods*.

Achieving Near-Unity Red Light Photoluminescence in Antimony Halide Crystals via Polyhedron Regulation

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Abstract

Zero-dimensional (0D) organic-inorganic hybrid metal halide recently has attracted ever-growing interests due to its highly efficient self-trapped exciton emission, showing extensive application in lighting, displays and optical waveguides. Although zero-self-absorption red emission is highly desirable, few is reported probably limited by the wide optical bandgaps. Herein, three $(TMS)_2SbCl_5$ (TMS: triphenylsulfonium cation) crystals have been prepared with diverse $[SbCl_5]^{2-}$ configurations and featured in distinctive emission color. Among them, cubic-phase $(TMS)_2SbCl_5$ shows bright red emission with photoluminescence quantum yield (PLQY) exceeding 90% and a large Stokes shift of 312 nm. Monoclinic and orthorhombic $(TMS)_2SbCl_5$ crystals deliver efficient yellow and orange emission, respectively. Comprehensive structural comparison reveals that larger lattice volume and longer Sb···Sb distance favor sufficient motion freedom at excited states, thus affording a larger Stoke shift emission and lower energy emission. Together with robust stability, $(TMS)_2SbCl_5$ crystal family has been applied as optical waveguide with ultralow loss coefficient of $3.67 \cdot 10^{-4}$ dB μm^{-1}, but also shown superior performance in white-light emission and anti-counterfeiting. In short, our study provides a novel and fundamental perspective to structure-property-application relationship of antimony hybrid halides, which will contribute to future rational design of high-performance emissive metal halides.

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Short Biography

Jinfeng Liao is a Research Assistant Professor at Institute of Applied Physics and Materials Engineering, University of Macau. She received her BSc and PhD from Sun Yat-sen University, Guangzhou, China. Her research interests are in the design and synthesis of novel types of lead-free metal halide luminescent materials and their applications in lighting and X-ray detection. She has published more than 50 peer-reviewed journal articles in these fields.

Solar-driven Hygroscopic Graphene Hydrogel for Atmospheric Water Harvesting and Moisture-enabled Electricity

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Abstract

Atmospheric water-enabled electricity generation offers significant potential for sustainable energy. However, existing materials struggle with low efficiency, salt leakage, and poor integration of photothermal and electrical functions. To address this, we developed an asymmetric nanocomposite by directly transferring laser-induced graphene (LIG) featuring tunable photothermal and electrical properties onto a lithium chloride-embedded cellulose hydrogel. This architecture synergizes rapid moisture absorption-evaporation cycling with stabilized ion transfer. The optimized composite demonstrates remarkable water uptake, reaching 1.31 and 3.74 g g^{-1} at 30% and 70% relative humidity (RH), respectively. It exhibits an outstanding moisture desorption rate of 3.2 kg m^{-2} h^{-1} under 1 kW m^{-2}. Critically, it achieves a power output of 0.173 W/m^2 under 70% RH and 20 ° C, outperforming conventional hydroelectric systems. The breakthrough lies in the enhanced interfacial bonding between LIG and the hydrogel, efficient water harvesting, and dual energy conversion pathways, enabling simultaneous atmospheric water utilization and electricity generation. This strategy provides promising insights into developing water-electricity co-production systems.

Short Biography

Miao Tang will be the presenter. He joined Prof. Li, Mitch's research group as a PhD candidate in the Division of Integrative Systems and Design at the Hong Kong University of Science and Technology in 2022. His work focuses on the research and development of multifunctional atmospheric water harvesting materials using a variety of interdisciplinary technologies.

Transfer Printing of Flexible Electronics through Soap Film and Soap Bubble

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Abstract

Flexible electronics represent emerging and exciting directions for future electronics, while transfer printing plays an essential and mainstream role in integrating electronics onto substrates. However, existing transfer printing approaches have restrictions for electronics in terms of stiffness and dimensionality, as well as limitations for substrates in terms of surface and adhesion. Here, we report facile transfer printing techniques through common soap film and soap bubble. The soap film enables the wrinkle-free transfer of ultrathin electronic films, precise alignment in a transparent manner, and conformal and adhesion-independent printing onto various substrates, including those too topographically and adhesively challenging by existing methods. The soap bubble enables damage-free and low-contamination integration of rigid, flexible, and freestanding three-dimensional curved electronics onto challenging substrates with complex surface and ultralow adhesion. The underlying mechanisms considering attaching, tilting, tombstoning and bursting are theoretically explored. To demonstrate the capabilities of soap film transfer printing, ultrathin electronics with multiple patterns, single micron resolution, sub-micron thickness, and centimeter size are conformably integrated onto the ultrathin web, ultra-soft cotton, DVD-R disk with the minimum radius of curvature of 131 nm, interior cavity of Klein bottle and dandelion with ultralow adhesion. To demonstrate the versatility and compatibility of the soap bubble transfer printing technique, not only special behaviors including wrap-like, multi-layer, selective, and interior printing are performed, but also flexible electronics are integrated onto various human organ models for health monitoring in both noninvasive and invasive manners.

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Short Biography

Dr Ming Li is a Professor at Dalian University of Technology. His research focused on transfer printing in flexible electronics and wrinkle-free design for membranes. Currently, they are investigating the transfer printing techniques through liquid film/bubble, which guarantees the wrinkle-free and easy-to-implement integration of ultrathin electronics.

Bioinspired Micro-nano Photonic Materials

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Abstract

Controlling the interaction between light and matter through optical structures has laid the foundations for a broad spectrum of applications, ranging from colors, lasers, and optoelectronics, to quantum information processing. Optical metamaterials, 2D or 3D structures comprising subwavelength metallic or dielectric pixels, are a new class of material that enable precision tailoring of light–matter interactions. Optical metamaterials present properties beyond those found in natural materials that is possible to explore novel light–matter interaction phenomena. These salient features have unveiled an impressive assemblage of potential applications including the generation of 'flat optics' (e.g. metalenses) and 'cloaking' materials.

Inspired by the natural hierarchical optical structures, we developed a series of optical metamaterials with a low spatial footprint and enhanced light-matter interaction. Deep-strong coupling of different optical structures, such as Fabry-Pérot interferometers, distributed Bragg reflectors, photonic crystals and grating structures, unlocks a large variety of novel phenomena spanning traditionally distant research areas. Moreover, we emerge compound optical structure materials with surface-functionalization, chemical regulation, and optoelectronic device which open prospects for diverse applications, including anti-counterfeiting, encryption, sensing, displays, photovoltaics and imaging.

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Short Biography

Mingzhu Li is a full professor at Technical Institute of Physics and Chemistry, Chinese Academy of Sciences (TIPC- CAS) and Fellow of the Royal Society of Chemistry (FRSC). Her interests lie in the design, fabrication, and application of bioinspired micro/nano photonic materials. She received her PhD degree from Institute of Chemistry, Chinese Academy of Sciences (ICCAS), and joined the Key Laboratory of Green Printing, ICCAS in 2008. In 2023, she moved to Laboratory of Bio-inspired Smart Interface Science, TIPC-CAS. She has published more than 100 peer-reviewed SCI journal articles, including *Science*, *PNAS*, *Sci. Adv.*, and so on. She has received several awards including the National Science Fund for Distinguished Young Scholars, the first prize of Beijing Science and Technology Award, etc. She has joined the Editorial Boards of Journal of Materials Chemistry C and Materials Advances as an Associate Editor since April, 2023.

Creation of Bioinspired 2D Nanocomposites

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Abstract

High performance nanocomposites can potentially solve the bottleneck problems of miniaturization and lightweight in the field of aerospace. Although two-dimensional carbon-based nanosheets, such as graphene, MXene, show excellent mechanical and electrical properties, the properties of carbon-based nanocomposites are much lower than expectation. It was found that the void is an essential factor to decrease the properties of carbon-based nanocomposites, but usually neglected in the past decades. Herein, we applied both focused ion beam and scanning electron microscopy tomography (FIB/SEMT) and nanoscale x-ray computed tomography (nano-CT) to reconstruct the void microstructure of carbon-based nanocomposites. These results overturned the conventional densely stacked structure model of carbon-based nanocomposites. We further developed a simple and effective densification strategy to cure the voids using a sequential bridging process with different interfacial interactions. The resultant sequentially bridged carbon-based nanocomposites[1-4] achieved dramatical improvement in mechanical properties, resistance to cyclic mechanical deformation, oxidation, and stress relaxation etc.

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Short Biography

Professor Qunfeng Cheng is a professor in the University of Science and Technology of China in China. He has discovered for the first time the void defects in the 2D nanocomposites induced by capillary contraction, and developed a new strategy of sequential bridging and nanoconfinement assembly to cure the void defects for creating high performance 2D nanocomposites with excellent mechanical and electrical properties. Dr. Cheng has been awarded the XPLORER PRIZE, the Meituan Green Tech Award, the Beijing Distinguished Young Zhongguancun Award, the Mao Yi-sheng Science and Technology Award-Beijing Youth Science and Technology Award, and China Young Scientist Award of Composites Society, etc. Dr. Cheng has published more than 100 papers including 3 papers in *Science*, 1 paper in *Nature*, with over 12,000 citations, and a Google Scholar h-index of 63. He has authorized 40 Chinese patents and has authored the book "Bioinspired Layered Two-dimensional Nanocomposites".

In Situ Multi-Directional Liquid Manipulation Enabled by 3D Asymmetric Fang-Structured Surface

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Abstract

Spontaneous directional liquid transport is ubiquitous in nature and essential for applications ranging from microfluidics to thermal management. While surfaces decorated with wetting gradients or topological structures can achieve unidirectional liquid control, current designs lack flexibility due to their fixed configurations. Here, we present a structured surface composed of arrayed threedimensional asymmetric fang-structured units that enable in situ control of customized multidirectional spreading for liquids across 22 - 72 mN/m [1]. The bottom-up distributed multi-curvature features generate tunable Laplace pressure gradients, allowing liquid spreading paths to be precisely controlled based on wettability. Unlike conventional structured surfaces, our design responds dynamically to liquid properties, unlocking adaptive multimodal control. Key demonstrations include (1) selective multi-path liquid circuits, (2) portable surface tension indication (resolution: 0.3–3.4 $mN \cdot m^{-1}$), and (3) temperature-mediated smart manipulation of liquids for spatiotemporal cooling on heated surfaces. This work reveals the underlying mechanisms of liquid directionality control via geometrically programmed Laplace pressure gradients, expanding the design space for responsive fluidic interfaces.

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Short Biography

Siqi Sun earned her Bachelor's degree from Dalian University of Technology (DUT) in 2020. She is currently pursuing her PhD at The Hong Kong Polytechnic University (PolyU). Her research focuses on surface science, smart materials, biomimetics, and small-scale mass transport. Her work has been published in high-impact journals, including *Advanced Materials*, *Advanced Functional Materials*, and *ACS Applied Materials & Interfaces*.

Micro-Nano Architectures for Heat Applications

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Abstract

Most human activities require effective heat management. As advanced artificial systems evolve to operate under extreme conditions with higher power and heat densities, cooling has become a critical bottleneck.[1] Recently, micro-nanostructured surfaces have emerged as a promising solution for enhanced cooling through phase change and radiation.[2] However, achieving optimal performance requires precise control of interfacial phenomena, such as bubble/droplet dynamics,[3] capillary action, and electromagnetic wave transmission, which necessitate sophisticated multi-tiered architectures. To achieve such creation, multi-scale design and manufacturing must be tightly integrated, yet this remains a significant challenge. Herein, inspired by the ultrafast liquid capillary transport on the plant root system, we developed a three-tier superhydrophilic architecture using pulsed laser processing. This hierarchical structure ensures dense bubble nucleation and simultaneously enables rapid capillary action against gravity; additionally, the hierarchical framework effectively anchors the liquid meniscus, preserving persistent evaporation and stable heat transfer performance; thus, a maximum heat flux of 148 $W\cdot cm^{-2}$ and heat transfer coefficient of 190 $kW\cdot m^{-2}\cdot K^{-1}$ were achieved. Furthermore, drawing from the hybrid wetting design of the Desert beetle, we incorporated hydrophobic microarrays via laser milling to lower the energy barrier for bubble nucleation, thus significantly improving the heat transfer efficiency. Notably, this hybrid wetting design, combined with the 3D hierarchical architecture, also enhances condensation: the inverse phase change process of boiling. Dropwise condensates were quickly formed, navigated, and rapidly ejected or drained from the surface. The high mobility of condensate droplets on this surface was believed to enforce the dropwise condensation durability: an efficient mode prone to failure due to flooding, which transitions it into filmwise condensation. By harmonizing the boiling and condensation, we created the bio-inspired micro-nanostructured cooling device with a cooling capacity up to 300 times greater than that of pure metal. This work highlights the potential of co-engineering principles for advanced functional structuring, with broad implications for energy management, biofluidic systems, and beyond.

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Short Biography

Dr Xiaolong Yang, Professor, received his Bachelor's degree from Hunan University in 2012 and his PhD from Dalian University of Technology in 2018. From 2016 to 2017, he conducted joint PhD program at the Georgia Institute of Technology in the United States. Since November 2018, he has been working at the School of Mechanical and Electrical Engineering, Nanjing University of Aeronautics and Astronautics (NUAA). His research interests focus on micro/nano manufacturing, heat and mass transfer, microfluidics, etc. He has published more than 20 SCI papers as the first or corresponding author in journals, such as *Nano Letters*, *ACS Nano*, *Lab Chip*, and *ACS Photonics*.

Functional Hydrogels and Their Applications

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Abstract

Hydrogels contain a large amount of water, possessing many advantages of being lightweight, good biocompatible, and low Young's modulus close to that of human skin. Various hydrogels, such as chitosan-based hydrogels, cyclodextrin-based topological hydrogels, have been prepared by us, showing excellent stretching ability and tough performance. These hydrogels can be used as flexible strain sensors, self-healing materials, fluorescent substrates, as well as antifouling coatings.

Short Biography

Dr Xiubin Xu is currently an Associate Professor at the School of Chemistry and Chemical Engineering at Guangzhou University. He received his BS from the Sun Yat-sen University and his PhD from Lanzhou University. Currently, his research focus on the design and fabrication of functional polymers, soft gels, and flexible devices with functional interfaces/surfaces. He has published over 50 papers in the field in famous peer-reviewed journals.

Anti-smudge Coating Materials with Orientational Structures

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Abstract

Anti-smudge coating materials have significant application prospects in various fields, such as anti-clogging, anti-thrombus and anti-infection. Teflon and anti-smudge materials with bio-inspired micro-/nano-scale structures or hydration layers have attracted significant interest; however, they are plagued with performance or process limitations, which restrict their industrial applications. Based on previous research on anti-smudge coatings with different mechanisms of orientational structures, this work designed and synthesized a series of targeted polymers with phase-selective segments and cross-linkable units. To achieve anti-smudge functional surface layers and strong substrate adhesion bottom layers, various orientational structures was constructed and locked via solvent volatilization, solvent penetration, and chemical cross-linking approach. Combined with different adhesion objects (i.e. crude oil resin, plasma protein and bacteria) and environmental conditions (i.e. aqueous salt concentrations and temperature conditions), the molecular structure and property relationships between specific orientational structures and the key coating performances was investigated, such as anti-smudge performances in air or underwater conditions, substrate adhesion and long-term stability. The molecular mechanisms which drive the interfacial migration and inhibit the chemical reconstruction of functional phase-selective segments was revealed. Strategies that fulfil the requirements of scalable processing for the controllable construction and locking of the expected coating orientational structures was described.

Short Biography

Dr Xu Wu, serves as Director of the Guangdong Provincial Engineering Research Center for Energy-Saving, Environmental Protection, and Fine Chemicals, Deputy Dean of Guangzhou University's School of Chemistry and Chemical Engineering, and visiting scholar at Queen's University (Canada). Recognized as a Guangdong Young Pearl River Scholar and Pearl River Science and Technology New Star,he leads 20+ research projects and has published 60+ SCI papers in high-impact journals including *Science Advances* and *Advanced Materials*. With 20+ granted patents, his research on functional coatings has achieved industrial applications.

Efficient Liquid Transport on Nature-inspired Surfaces

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Abstract

Regulating liquid motion on functional surfaces is essential to various applications, ranging from thermal management to microfluidics, water harvesting and energy harvesting. However, research in this fiend is still in the rough. For instance, there exists a theoretical contact time limit which is imposed by the classical hydrodynamics and the controllable liquid manipulation remains challenging in terms of response and functional adaptability. In this talk, I will briefly discuss our recent efforts to these puzzles. Several liquid bouncing mechanisms were proposed to reduce the contact between impinging droplets and the underlying solid surfaces, and various liquid maneuvering approaches by leveraging external stimuli have been explored to realize the goals. Building on this foundation, we extended our research from macroscopic liquid dynamics to microscopic ion migration, shifting the focus from surface interactions to internal interfaces. By applying bioinspired design to heterogeneous material interfaces, we achieved much more efficient ion transport and regulation, leading to substantial improvement in the energy conversion efficiency of moisture-driven power generation.

Short Biography

Yahua Liu is a Professor in the School of Mechanical Engineering at Dalian University of Technology. He received his PhD degree in mechanical engineering from the City University of Hong Kong, China, in 2015. His research interests center on the interfaces between engineering and materials, with an emphasis on the rational design and development of novel materials and devices for multifunctional applications using a nature-inspired approach. He has published more than 30 articles in prestigious journals such as *Nature Physics*, *PRL*, *Science Advances* and *Nature Communications*.

How Liquids Charge the Superhydrophobic Surfaces

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Abstract

Liquid-solid contact electrification (CE) is essential to diverse applications. Exploiting its full implementation requires an in-depth understanding and fine-grained control of charge carriers (electrons and/or ions) during CE. Here, we decouple the electrons and ions during liquid-solid CE by designing binary superhydrophobic surfaces that eliminate liquid and ion residues on the surfaces and simultaneously enable us to regulate surface properties, namely work function, to control electron transfers. We find the existence of a linear relationship between the work function of superhydrophobic surfaces and the as-generated charges in liquids, implying that liquid-solid CE arises from electron transfer due to the work function difference between two contacting surfaces. We also rule out the possibility of ion transfer in CE occurring on superhydrophobic surfaces by proving the absence of ions on superhydrophobic surfaces after contact with ion-enriched acidic, alkaline, and salt liquids. Our findings stand in contrast to existing liquid-solid CE studies, and the new insights learned offer the potential to explore more applications.

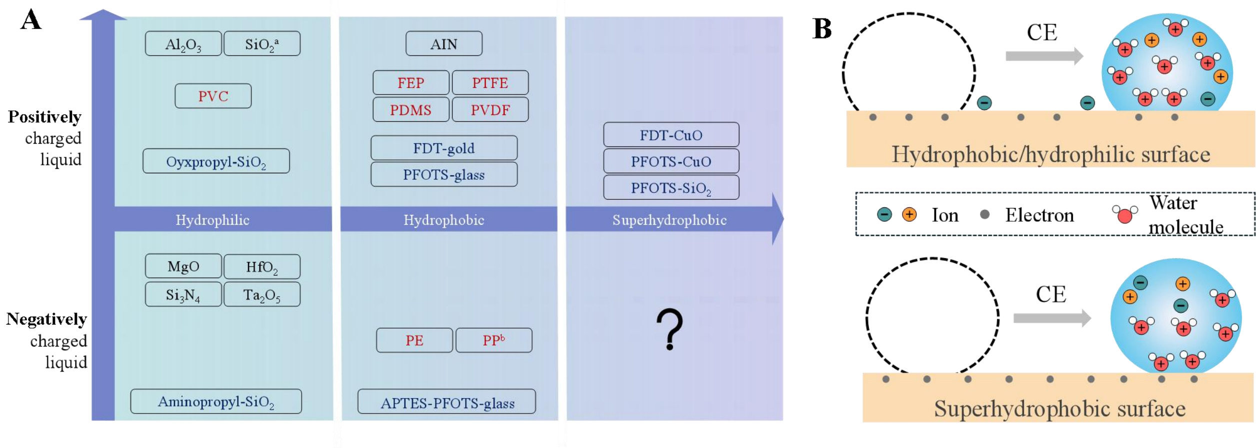

Figure 1. A Classification for the existing studies on liquid-solid CE based on the wettability of solid surfaces and charge polarity of water. B Comparison of CE occurring on hydrophobic/hydrophilic surfaces and superhydrophobic surfaces regarding the nature of charge carriers.

References

[1] Y. Jin, S. Yang, M. Sun, et al., *Nat. Commun.* 15, 4762 (2024).

Short Biography

Dr Yuankai JIN is currently Research Assistant Professor in the Department of Mechanical Engineering at the Hong Kong Polytechnic University. His research interest mainly focuses on interfacial electrostatics, including mechanism of electrostatics generation and control, electrostatics-driven fluidic manipulation, and electrostatics-orchestrated icing control. Over the past several years, he has published more than 30 papers in high-impact journals including *Nature Communications*, *Nature Chemical Engineering*, *PNAS*, *Science Advances*, etc.

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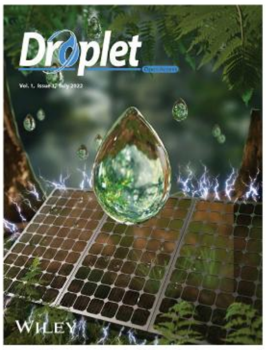

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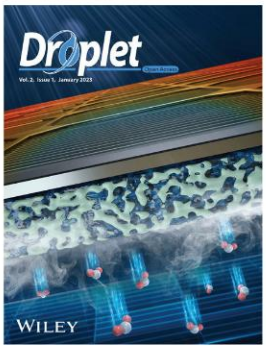

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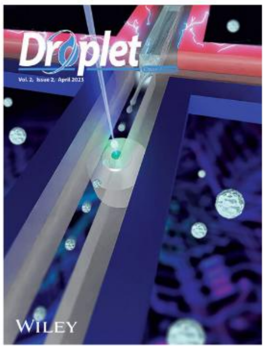

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*About our findings: Our research focused on the metrics that authors have told us are important to them: usage (defined here by full-text downloads), citations (we used Dimensions citations here), and Altmetric Attention Scores. Insights were gained from an extensive review of Wiley journal articles from January 1 2015 to December 31 2021. To learn more about our findings, see our white paper.

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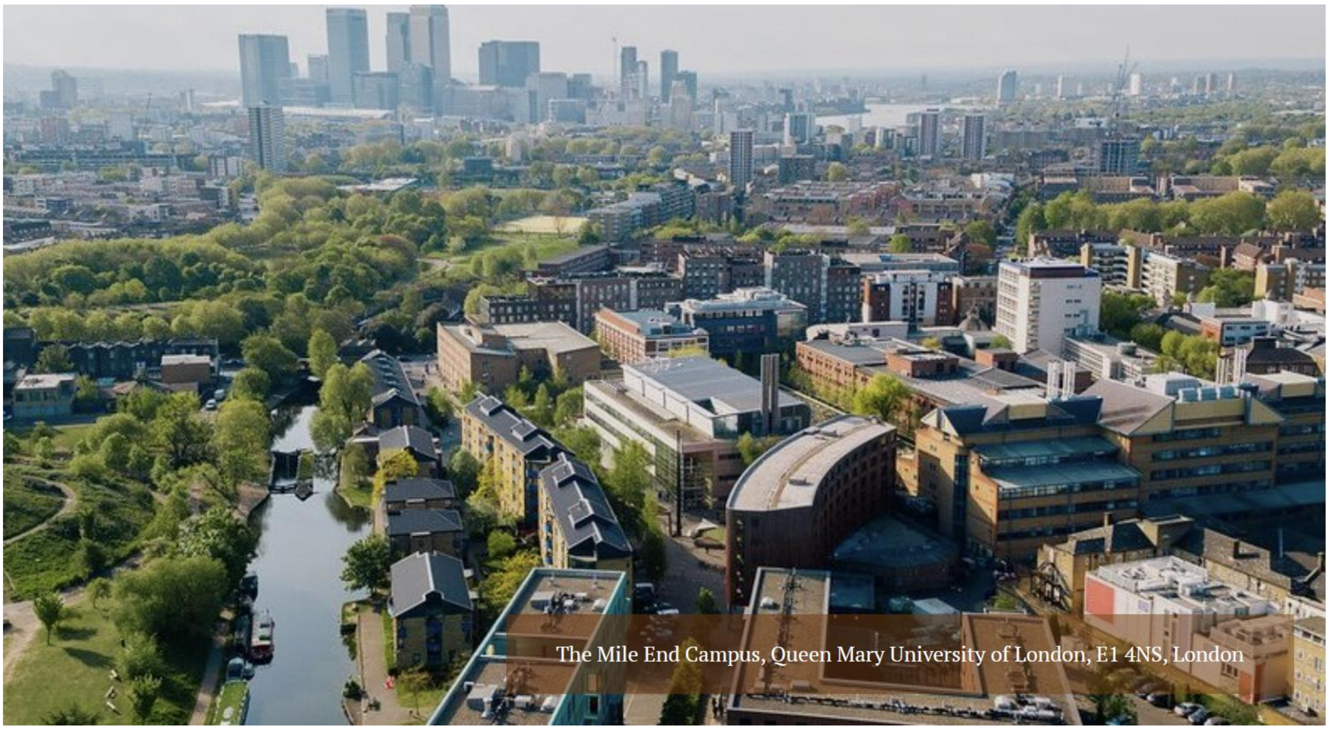

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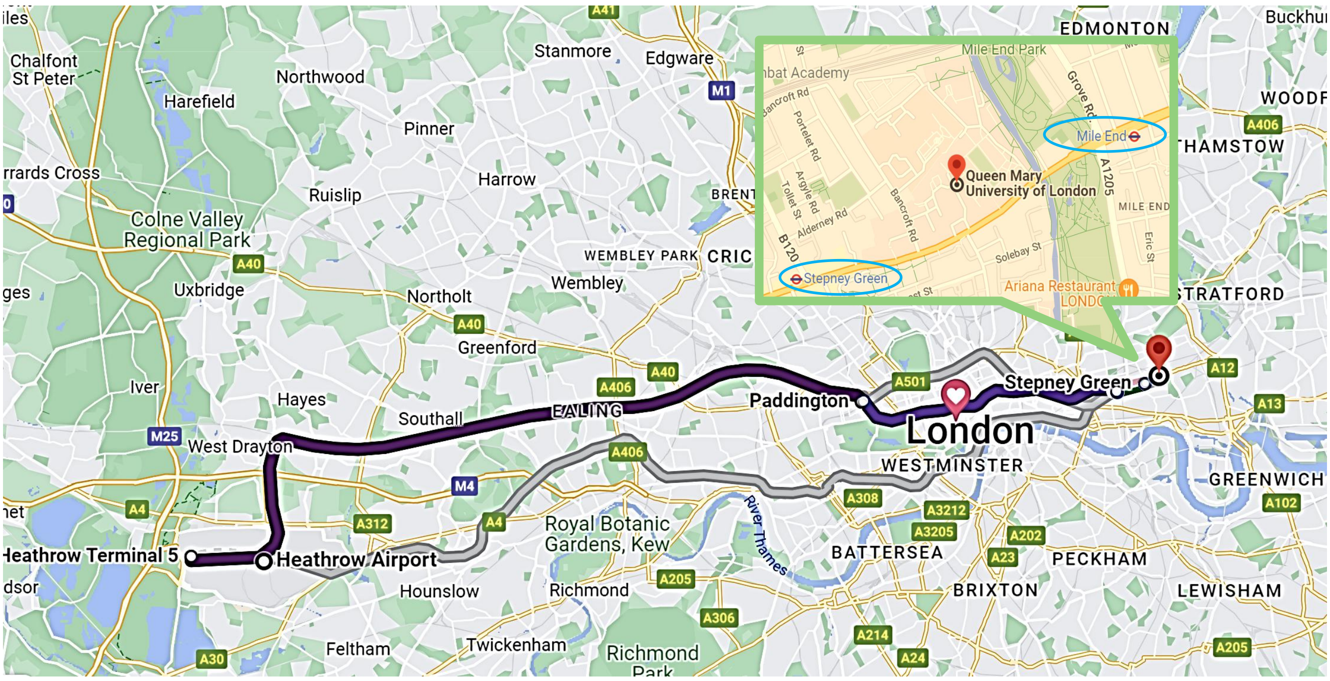

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