Boosting science and technology innovation in Beijing

Views from the leaders of some major research institutions in Beijing

DING SHENG

Dean, School of Pharmaceutical Sciences (SPS), Tsinghua University Institute Director, Global Health Drug Discovery Institute (GHDDI)

At SPS, Tsinghua University, we endeavor to deliver the best education to our students, conduct cutting-edge research, and accelerate translation from scientific discoveries into new medicines and treatments.

In 2016, Tsinghua University joined forces with the Bill & Melinda Gates Foundation and the Beijing Municipal Government to establish GHDDI, an independent, not-for-profit institute with a broad interest in addressing global health concerns. The first translational and drug discovery platform of its kind in China, GHDDI focuses on tackling the most pressing disease challenges in developing countries.

Both SPS and GHDDI have been growing rapidly and we are actively recruiting outstanding researchers from around the world. We welcome your joining us to make best efforts in improving human health via great science and innovative translation.

JIANG LEI

Director, Bioinspired Smart Interfacial Science Centre, TIPC, CAS

Following the notion of learning from nature, we discovered that the properties of smart materials are highly dependent on the "cooperation distance principle" and "time-dependent" factors. With the discovery, we proposed designing interfacial nanomaterials based on the binary cooperation complementary principle, according to which, promising materials can be built by placing two components with opposite physiochemical properties in the "cooperation distance".

Our centre pioneered the research on bio-inspired interfacial materials with superwettability and developed interfacial chemistry through integration and innovation. The research is widely applied in industrial manufacturing, agriculture, health, and energy resources.

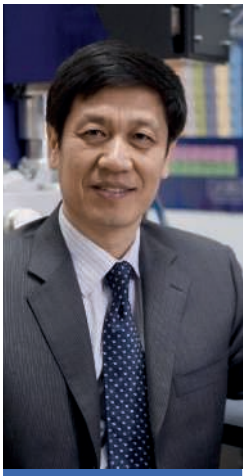
TANG HUAJUN

President, Chinese Academy of Agricultural Sciences

The Chinese Academy of Agricultural Sciences (CAAS) is a national-level institution for integrative agricultural research. Our mission is to address major scientific and technological issues in China's agricultural development. Over the past 60 years, we have achieved world-leading original results and trained a troop of leading figures in agricultural sciences.

Going forward, we aim to become a world-class research entity conducting first-class research.

We will strengthen our academic programmes, enhance research platforms and researcher development, deepen international collaboration, and accelerate agricultural research innovation and the transfer of research results. Committed to boosting China's agricultural science and technology, we support food security and sustainable development of agriculture in China.



XU HUIBIN

President, Beihang University

The mission of the Beihang University is to advance knowledge and educate students in science, technology and engineering that will best serve the nation and the world in the 21st century. At its founding in 1952, Baihang University was committed to advancing the fundamental science and technology through educational innovation to make the world a better place. Now, the university has more than 2,400 faculty members, training more than 15,000 undergraduates and 13,000 graduate students. We still stay true to our commitment of creating knowledge, particularly of aeronautics and astronautics, to bear on the world's great challenges.

FANG FUQUAN

Vice President, Capital Normal University

Devoted to geometry and topology, the foundation of modern imaging technologies, I am now leading the Beijing Advanced Innovation Centre for Imaging Technology at Capital Normal University (CNU). The newly established centre integrates existing technical resources of CNU and applies an innovative management mechanism. It seeks to bring in greater social benefits with innovation in imaging technologies. Boasting state-of-the-art infrastructure, a supportive research environment and an innovation-driven strategy, we have attracted a growing number of talented researchers to CNU and are expecting to achieve more technological breakthroughs soon.

LI WU

Director, State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University

After a decade's fast development, the State Key Laboratory of Cognitive Neuroscience and Learning has become the leading centre for cognitive neuroscience in China. Distinct from other neuroscience institutes, our laboratory focuses on high-order functions of the human brain, providing scientific basis for promoting intellectual development and mental health. With concerted endeavors of a multidisciplinary research team, we are on a journey to fulfil an ambitious mission—understanding the mind and empowering the brain. All talented researchers sharing the same aspiration are welcome to join our expedition.

CHEN JIANFENG

Dean, College of Chemical Engineering and Vice President, Beijing University of Chemical Technology

Beijing University of Chemical Technology (BUCT) is a national key university directly under the administration of the Chinese Ministry of Education. It is selected as the key university of the state "Project 211"and"985 Innovation Platform for Superiority Disciplines". As a core of this university after nearly 60 years' development, the College of Chemical Engineering has become an important national base for talent training and scientific research in chemical engineering, occupying the front rank among counterpart colleges of domestic notable universities.

TIAN GENG

President, CEO, Chief Scientist GENEIS

Dedicated to precision medicine research, Geneis aims to advance precision medicine and personalized clinical practices in China. With robust and specialized R&D teams, it will provide more professional, accurate and effective services to doctors, clinical departments and hospitals, safeguarding the health of every customers and the general public.

SURGE IN SUPERWETTABLE MATERIAL RESEARCH

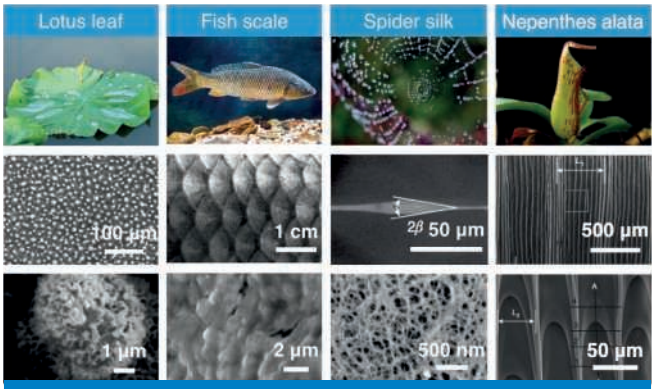
The research centre for BIOINSPIRED SMART INTERFACIAL SCIENCE (BISIS) is helping drive a global wave of study on nature-inspired 'superwettable' materials

Opened in 2014, China's Bioinspired Smart Interfacial Science (BISIS) research centre is already a key player in the booming study of bio-interfacial materials and devices – and home to some of the innovative field's founding academics.

The centre, which is part of the Technical Institute of Physics and Chemistry at the Chinese Academy of Sciences (TIPCCAS), is located in Beijing's Zhongguancun area, a science and technology hub for leading universities and research institutes. In order to best align itself with China's sustainability goals, the centre is working towards breaking through fundamental technical bottlenecks in a broad range of industries, including: energy, resources and environment, health and medicine, information, agriculture and chemical engineering.

New biologically inspired materials

Since its inception, BISIS has already been largely responsible for the development of the study of interfacial materials, or surface materials, with superwettability. Inspired by nature, professor Lei Jiang, BISIS director and an academician at CAS, proposed the binary cooperation complementary principle for designing interfacial nanomaterials and developed bioinspired interfacial materials with superwettability, establishing the interfacial chemistry system.



Superhydrophobic/Superhydrophilic surfaces

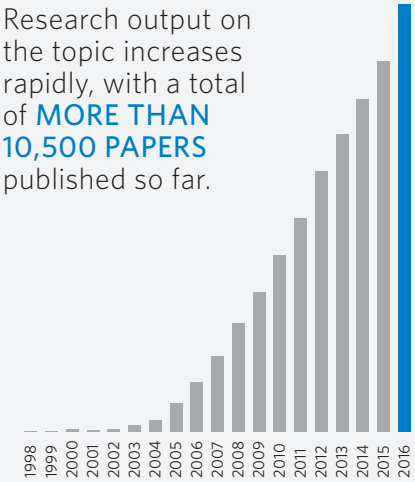
Superwettability is the extreme wetting state that the water contact angle can reach 0° on glass with intrinsic 10° and >150° on Teflon with intrinsic 119°. Harnessing this could help produce self-cleaning materials and aid in developing materials for industrial uses, such as for oil and water separation.

It's a booming area. In recent times, nearly 500 institutions from 140 countries have devoted themselves to research

WORLDWIDE GROWTH OF RESEARCH ON BIOINSPIRED INTERFACIAL MATERIALS WITH SUPERWETTABILITY

Approximately 500 research institutions from 140 countries involved.

Research output on the topic increases rapidly, with a total of MORE THAN 10,500 PAPERS published so far.

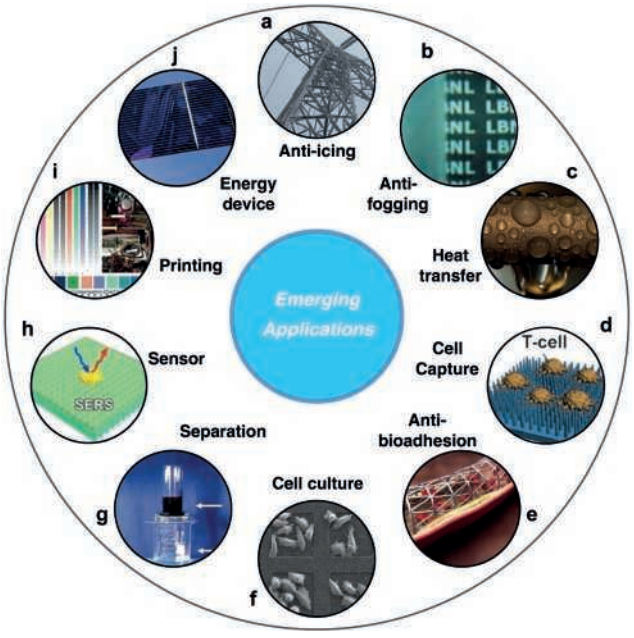


in this area. The discovery of superhydrophobic coating, a water-repellent, nanoscopic surface layer, has led to a surge of related material research, demonstrated by a huge growth in academic papers in this field. Roughly 1,850 papers were published in 2016 alone and a total of more than 10,500 papers on the topic have been published so far.

Indeed, superwettability research has a long history and can be traced back to the 1756 discovery of the Leidenfrost effect, which is when water produces an insulating vapour layer as it comes into contact with something hotter than its boiling point. This is what makes water droplets skitter across hot surfaces. Between 1944 and 1945, scientists studied water repellent, or 'superhydrophobic', phenomenon on wheat leaves and duck feathers. The birth of hydrophilic silicon wafers in 1959 established the foundation of the semiconductor industry, followed by the discovery of the hydrophilic properties of corneas in 1970. In 1997, the mono-microscale papillae of lotus leaves were shown to explain their water repellence.

In 2002, led by Jiang, BISIS researchers studied lotus leaves and revealed that the cooperation of multiple microscale and nanoscale structures was the key to their water repellent properties. The exponential increase in papers on bio-inspired superwettability interfacial science papers from 2002 onwards demonstrates many material scientists once focused on polymers were inspired to step into the field.

In 2009, by studying the super-oleophobic, or oil-repellent characteristic of fish scales, Jiang's group identified an underwater superwettability interaction system between liquids and solids. In the same year, a model for the underwater superwettability system between gases and solids was established based on the super-hydrophilicity of underwater lotus leaves. BISIS has expanded the research to three-phase systems that involve two rounds of liquid and a solid as well as a gas, liquid and a solid, which has helped the centre develop 64 variations of material. By applying the "cooperative distance" controlling two nanoscale units with opposite properties and "time regulation" in new materials, BISIS has pushed material designing to the philosophical level and is better equipped to harness the future technology.



Wide applications and collaborations

Intelligent bio-interfaces are an emerging frontier, and BISIS focuses both on basic research and research applications. By exploring heat-transfer, sensors, cell capture, printing and energy devices, BISIS hopes to help develop artificial interfacial materials for large-scale industrial applications.

In an effort to encourage industry collaborations, the centre has worked with multiple companies to achieve technology transfer successes. Examples include: a technique to produce more than two hundred thousand square metres of self-cleaning glass for NanoSolutions Ltd; oil-water separation filter membranes that were applied in about 800 ships for Beijing Binary Century Nano-Technology Co., Ltd.; the technology to produce superamphiphobic neckties and silk scarves for Ningbo Elite holding Group Company; and the nano green printing technique, transferred to Beijing Zhongke Nanothink Printing Technology Co. Ltd., and applied in a dozen of printing factories for printing books and newspapers. The green printing equipment was also sold to South Korea.

Currently, BISIS has also established a strategic partnership with a local company, SciTech Superwettability Interface Ltd, to build a research centre to develop advanced materials in health, energy and agriculture, accelerating the translation of research results.

People-oriented development

BISIS values talent cultivation and the sustainable development of its laboratories. As a result, the centre has co-founded the Department of Bionic Intelligence at the School of Future Technology at the University of Chinese Academy of Sciences. A state key laboratory is also planned in partnership with Beihang University in Beijing. Furthermore, the centre is working with Beihang University, Soochow University and the Institute of Chemistry at CAS to secure additional funds to support the centre's innovation abilities.

As a member of the United States National Academy of Engineering, Jiang and BISIS have attracted 100-plus leading researchers from China and abroad to create an ambitious, energetic and innovative research team. Jiang has cultivated dozens of talents, including Professors Shutao Wang, Liping Wen and five other outstanding researchers who are all winners of the National Science Fund for Distinguished Young Scholars.

The BISIS welcomes outstanding researchers from all over the world to join the team on an academic exchange. It believes that incorporating new international ideas will spark even greater creativity in this fascinating field. ■

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