



UNIVERSITY OF
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**COLLABORATIVE
RESEARCH**
demonstrates
alternative hole
transport layer to
enable high-efficiency
perovskite solar cells

AN INTERVIEW
with the OSCAR
Director



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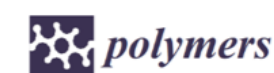


Collaborative research demonstrates alternative hole transport layer to enable high-efficiency perovskite solar cells

Perovskite materials exhibit intriguing physical properties that have been extensively studied for practical applications. This material class has been disruptive, with a broad research area open to many revolutionary discoveries for new device concepts in optoelectronic fields.

In particular, perovskite solar cells have been the fastest-advancing solar technology with the potential to achieve high efficiencies and very low production costs.

In a recent paper jointly published by OSCAR's Co-PI Dr.Jingsong Huang and his collaborators from Nanjing University of Posts & Telecommunications and Guangdong University of Technology, scientists reported a new method for preparing the hole transport layer (HTL) which induces better perovskite crystal growth, resulting in larger perovskite grain sizes and fewer defects. The new approach demonstrates an attractive alternative for HTL to achieve high-efficiency perovskite solar cells (PSCs).



Article

Highly Efficient Perovskite Solar Cell Based on PVK Hole Transport Layer

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Abstract: A π -conjugated small molecule N, N'-bis(naphthalen-1-yl)-N, N'-bis(phenyl)benzidine (NPB) was introduced into poly(9-vinylcarbazole) (PVK) as a hole transport layer (HTL) in inverted perovskite solar cells (PSCs). The NPB doping induces a better perovskite crystal growth, resulting in perovskite with a larger grain size and less defect density. Thus, the V_{OC} , J_{SC} , and FF of the PSC were all enhanced. Experimental results show that it can be ascribed to the reduction of surface roughness and improved hydrophilicity of the HTL. The effect of NPB on the aggregation of PVK was also discussed. This work demonstrates the great potential of PVK as the HTL of PSCs and provides an attractive alternative for HTL to realize high-efficiency PSCs.

▲ The paper, entitled "Highly Efficient Perovskite Solar Cell Based on PVK Hole Transport Layer" was published in *Polymers* in May 2022, available online at <https://www.mdpi.com/2073-4360/14/11/2249/html>



Dr. Jingsong Huang supports
Professor Paul Stavrinou in
leading OSCAR's Optoelectronic
Technology Laboratory (OeTL).



Prof. Paul Stavrinou



Dr. Jingsong Huang



▲ OeTL's interests span the development of novel semiconducting optoelectronic materials and devices and their application, such as lasers, light emitting diodes, and solar cells.



An interview with the OSCAR Director: "OSCAR is well-placed to deliver solutions to major challenges for the UK, China, and the world"

In an interview early this year with People.cn, the online presence of People's Daily, Professor Zhanfeng Cui traced the story of OSCAR back to the first discussion he had with Suzhou Industrial Park, and explained what he envisions for the Centre in the years to come. In particular, Prof Cui "looks forward to returning to China and to OSCAR Suzhou soon."

From completing his PhD in China, to pursuing further studies in the UK, all the way to obtaining the Donald Pollock Professorship at the University of Oxford, the Fellowship of the Royal Academy of Engineering and the Chinese Academy of Engineering, Professor Zhanfeng Cui has established himself as a leading international academic and a top-notch scientist in the fields of biomedical engineering, biochemistry and regenerative medicine.

Despite spending many years teaching in the UK, Professor Cui has a deep emotional bond with China and has always been hands-on about giving back to the place where he was raised and educated. The role he played in bringing the



OSCAR project across the line, over a span of seven years, is a manifestation of that bond.

"I was educated in China, from my undergraduate degree through to my doctorate. I've always desired to be a part of the development of my home country. I have worked with many universities in China. I firmly believe that bringing Oxford University to China makes the most sense," says Professor Cui.

"It all began with my visit to the Suzhou Industrial Park in 2011. In the hope of establishing itself as a region for innovative undertakings, SIP expressed the wish to see a stronger presence of world-class universities and to attract other prestigious educational institutions to locate

some of their teaching and research activities in SIP. I believed SIP held great prospects, so I suggested that we could explore the possibility for Oxford University to set up a research centre in collaboration with SIP," Professor Cui recalls.

Over the next five years, Prof Cui proceeded to make a compelling business case for an Oxford University research centre in Suzhou, a period that saw the service of two Vice-Chancellors.

"I have always stressed to the University that it makes perfect sense for Oxford too, that Oxford should shape a social impression of

accessibility and increase its social impact in China. Everyone knows that Oxford is famous, but for the Chinese people, their impression of Oxford is only limited to the Oxford English-Chinese Dictionary and the Harry Potter film location. At the same time, OSCAR can serve as a bridge for collaboration between researchers from Oxford University and Chinese universities."

From the first engagement in 2011 to the signing of the collaboration agreement between the University of Oxford and Suzhou Industrial Park at the end of 2016, and to the official opening at the end of 2018, Professor Cui had

been persistent in promoting this undertaking, which finally translated into the birth of the Oxford Suzhou Centre for Advanced Research, and a new step forward for his career in China.

OSCAR's mission is to establish a long-term international collaboration between the UK and China, bringing innovative technologies to market that benefit the world through a mutually beneficial partnership with the manufacturing industry in the Suzhou Industrial Park, combining academic research, technology development and commercial applications.

"As the founding Director, I was contemplating

in the early days, how we should go about managing this research centre, and how we can make OSCAR a testing ground for managing research in a non-Chinese fashion in the Chinese context. Now OSCAR mirrors practices at Oxford. OSCAR's professors are not imposed rigid performance targets, such as publishing a set number of papers in a year. This doesn't change the way our professors pursue research-worthy questions and work hard to get things done. With such self-drive, you don't need quantitative targets to manage." In fact, OSCAR has already achieved much in a short period of time, publishing 40 papers and filing nine patent applications by the end of May.

▼ The grand opening of Oxford Suzhou Centre for Advanced Research on 22 November 2018



Shortly after OSCAR became operational, the Covid pandemic started to rage across the globe. Even in this circumstance, the Centre has captured growing attention from like-minded research partners and developed an expanding research team over the past three years.

For Professor Cui and his team, OSCAR is a challenging new venture, but despite the enormous challenges posed by the epidemic, the growth of OSCAR is undeterred.

"When the pandemic broke out in Wuhan, we immediately thought about what the team could do."

Wasting no time, Professor Cui and his team turned to the problem of rapid and accurate virus detection. The team based their research on the RT-LAMP technology. With an accurate selection of protein targets and the adoption of molecular switches, researchers were able to surmount the problem of false positive results, and eventually arrived at an optimized approach named 'Ox-LAMP'. This new technology is now in use at airports and other scenarios in need of rapid testing.

"During that time, we worked around the clock doing experiments. It wasn't long before the UK went into lockdown due to local outbreaks. With only two teams, the vaccine team and us, continuing to work at Oxford, in the same building, we were bent on developing a rapid test kit as quickly as possible."

Professor Cui and his team achieved an incredible timeline, advancing the technology from patent filing through to the set-up of a

spin-off company called Oxsed and its acquisition by an industry partner within just 8 months. In August 2020, Professor Cui and his team were awarded the Royal Academy of Engineering President's Special Awards for Pandemic Service.

Professor Cui believes this project and its achievements shows that in the context of the pandemic, international collaboration can benefit from complementary strengths. "Most of our award winners are post-docs of OSCAR, and five people have been working in China. The China and UK-based teams worked with one mind on the same research project, sharing resources and working around Covid restrictions in each other's country."

He explains that his team is currently developing a new generation of more accurate, faster and more convenient rapid tests and also devices for home testing, in the hope to support the world's continued fight against the pandemic.

In Professor Cui's view, with such an outstanding and hands-on team, OSCAR will stride forward with more momentum and more outputs in the next five years. He is also convinced that OSCAR will help strengthen and expand partnerships for Oxford academics and promote more research projects, while also being better positioned to develop technologies closer to the Chinese market. He says OSCAR is well-placed and capable of delivering solutions to major challenges for the UK, China, and the world. "Starting in September this year, I'll be on my year-long academic sabbatical. I particularly look forward to returning to China, returning to OSCAR in Suzhou soon."



Meet OSCAR's New Researcher



Xiaoning Zhang

Research Assistant in Prof. Jeremy Robertson's group

Xiaoning Zhang joined OSCAR in May 2022 as a Research Assistant in Organic Synthesis. She graduated from Hebei University of Technology in 2018 with a master's degree in Biochemical Engineering. During her graduate years, Xiaoning's study concerned the combination of enzyme with nanocomposites, and the application of immobilized enzymes. After graduation, she joined a consulting firm where her role was to assist medical device manufacturers with FDA registrations. After that, she joined the Sichuan Industrial Institute of Antibiotics' branch in Jinhua, Zhejiang province, as a Research Assistant working in an organic chemistry laboratory. There, she mainly worked on the development of novel organic methodologies for transition-metal-catalyzed C-H functionalization of indoles.

"I'm very happy and honored to join the big OSCAR family. OSCAR offers a good platform for professional development and for meeting fellow researchers." Xiaoning says, "At OSCAR, I feel an active and pleasant research environment. I'm very excited to work with such professional research groups." At OSCAR, the main task for Xiaoning is to work with research scientists on the selective oxidation of organic compounds using engineered variants of cytochrome P450 enzymes. The research finds applications in the synthesis of high-value intermediates and active ingredients for the agrochemical and pharmaceutical industries.

"This job requires cross-disciplinary knowledge. Although I majored in biology, and I have work experience in organic synthesis, there remain challenges and many aspects for me to cope with. I will adapt myself to the new environment within the shortest time, and gain a command of the necessary skills and knowledge. I will cherish every opportunity in this job to develop myself and to contribute to OSCAR's mission." Xiaoning said.



OSCAR conducts Factory Acceptance Test for Purified Water and Water for Injection distribution systems

On 30 May, professionals from OSCAR's Building Services Section conducted a three-day Factory Acceptance Test (FAT) for a Purified Water (PW) System and a Water for Injection (WFI) distribution system. PW and WFI are very sophisticated systems that form an essential part of OSCAR's Phase II Fit-out Project.



FAT is one of the key steps required for Good Manufacturing Practice (GMP) certification, preceding Site Acceptance Test (SAT), Operation Qualification (OQ), and Production Qualification (PQ). A FAT entails the inspection of extensive items, including documentation, process and instrumentation diagrams, components, material certificates, system installation, pipeline welding records, electrical installation, and automatic control system.

Working with the supplier team, OSCAR's Building Services Manager Frank Zhang and Engineering Supervisor Lei Chen conducted thorough inspections and tests on the configuration and functions of the whole system. They verified records of the construction process and installation requirements and rectified non-conforming items. The procedure helps ensure a smooth system calibration, reducing the probability of problems and the workload associated with modification during on-site installation at OSCAR.

When operational, the PW and WFI systems will provide up-to-standard water for the preparation of laboratory and pilot batches within OSCAR's Innovation and Technology Centres, as well as for current experiments.



SIP News in May



Foreign companies show confidence in Suzhou

A cloud contract signing event took place in Jiangsu province on 16 May.

The event saw Suzhou securing 13 foreign-investment projects, accounting for 25% of the province's total. These projects drew a combined investment of 2.73 billion US dollars. Thirty-nine multinational companies with provincial-level regional headquarters and functional agencies in Suzhou received plaques online. During the event, SIP was recognised as the first and only provincial-level economic cluster of international headquarters in Jiangsu.

What's behind the increasing foreign investment in Suzhou, a city that have seen COVID-19 resurgences in the past few months?

In the first quarter of 2022, total import and export value of Suzhou hit 637.78 billion RMB, up 14.1% year on year. Of the total, exports rose 14.2% year on year to 374.51 billion RMB, while imports gained 14.1% to 263.27 billion RMB. The city's actual use of foreign direct investment (FDI) expanded 50.6% year on year to 3.49 billion US dollars, and the service industry saw FDI inflows jump by 88.2% from a year earlier.

As of now, 197 multinational companies have set up city-level regional headquarters in Suzhou, and 171 have established provincial-level regional headquarters and functional agencies in the city, which accounts for 51.7% of the total number of the province.

The article is sourced from iSuzhou WeChat subscription account.