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OSCAR RESEARCH develops new process to modify glass fibre membranes

OSCAR APPOINTS Prof. Donna Kurtz as Visiting Professor for collaboration in Linked Open Data technologies

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DID YOU KNOW THIS ABOUT SIP?

Front cover image: crystals captured in OSCAR's surface science laboratory. *Photo credit:* Dr. Dandan Wang, Dr. Xiaosong Liu

OSCAR research develops new process to modify glass fibre membranes

Utilizing glass fibre membranes as a starting material to be modified, researchers from OSCAR's Functional Materials group recently developed a new surface modified by bis-carbene to create a cost-effective new material.

In previous studies, glass membrane modification was realized mainly by silane coupling reagents which are commercially available due to widespread usage and proven effectiveness. However, this approach makes it difficult to observe any changes in the material with the naked eyes and does not allow add-on functional chemical groups.



Professor Mark Moloney OSCAR PI and Deputy Director

In the research at OSCAR, Prof. Mark Moloney and Dr. Dandan Wang turned to bis-carbene for the modification of glass fibre membranes, resulting in a method that is direct to deploy and allows the introduction of new surface properties.

The modified glass fibre films have increased abrasion resistance (see Fig. 1) and can be used to add more chemical properties in a simple way to meet hydrophilic, colour rendering requirements where needed. Researchers also proposed, for the first time, the mechanism and structure of the new surface's polymerization, which may provide a new way of copolymerization that does not require transition metals as catalysts.

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Dr. Dandan Wang OSCAR Research Scientist

Theses findings are reported in the paper Surface modification of glass fiber membrane via insertion of a bis (diarylcarbene) assisted with polymerization and cross-linking reactions, available online at https://doi.org/10.1016/j.surfin.2022.102155





- ▲ Fig. 1 (a) Glass membrane without modification
- ▲ Fig. 1 (b) Modified glass membrane using bis-carbene

The same bis-carbene-enabled surface modification technology was also found to be useful in enzyme immobilization, stabilizing enzymes on the modified glass membrane while achieving remarkable sustainability and retaining a high level of activity of the tested enzymes (see Fig.2). Additionally, bis-carbene-based surface modification may be extended to bond enzymes to multiple carriers, instead of being limited to only one.



immobilization (GF: Glass fibre)

Two IP projects arising from this research have been filed with China National Intellectual Administration.

OSCAR appoints Prof. Donna Kurtz as Visiting Professor for collaboration in Linked Open Data technologies

OSCAR's cadre of Visiting Investigators has grown further with the appointment of Prof. Donna Kurtz, Emeritus Professor of the University of Oxford, as Visiting Professor. A welcome addition to OSCAR's close links with eminent international academics, Prof. Kurtz will be hosted by OSCAR's Digital Health Laboratory, led by Prof. David Clifton, and work collaboratively to advance Linked Open Data and W3C International Standards of interoperability, initially for the heritage sector where data are non-sensitive.

Professor Clifton is one of seven professorial Board Members of OxLOD, Prof. Kurtz's recent social enterprise spinout from Oxford University with a mission to promote W3C standards for Linked Open Data.

As well as a distinguished career in Classical Archaeology and Cultural Heritage, Prof. Kurtz has also undertaken decades of remarkable work in data handling and web technologies. She was one of the first at the University of Oxford to attempt international data exchanges as soon as they were technically feasible. She was responsible for the creation of one of the University's early websites thanks to an EU-funded R&D project in telecommunications. Rather than continuing to write scholarly books and articles, she embraced the web, seeing its potential to reach anyone anywhere. She was also among the first in the University to adopt the Semantic Web.



Professor Donna Kurtz

- Emeritus Professor, Oxford University e-Research Centre (OeRC), Department of Engineering Science
- Emeritus Professor of Classical Art, Faculty of Classics, Oxford • Emeritus Fellow, Wolfson College,
- Oxford



OXFORD SUZHOU CENTRE FOR ADVANCED RESEARCH

Her collaboration across the four academic divisions and Museums and Collections at Oxford throughout her career, illustrates her commitment to a cross-disciplinary approach.

Her interest in China evolved from Greek archaeology through World Archaeology to the archaeologically richest and oldest culture.

In the autumn of 2019, some of Prof. Kurtz's colleagues from Shanghai Normal University, Fudan University, Shanghai Library, China Academic Digital Associative Library (CADAL library) and the Institute for the Science of Science joined her visit to OSCAR.

The Shanghai group had been able to build on work done earlier (2017) by Prof. Hongjie Sun, who spent a year in Oxford sponsored by CADAL. Despite pandemic restrictions, the group progressed. By 2021, discussions began with the Digital Team of the Palace Museum in the Forbidden City who had already decided to implement Linked Open Data technologies.

Prof. Kurtz's initial research project in OSCAR will be a pre-pilot with Chinese heritage data handled by Chinese researchers in China. A successful pre-pilot could be followed by an international data exchange between OSCAR and Oxford. The 2018 OXLOD Exemplar, funded by the University of Oxford, applied Linked Open Data technologies to Chinese objects from the University's Museums and Collections. The Semantic Web of Linked Open Data is **Web3.0** - a broader and more firmly established concept than Web3 now synonymous with cryptocurrency. Prof. Kurtz believes that everyone in OSCAR can benefit.

▼ Prof. Kurtz's and her colleagues in China visited OSCAR in 2019



OSCAR Academic Seminar Series

On Friday 10th June, OSCAR held its first academic seminar of the year and the 11th session thus far, bringing an expanded research staff and the PIs together online.

Two guest speakers invited to present their research work were OSCAR PIs Mauro Pasta, Associate Professor in the Department of Materials at the University of Oxford, and Zhongmin Qian, Professor in the Mathematics department at the University of Oxford.

The OSCAR Deputy Director Professor Mark Moloney chaired the meeting.

Talk 1 - "Platinum Single-Site Catalysts for the Hydrogen Evolution Reaction" by Prof. Mauro Pasta



Prof. Pasta's lecture focused on the research being conducted in his OSCAR lab, developing electrocatalysts for water splitting, with the goal of facilitating the production of hydrogen from green sources.

At present, 96% of the global hydrogen demand is generated by non-renewable energy sources with only 4% coming from renewables through a process called electrolysis. The predominant technology for hydrogen production by electrolysis of water is based on precious metal catalysis, which is extremely expensive, largely due to the high usage of precious metals (which accounts for a quarter of the cost of the equipment). Therefore, reducing the use of these metals is of urgent importance in hydrogen production.

During his lecture, Prof. Pasta explained that the use of monatomic catalysts instead of conventional precious metal catalysts for hydrogen production by electrolysis of water can significantly reduce the quantity of precious metals used and improve the utilization thereof.

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Talk 2 - "Duality of diffusions and Monte-Carlo simulations for time irreversible processes" by Prof. Zhongmin Qian



Prof. Qian's lecture introduced the topic of Monte-Carlo simulations for Time Irreversible Processes that includes many physical and chemical actions, such as fluid flows, diffusion, and financial activities, and that may be described or modelled by large-scale non-linear partial differential equations. Through a series of equations, Prof. Qian went on to describe how non-linearity and irreversibility cause substantial difficulties in numerically simulating their dynamics by using Monte-Carlo methods.

In the lecture, Prof Qian explained how to realize the numerical simulation of irreversible processes by the Monte Carlo method with the help of the newly discovered duality of some diffusion processes, taking fluid flows as an example.

At the end of the seminar, OSCAR Director Professor Zhanfeng Cui pointed out that the purpose of this cross-disciplinary seminar is to understand the distinct approaches and new knowledge that a different discipline can offer, as well as to meet and catch up with colleagues. Professor Moloney said that the OSCAR Academic Seminar series shows it is possible and beneficial to have meaningful discussions across vastly different disciplines.

About the speakers

Prof. Mauro Pasta is an Associate Professor in the Department of Materials at the University of Oxford, and a Tutorial Fellow at St. Edmund Hall. Throughout his career,



Mauro has focused on creating new materials with the performance and durability to enable next-generation clean energy technologies. His research currently centres on several key strategies to bring about step-change improvements to electrochemical energy storage.

Prof. Qian is interested in stochastic analysis: diffusion processes, rough path analysis and machine learning, statistical mechanics, backward stochastic differential equations and



stochastic (partial) differential equations. His research has practical application in financial innovations such as active portfolio management, exchange rates, stochastic volatility models and high-frequency data analysis. His secondary area of interest concerns research on mathematical physics in areas such as condensed matter physics, quantum fields, high energy physics and theoretical aspects of neutrinos.

OSCAR Outreach and Collaboration

OeTL explores partnership opportunity with Shangqiu Hongda Optoelectronics

Dr. Jingsong Huang, Co-PI of OSCAR's Optoelectronic Technology Lab (OeTL) and Head of Research Collaboration Alex Yang, visited Shangqiu Hongda Optoelectronics from 14th to 17th June, aiming to build on previously expressed desire to form a partnership with OeTL to develop high-quality Perovskite Thin-Films and promote the commercial application of perovskite technologies in the fields of solar cells, light-emitting devices, lasers, and imaging.



Mr. Haijun Tian (R2), Board Chairman of Hongda received Dr. Jingsong Huang (L2) and Alex Yang (L1) and introduced the OSCAR group to local government officials.

Shangqiu Hongda Optoelectronics is a high-end functional glass manufacturer, specialising in the production of BIPV glass, electric heating glass, transparent display glass, conductive glass, ultra-thin



photovoltaic glass and special optical glass for displays. As the only manufacturer in the photovoltaic industry in Shangqiu City, Henan Province, Hongda previously received support from the local government to engage in the business of roof-top PV PowerStation, in cooperation with Shanghai Electric Group. The Hongda Industrial Park covers an area of approximately 20 acres.

Foreign Affairs Officials visit OSCAR

On 14th June, Wei Shujie, Director of Suzhou Foreign Affairs Office, and his deputy, Hui Yanlan, visited OSCAR. Xu Wenqing, Secretary of Suzhou Dushu Lake Science and Education Innovation District (SEID) CPC Working Committee, Chen Miao, Deputy Director of the SEID Administration Committee, and Xu Xiaoyan, Deputy Director of SIP Foreign Affairs Office joined the visit. OSCAR General Manager Leah He briefed the group on OSCAR's formation and founding, its operations management and research collaboration.





Did you know this about SIP?

Gold Medal City of

Investment Environment

in China

World Bank

Best Commercial City

in Mainland China

Forbes

SIP boasts an internationalized, convenient environment

- No.1 in enforcing contracts globally World Bank
- No.1 among all National Economic Development Zones in terms of overall competitiveness for 6 consecutive years (2016-2021) ranked by Ministry of Commerce of China
- No.1 in the Evaluation on the Industrial Competitiveness, and Talents of Bio-pharmaceutical Industry Park in China by Ministry of Science
- "2019, 2020 the most attractive investment park in China" —— <Global Times>

SIP's performance in World Bank evaluation



Suzhou Industrial Park scores 79.6 in Doing Business, ranking 25th among 190 economies



Fortune 500 in SIP

