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Technology Transfer Office



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Success Story

Staggered structure monolayer organic field effect transistors (OFETs) | Invented by Dr Paddy K.L. Chan (Associate Professor at the Department of Mechanical Engineering) and his research team.

Event highlights

ZOOM Workshop - Invention Disclosure and Patent Process in HKU

ZOOM Webinar - Takeways from MIT Tech Transfer Expert: Industry Collaboration & Technology Commercialisation

Latest Patents Filings

2022



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SUCCESS STORY

Staggered structure monolayer organic field effect transistors (OFETs)

ABSTRACT

The invention of new electronic devices that can monitor heart health and mimic human brain activities marks a breakthrough in human-machine interfaces.

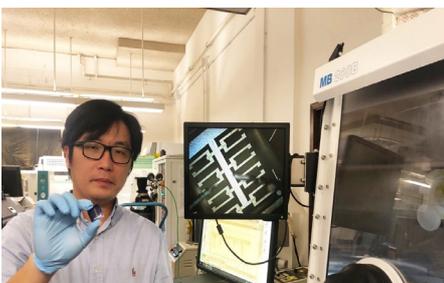


Figure 1 Dr Paddy Chan of the Department of Mechanical Engineering and research team develop the staggered structure monolayer Organic Field Effect Transistors

For many electronic devices, size is a critical consideration. When a smaller sized electronic component is also flexible, it can be used in devices that can operate in many more conditions, including inside the human body. This is now possible thanks to development of miniaturised Organic Field Effect Transistors.

Many of the latest electronics devices including integrated circuits and computer central processing units (CPUs) rely on Field Effect Transistors, or FETs, to function. Organic FETs, or OFETs, operate with an organic

semiconductor for current to flow through and offer the advantage of flexibility compared with inorganic materials, such as silicon. These OFETs have properties including high mechanical flexibility, biocompatibility and low cost production, making them potentially usable in many exciting new applications, such as roll-up display drivers, and smart wearable electronic devices or clothing that can collect vital body signals and provide biofeedback in real time. They can also be used inside mini-robots that could patrol inside the human body to diagnose diseases, transport drugs and carry out small surgical procedures other treatments. However, finding a way to make OFETs small enough for these kinds of applications while maintaining the performance levels of the transistor has been a persistent problem for scientists. Now, thanks to the invention of Dr Paddy K.L. Chan, Associate Professor and his team at the Department of Mechanical Engineering, these potential uses can be exploited. They have invented staggered structure monolayer OFETs with a record low 40 ohm-cm width of normalized contact resistance. This achievement allows OFETs to be made small enough to be used in advanced applications such as those mentioned above.

Dr Chan has also developed a new wearable electrocardiogram sensor in collaboration with Nanjing University. The sensor is powerful enough to detect unusual signals from patients with atrial fibrillation that other electrodes cannot find and could be used to warn at-risk patients of an impending stroke or heart

attack. "People wearing the new sensors can also enjoy freedom of movement, run around or even take a shower if they want, not being attached to a machine," says Dr Chan. "We have seen a breakthrough in application with the use of a new device structure."

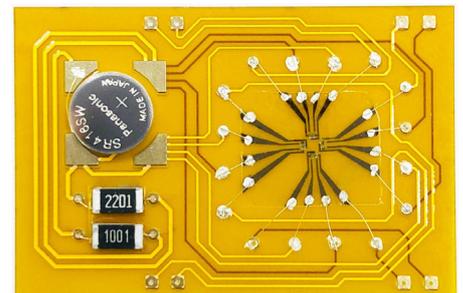


Figure 2 Portable ECG sensors based on organic monolayer OFETs

In a related experiment, Dr Chan and his team worked with Northwestern University to add 'memory' or collected signal information to an organic electrochemical transistor. That is an important milestone for enabling advanced machine learning that mimics the workings of the human brain by enhancing a device's learning function. "For example, we can integrate the memory transistors with optical sensors for image processing and computation at the same time," explains Dr Chan.

The TTO office assisted Dr Chan with filing a US patent application for the staggered structure monolayer OFETs and in arranging to showcase the invention at the InnoCarnival 2021 exhibition.

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IP00790 Prof CHEN Honglin; Microbiology (HK standard application filed on 26 Nov 2021)
 Live Attenuated Influenza B Virus Compositions
 Methods of Making and Using Thereof
 IP00837 Dr CHAN David Wai; Obstetrics and Gynaecology (HK standard application filed on 26 Nov 2021)
 苦瓜蛋白MAP30在製備預防和治療卵巢癌的藥物或化療補充劑中的用途
 IP01146 Dr. ZHANG Shiming; EEE (USP filed on 30 Nov 2021)
 A wireless, high-resolution, and smartwatch-compatible wearable data readout system for low-voltage transistor characterization
 IP01144 Prof. YAM Vivian Wing-Wah; Chemistry (USP filed on 30 Nov 2021)
 PHOTOCROMIC GERMOLE-FUSED DIARYLETHENES AND THEIR PRODUCTION THEREOF
 IP01129 Dr. CHU Zhiqin; EEE (USP filed on 1 Dec 2021)
 Methods and apparatus for an anti-counterfeiting system using color space correlated Raman spectroscopy of diamond
 IP01114 Prof WU Ed Xuekui; EEE (USP filed on 1 Dec 2021)
 SYSTEMS AND METHODS FOR RADIO FREQUENCY INTERFERENCE SUPPRESSION IN RADAR SYSTEMS
 IP01142 Dr. CHEN Jian Ping; Chinese Medicine (CN application filed on 3 Dec 2021)
 Development of isoliquiritigenin-loaded oral zein lipid hybrid nanoparticles and its anti-tumor applications
 IP00835 Prof CHOW Billy Kwok Chong; School of Biological Sciences (US Reg filed on 9 Dec 2021)
 Purmorphamine as a Small Compound Positive Allosteric Modulator of Secretin Receptor for The Treatment of Hypertension
 IP01011 Prof. POON, Leo Kit Man; School of Public Health (US Reg filed on 8 Dec 2021)
 Molecular detection of a novel coronavirus
 IP01094 Prof. CHAN Chi Fung; Paediatrics and Adolescent Medicine (US provisional filed on 8 Dec 2021)
 Methods to improve efficacy of Mesenchymal stem cells (MSC) for clinical application
 IP01011 Prof. POON, Leo Kit Man; School of Public Health (US Reg filed on 8 Dec 2021)
 Molecular detection of a novel coronavirus
 IP00995 Prof. HUANG Mingxin; ME (PCT filed on 14 Dec 2021)
 A method of Cu-Cu direct welding for packaging application in semiconductor industry
 IP00854 Prof CHEUNG Shun Pan Gary; Dentistry (US Reg filed on 14 Dec 2021)
 Micro-/Nano-Structured Anti-Biofilm Surfaces
 IP00995 Prof. HUANG Mingxin; ME (TW application filed on 14 Dec 2021)
 A method of Cu-Cu direct welding for packaging application in semiconductor industry
 ZIRI00011 Prof HUANG Lixi; ME (PCT filed on 16 Dec 2021)
 Impervious cover design for sound absorption devices
 ZIRI00012 Prof HUANG Lixi; ME (PCT filed on 15 Dec 2021)
 Impervious rangehood silencer design
 IP00857 Prof HUI Shu Yuen, Ron; EEE (EP application filed on 16 Dec 2021)
 Battery Charging System and Method Using Dynamically Adjusted Battery Voltage Threshold for Switching Charging Modes
 IP01148 Prof Kenneth Wong; EEE (US provisional filed on 16 Dec 2021)
 Hybrid optical parametrically-oscillating emitter (HOPE)
 IP01097 Dr. WONG Siu Lun; School of Biomedical Sciences (US provisional filed on 15 Dec 2021)
 High fidelity KKH SaCas9 variants for genome editing
 IP00857 Prof HUI Shu Yuen, Ron; EEE (KR application filed on 23 Dec 2021)
 Battery Charging System and Method Using Dynamically Adjusted Battery Voltage Threshold for Switching Charging Modes
 IP01015 Prof YUEN Kwok; Microbiology (PCT filed on 10 Dec 2021)
 Compositions immunogenic against influenza and SARS coronavirus 2, methods of making and using thereof
 IP01164 Prof. HUANG, Jiandong; Biomedical Sciences (US provisional filed on 20 Dec 2021)
 Method of developing a peptide-based vaccine conjugated with 1V209
 IP00860 Prof CHAN Tak Mao Daniel; Medicine (CN application filed on 23 Dec 2021)
 Compositions and Methods for Clearing Tissue

ZOOM Workshop Invention Disclosure and Patent Process in HKU

This one-hour Zoom workshop held on January 13 was designed for HKU researchers and potential PIs. More than 100 registered attendees heard detailed information about the subject from the TTO IP management team, followed by a Q&A session.



ZOOM Webinar Takeaways from MIT Tech Transfer Expert: Industry Collaboration & Technology Commercialisation

Attendees at this Zoom webinar held on January 20 heard Ms Lita Nelsen, former Director of the MIT Technology Licensing Office, share her experiences with industrial collaborations.



TECHNOLOGY COMMERCIALISATION

List of technologies Licensed in Dec 2021

Item	IP Type	PI	Faculty
A Method and Reagents to Chemically Label and Modify Peptides and Proteins	CN Patent No. ZL201510236410.0 US Patent No. 9,752,137	Prof. Xuechen Li	Science
Compositions Immunogenic Against Sars Coronavirus 2, Methods of Making, And Using Thereof	PCT Application No. PCT/CN2021/075527 US Patent Application No. 17/172,300	Prof. Honglin Chen	Medicine
Cold Adapted and Virulence Factor Deleted Live Attenuated Vaccine Suitable for Mucosal Delivery	PCT Application No. PCT/US2017/028170 and subsequent national filings in Europe, Russia, India, China, Australia, Canada, US Taiwanese Application No. 106125136	Prof. Honglin Chen	Medicine

Top 3 revenue-booked IPs in December 2021

Item	IP Type	PI	Faculty
PD-1-Based Vaccines Against Coronavirus Infection	PCT Application No. PCT/CN2021/072657 US Application No. 17/186,822	Prof. Zhiwei Chen	Medicine
Analysis of Insurance products	Contract Research/ Consultancy	Dr Eddy Lam	Social Sciences
Monitoring of air flow in city	Contract Research/ Consultancy	Dr Ren Chao	Architecture

TRANSFERRING YOUR NEW TECHNOLOGIES INTO BUSINESS OPPORTUNITIES

POLICY STIPULATION

The latest policy stipulates that the net receipts arising from the exploitation of an Invention are shared among the University, the relevant faculty/department and the inventor(s) in the ratio of 1/3 : 1/3 : 1/3. It aims to encourage the researchers at HKU not only to excel in academic performance but also to apply their technology for the benefits of mankind with an impressive reward.

HOW TO APPLY: 4 PHASES FOR RESEARCH PROJECTS

Phase 1: Initial project negotiation

1. PI will negotiate with their collaborator(s) and confirm a project proposal which includes the scope, budget and duration of the project.

2. PI will negotiate with their collaborator(s) and prepare a draft agreement (Agreement templates are available at the website of the Research Services (RS): <http://www.rss.hku.hk/contracts/contractresearch/templates>).

Phase 2: Endorsement from department/faculty

3. PI will submit the project proposal, the draft agreement, and the information form/grant application form to their department/faculty to seek an approval (The information form for research/consultancy agreements is available at: <http://intraweb.hku.hk/local/rss/tto/researchor-consultancy-agreements-form.doc>).

4. After obtaining the approval, PI will

submit the project proposal, the draft agreement, and the information form/grant application form to the Research Service (RS).

Phase 3: Financial legal/IP review

5. The RS will distribute the project proposal and the draft agreement to the Finance and Enterprises Office (FEO) for financial review and to the Technology Transfer Office (TTO) for legal review.

6. If there is any financial/legal issue, the FEO/TTO will inform PI through the RS. PI will negotiate with their collaborator(s) on the financial/legal issue until it is settled.

Phase 4: Signature and document archiving

7. After consolidating the settled project proposal and the agreement, the RS will proceed to the signature process.

8. After duly performing the signature process, the RS will assign the RCGAS number(s) for opening the project account(s)

ABOUT US

About HKUTTO

The Technology Transfer Office (TTO) is committed to maximising the impact of research through technology transfer at both the institutional and industrial levels. TTO works closely with researchers at HKU to commercialise their inventions through professional consultation on business development, legal advice and assistance, as well as patent application filings. Your inventions will not benefit society unless they are mass produced.

About Versitech

Versitech Limited is the commercial arm of HKU. Versitech negotiates, executes and manages commercial business contracts and agreements on behalf of the University.

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