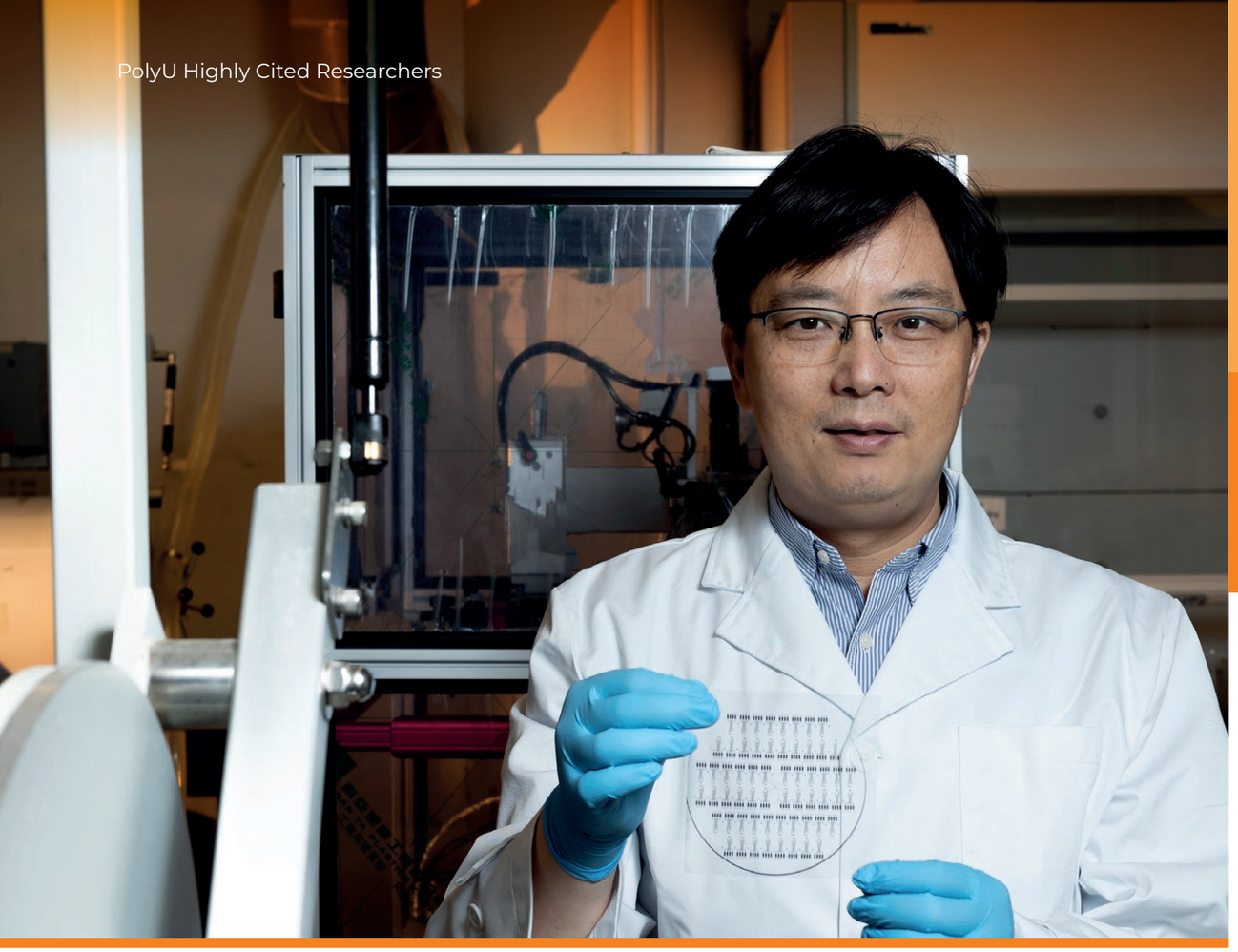

Advancing Materials Science to Attain Immense Impacts

Persistency and curiosity are crucial to achieve research breakthroughs.

Materials science is a multidisciplinary field that involves the study of the properties, structure, processing, and performance of various materials, with the ultimate goal of improving their performance for practical applications that can benefit the society.

PolyU Highly Cited Researchers

Prof. Feng YAN

Chair Professor of Organic Electronics

Professor of Department of Applied Physics

Highly Cited Researcher:

2021-2022

Clarivate Analytics

Prof. Feng YAN, Chair Professor of Organic Electronics in Department of Applied Physics at The Hong Kong Polytechnic University (PolyU) has spearheaded the research on materials science. His research on advanced materials, notably organic semiconductors and perovskite materials, has contributed to the advancement of biosensors and optoelectronic devices such as photodetectors and solar cells.

With the high number of citations across various fields, Prof. YAN's research on advanced materials have made noteworthy contributions. This is particularly significant in the fields of polymer-and perovskite–based solar cell technology and transistor-based sensors, with a focus on practical devices and applications.

Prof. YAN, said, "The recognition of being highly cited is motivating my research on material development, aimed at contributing to a sustainable future and improving human life. In-depth knowledge in pure sciences from multiple disciplines, including physics, chemistry and engineering, is fundamentally essential for conducting robust research."

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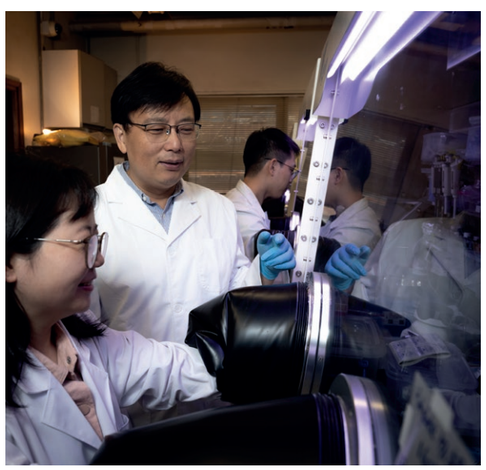
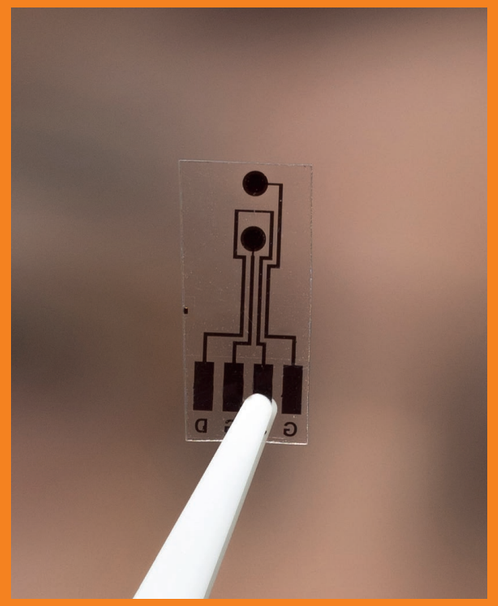


Transistor-based sensors

Prof. YAN is a global leader in organic electronics and the developer of highly sensitive transistor-based sensors for light, molecule and biomarker detections. His novel research on advanced materials, including organic semiconductors and perovskite materials, has greatly advanced biosensors, optoelectronic devices such as photodetectors and solar cells, and other technologies.

"Quantum dots are really interesting because they are highly responsive to light and make for highly sensitive photodetectors," said Prof. YAN. "But for them to work, they need to be fixed to a conductive channel of a transistor[5]. We developed a field-effect transistor using graphene as a channel and modified quantum dots with short molecular connections to create a high-performance, photo-detector system that has now been further developed for a range of industrial applications."

Prof. YAN and his team went on to extend that work to organic or two-dimensional, metal-organic framework –based transistors that can be combined with commercial biomolecular probes - molecules designed to bond to proteins and other biomolecules of interest - to create ultra-high-sensitivity and low-cost biosensors. Their device consists of an array of transistors on a chip that, when modified with the right probe, can detect various types of biomolecules at very low concentrations.



Electrochemical transistors

In his recent study, two-dimensional conjugated metal organic frameworks are proven to be excellent semiconductor materials for high-performance electrochemical transistors (ECTs) with promising applications in flexible and wearable electronics[1]. ECTs have shown broad application in bioelectronics and neuromorphic devices due to their high transconductance, low working voltage and versatile device design[2].

"We developed a bioelectronics device for detecting Sars-CoV-2, the virus responsible for COVID-19, as an ultrafast, sensitive and portable diagnostic tool[2]," said Prof YAN. "We continue to develop this biosensor system, because it can be used non-invasively with saliva to detect a range of useful biomarkers."

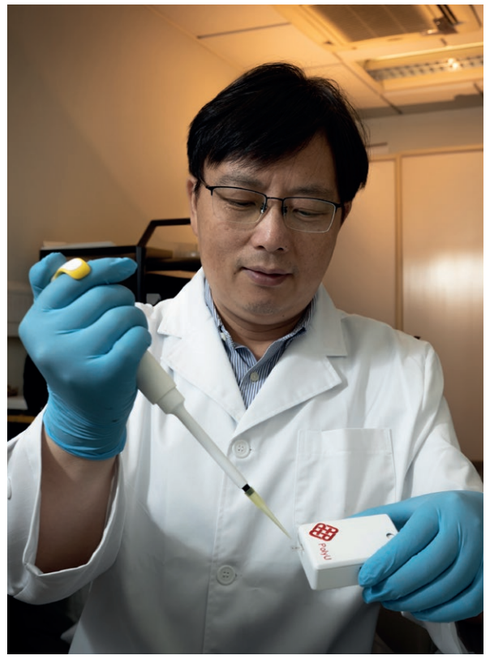
PolyU Highly Cited Researchers

Prof YAN's team is also working on perovskites - a class of inorganic crystalline materials with photoelectric properties - as another alternative to silicon-based solar cells. Prof. YAN has made significant breakthroughs that improve the efficiency and stability of perovskite solar cells in an ambient atmosphere[4] and also by using tin to replace lead, which is conventionally used in perovskites - providing a less toxic alternative[3].

Prof. YAN's global leadership in advanced materials epitomises his persistence focus on materials science that contributes to society.

This article is excerpted from the feature published by Nature Portfolio.

Reference:
https://www.nature.com/articles/d42473-023-00143-3



Research Interests

Solar Cells (Organic & Perovskite), Organic Electronics, Electrochemical Transistors

Selected Highly Cited Publications

1. F. Yan, J. Song, H. Liu, Z. Zhao, et al., 2D metal-organic frameworks for ultraflexible electrochemical transistors with high transconductance and fast response speeds, Science Advances, vol 9, Jan. 2023.
2. F. Yan, H. Liu, A. Yang, J. Song, et al., Ultrafast, sensitive, and portable detection of COVID-19 IgG using flexible organic electrochemical transistors, Science Advances, vol 7, Sept. 2021.
3. F. Yan, Q. Tai, X. Guo, G. Tang, et al., Antioxidant Grain Passivation for Air-Stable Tin-Based Perovskite Solar Cells, Angew. Chem. Int. Ed., vol 58, 2019.
4. F. Yan, Q. Tai, P. You, H. Sang, et al., Efficient and stable perovskite solar cells prepared in ambient air irrespective of the humidity, Nature Communications, 7:11106, 2016.
5. F. Yan, Z. Sun, Z. Liu, J. Li, et al., Infrared photodetectors based on CVD-grown graphene and PbS quantum dots with ultrahigh responsivity, Advanced Materials, vol 24, Nov. 2012.