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# IAPME Seminar

# Celebrating the 45th Anniversary of the University of Macau: Suppressing wide-angle light loss, ion migration and non-radiative recombination for efficient perovskite solar cells

## 14 May 2026

Prof. Guojia FANG
Wuhan Textile University

Venue: N23-4018
Time: 10:00 - 11:30
Hosted by: Prof. Guichuan XING

**Abstract**

Surface reflections and non-radiative recombinations create energy losses in perovskite solar cells (PSCs) by hindering the generation and extraction of carriers. These losses can reduce device efficiency in practical applications since the incident angle of sunlight varies throughout the day. Here, we introduce a universal strategy to address this issue by coating glass substrates with highly distributed nanoplates of fluorine-doped tin oxide (NP-FTO). An electron-selective homo-junction is then formed with a thin atomic layer deposition layer $SnO_2$ covered with $SnO_2$ quantum dots. Systematic mechanistic studies reveal the exceptional ability of NP-FTO to harvest photons omnidirectionally and its beneficial influence on perovskite crystallization. These combined effects result in substantial improvements in the short-circuit current density, open-circuit voltage, and fill factor of n-i-p PSCs under wide-angle incident light illumination. The best-performing PSC achieve a remarkable power conversion efficiency (PCE) of 26.4% (certified 25.9%) under AM 1.5G illumination. The devices also demonstrate exceptional stability, retaining 95% of their initial PCE after 1200 hours of light soaking under simulated solar intensity with maximum power point tracking. Moreover, the beneficial effects of NP-FTO are also applicable to 1.77 eV wide bandgap PSCs with a p-i-n structure, enabling the fabrication of all-perovskite tandem solar cells with a champion PCE of 28.2%.

**Biography**

Prof. Guojia FANG is a specially appointed Professor at Wuhan Textile University. He earned his Ph.D. from Huazhong University of Science and Technology (2000) and conducted postdoctoral research at Tsinghua University (2001–2003). He was a visiting scholar at Imperial College London. From 2003 to 2024, he was a Professor at Wuhan University, and he joined Wuhan Textile University in 2025 as the leader of the Advanced Energy and Future Display Technology Center. He is a recipient of the State Council Government Special Allowance and is recognized as an Elsevier Highly Cited Chinese Researcher. Prof. Fang has led multiple national key projects, including the National Key R&D Program and key projects of the National Natural Science Foundation of China (NSFC). His research focuses on optoelectronic devices, particularly perovskite solar cells, light-emitting diodes, and photodetectors. He has published over 300 SCI-indexed papers in top journals such as *Nature*, *Nature Photonics*, *Nature Energy*, *Advanced Materials*, and *Joule*.