Xi'an Jiaotong-Liverpool University 西交利物浦大学

PhD studentship (Full-time)

Institution	Xi'an Jiaotong-Liverpool University, China
School	School of Science
Supervisors	Principal supervisor: Professor John Dennis (XJTLU) Co-supervisor: Dr Eric Amigues (XJTLU) Co-supervisor: Dr George Darling (UoL)
Application Deadline	Open until the position is filled
Funding Availability	Funded PhD project (world-wide students)
Project Title	Application of flexible conductive molecular linkage for enhanced electron extraction, surface passivation, and cell stability in perovskite solar cells
Contact	Please email john.dennis@xjtlu.edu.cn with a subject line of the PhD project title. The principal supervisor's profile is linked here: https://scholar.xjtlu.edu.cn/en/persons/JohnDennis

Requirements:

A Master's degree with Merit and a Bachelor's degree with first-class or upper second-class honors are required for PhD admissions. Exceptional candidates holding only a Bachelor's degree may be considered on an individual basis in certain disciplines.

Evidence of good spoken and written English is essential. The candidate should have an IELTS (or equivalent) score of 6.5 or above, if the first language is not English. This position is open to all qualified candidates irrespective of nationality.

Degree:

The student will be awarded a PhD degree from the University of Liverpool (UK) upon successful completion of the program.

Funding:

The PhD studentship is available for three years subject to satisfactory progress by the student. The award covers tuition fees for three years (currently equivalent to RMB 99,000 per annum). It also provides up to RMB 16,500 to allow participation at international conferences during the period of the award. The scholarship holders are expected to conduct the majority of their research at XJTLU in Suzhou, China. However, they may apply for a short-term research visit to the University of Liverpool if the project requires it.

Project Description:

Solar panels made with perovskite materials are a relatively new technology that has achieved impressive efficiency in converting sunlight into electricity–even outperforming traditional silicon technology. Furthermore, they offer significant fabrication advantages over traditional silicon cells: including lower production costs, simpler room-temperature manufacturing processes, and the ability to be produced on flexible substrates. As such, perovskite solar cells are a promising option for the future of renewable energy. However, their durability remains a challenge. Tiny gaps, called pinholes, often form in an outer layer of these devices, which extracts electrons and then transports them to the relevant electrode. These pinholes allow moisture to seep in, which can irreversibly damage the entire device. The root of the problem lies in structural mismatches between the perovskite and fullerene-based electron extraction/transport layer, creating stress that leads to these gaps. This project proposes an innovative and inventive solution: a self-assembled monolayer of conductive flexible molecular "tethers" that act as connectors between the two layers. These tethers will be specially designed, with one end attaching firmly into the perovskite surface and the other into the fullerene. This flexibility allows the fullerene layer to maintain its natural unstressed structure and thereby sealing off moisture. Beyond solving the moisture issue, these tethers will improve how efficiently the solar cells by more efficient electron extraction and enhanced connections between grains in the perovskite layer. This combined approach promises to make perovskite solar cells not only longer lasting but also more efficient, paving the way for their commercialization.

Phase 1: Design and Synthesis of Molecular Tethers: Develop flexible molecular tethers to bridge perovskite and fullerene layers, focusing on efficient electron conduction and eliminating pinholes. The tethers will feature perovskite-compatible anchoring groups and fullerene terminals connected via π-conjugated backbones, optimized for charge transport.

Phase 2: Characterization and Analysis. Characterize tethers using X-ray diffraction, microscopy, spectroscopy, and conductivity measurements to assess structure, interface integration, and electron transport efficiency. Phases 1 and 2 will run in parallel to expedite development.

Phase 3: Device Fabrication and Testing. Incorporate tethers into perovskite solar cells, testing for stability (against moisture, oxygen, UV) and efficiency (PCE, photoluminescence, impedance). Compare performance with control devices to validate improvements.

Phase 4: Scalability and Applications. Evaluate large-scale tether production and compatibility with manufacturing processes. Explore application of the tether strategy to other perovskitebased devices, such as LEDs and photodetectors.

For more information about doctoral scholarship and PhD programme at Xi'an JiaotongLiverpool University (XJTLU), please visit https://www.xjtlu.edu.cn/en/admissions/global/entry-requirements/

https://www.xjtlu.edu.cn/en/admissions/global/fees-and-scholarship

How to Apply:

Interested applicants are advised to email john.dennis@xjtlu.edu.cn the following documents for initial review and assessment (please put the project title in the subject line).

- CV
- Two formal reference letters
- Personal statement outlining your interest in the position
- Certificates of English language qualifications (IELTS or equivalent)
- Full academic transcripts in both Chinese and English (for international students, only the English version is required)
- Verified certificates of education qualifications in both Chinese and English (for international students, only the English version is required)
- PDF copy of Master Degree dissertation (or an equivalent writing sample) and examiners reports available