PhD studentship (Full-time)

Institution	Xi'an Jiaotong-Liverpool University, China
School	School of CHIPS.
Supervisors	*Please list all the names in the supervisory team. It should be consistent with the information on your approved PGRS proposal.* Principal supervisor: Professor/Dr Jie Zhang (XJTLU) Co-supervisor: Professor/Dr Wei Chen (XJTLU) Co-supervisor: Professor/Dr Wen Liu (XJTLU) Co-supervisor: Professor/Dr Wenqing Liu(UoL)
Application Deadline	Open until the position is filled
Funding Availability	Funded PhD project (world-wide students)
Project Title	GaN P-Channel Heterojunction Field-Effect Transistors for CMOS Circuit
Contact	Please email Jie.Zhang06@xjtlu.edu.cn (XJTLU principal supervisor's email address) with a subject line of the PhD project title. The principal supervisor's profile is linked here: https://scholar.xjtlu.edu.cn/en/persons/JieZhang06

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:

There is a growing need for high-performing p-FET semiconductors as demand for semiconductors is increasing. Although etching is the dominant method to produce p-FET, dry etching can significantly reduce device performance due to interface damage. Therefore, it is crucial to address this issue to optimize electrical properties after dry etching. This study aims to use different chemical agents (acids and bases) in a wet environment to treat the damaged interface and enhance the electrical performance.

The presence of a 2D electron gas in GaN HEMT renders GaN high electron mobility transistors as constant junction devices. To achieve more advanced applications, the primary challenge that needs to be addressed for GaN semiconductor materials is the establishment of a stable and reliable GaN p-FET process. Among the existing preparation methods, etching to create a recessed p-FET below the gate proves to be an effective approach. However, limitations arise from issues such as material uniformity and defects after etching, as well as controlling thickness at critical points. Additionally, dry etching can impair the performance of GaN p-FETs. Interface treatment emerges as a promising solution to tackle these problems.

Recently, several studies have focused on interface treatment for GaN P-FETs after dry etching with aims to reduce surface roughness, enhance dielectric layer nucleation, and address surface contamination including particles, metals, and other chemicals. It has been proposed that defects and nitrogen vacancies may form in the crystal structure during the etching process of GaN gate p-FETs. In 2024, Jin Wei et al. developed a post-etching wet treatment method to mitigate damage caused by dry etching. Experimental results demonstrate that current density of p-FET treated with wet process is over two times higher than the performance of untreated P-FETs. Wet chemical treatment effectively mitigates this issue by passivating dangling Ga bonds or compensating for N vacancies. However, existing research in this area remains insufficient and limited due to inadequate availability of reported reagents. Therefore, further investigation is warranted to identify more suitable reagents that can yield desired outcomes.

For more information about doctoral scholarship and PhD programme at Xi'an Jiaotong-Liverpool 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 Jie.Zhang06@xjtlu.edu.cn (XJTLU principal supervisor's email address) 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