

XJTLU-XJTU-UoL Joint Doctoral Supervision Project (Full-time)

Reference No.	SFXJTU2501
XJTLU School	School of Advanced Technology
PhD Programme	Electrical and Electronic Engineering
Supervisors	XJTLU supervisor: Dr Quan Zhang XJTU supervisor: Professor Yi Wu UoL supervisor: Professor Joseph Yan
Project Title	Study on SF6 Alternative Gases Based on Thomson and Schlieren Optical Diagnostics 基于汤姆逊及纹影光学诊断的 SF6 替代气体研究
Application Deadline	Open until the position is filled

Requirements:

A UK first-class or upper second-class honours Bachelor's degree and a UK Master's degree with Merit (or their equivalent) are required for PhD admissions. Exceptional candidates holding only a Bachelor's degree may be considered on an individual basis.

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.

For more information about entry requirements and admission procedures of PhD programme at XJTLU, please visit:

[Entry Requirement - Xi'an Jiaotong-Liverpool University](#)

[How to Apply - Xi'an Jiaotong-Liverpool University](#)

Programme Structure:

Doctoral students in the joint programme are registered with both XJTLU and the UoL. Upon successful completion of the programme, the students will be awarded a PhD degree from University of Liverpool.

During their doctoral studies at XJTLU, students are expected to conduct research at XJTU as visiting students. Additionally, students have the opportunity to apply for a three to six-month research visit to UoL.

Project Description:

Replacing SF₆ with environmentally friendly gas media in high-voltage electrical equipment is essential for the green transformation and upgrading of the power industry. Current experimental studies on eco-friendly gases for arc interruption primarily focus on macroscopic characteristics such as insulation performance, arc quenching properties, and gas recovery

characteristics. However, the microscopic mechanisms of arcs remain unclear, necessitating diagnostics and investigations of arc micro-parameters such as electron density and electron temperature. Thomson scattering, recognized as the most accurate method for electron density measurement, has been widely used in plasma diagnostics. Nevertheless, its application to gas arcs in electrical switches has been limited due to the high precision required for calibration and the challenges of measuring gas arcs. Schlieren imaging, highly sensitive to refractive index changes, is mainly used in aerodynamic analysis and post-arc quantitative studies. This study establishes a Thomson scattering and Schlieren optical diagnostic platform tailored for gas arc measurements on a circuit breaker prototype. It conducts comprehensive diagnostics across all stages of the arc process—burning, current zero, and post-arc—on various eco-friendly gas mixtures, including SF₆ alternatives like C₄F₇N and C₃F₆ mixtures. Key arc parameters, such as temperature fields, pressure fields, electron density, and electron temperature, are measured, enabling an in-depth investigation of the mechanisms underlying eco-friendly gas arcs in high-voltage equipment. Additionally, magnetohydrodynamic (MHD) simulations are performed on the circuit breaker prototype. This integrated approach combines arc burning to post-arc analysis, macro- to micro-level studies, experimental to simulated validations, and laboratory to practical applications, presenting a holistic SF₆ alternative gas research framework. This research is important for development of the next generation environmentally friendly electrical apparatus.

Joint Supervisory Team:

XJTLU supervisor: [Dr Quan Zhang](#)

XJTU supervisor: [Professor Yi Wu](#)

UoL supervisor: [Professor Joseph Yan](#)

How to Apply:

Interested applicants are advised to email Dr Quan Zhang (Quan.Zhang@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