

### PhD studentship (Full-time)

Institution	Xi'an Jiaotong-Liverpool University, China
School	Design School
Supervisors	Principal supervisor: Dr Tianhong Gu (XJTLU)  Co-supervisor: Dr Qingquan Lai (JITRI)  Co-supervisor: Prof Konstantinos Papadikis (XJTLU)  Co-supervisor: Dr Haifei Zhang (UoL)
Application Deadline	Open until the position is filled
Funding Availability	Funded PhD project
Project Title	Flash annealing processing and microstructure engineering of UFG fibrous quenching & partitioning steels 超细层状 Q&P 钢的快速退火工艺与组织工程
Contact	Please email <a href="mailto:tianhong.Gu@xjtlu.edu.cn">tianhong.Gu@xjtlu.edu.cn</a> (XJTLU principal supervisor's email address) or <a href="mailto:lai@njtech.edu.cn">lai@njtech.edu.cn</a> (JITRI supervisor's email) with a subject line of the PhD project title

#### **Requirements:**

The candidate should have an undergraduate degree with a first-class or upper second-class honours degree, and/or a master's degree with distinction or merit (or equivalent qualification) in Materials Science and Engineering or Mechanical Engineering. The candidate is desirable to have a strong background in materials processing, solid mechanics, mechanical testing and microstructure characterisation and be familiar with computer programming (Matlab, etc).

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

**Please note that the joint PhD project is industry-based and the candidate is expected to undertake part of the research at the partner organization in China.**

#### **Degree:**

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

### **Funding:**

This PhD project is a collaborative research project between XJTLU (<http://www.xjtlu.edu.cn>) in Suzhou and JITRI (Jiangsu Industrial Technology Research Institute) Yangtze Delta Region Institute of Advanced Materials. The student will be registered as an XJTLU PhD student but is expected to carry out the major part of his or her research at the Institute in Yangtze Delta Region Institute of Advanced Materials.

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). In addition, during the period of undertaking main research at the institute in Suzhou, the PhD candidate will be provided with a monthly living allowance at a standard RMB 5000/month per month by the Yangtze Delta Region Institute of Advanced Materials.

### **Project Description:**

The stringent requirements in weight saving and passenger safety in the automotive industry have driven the increasing application of advanced high-strength steels (AHSS). Quenching-&-Partitioning (Q&P) steels are a promising grade of the 3rd generation AHSS, which demonstrates a desired combination of strength, and ductility. However, the Q&P steels involve cracking-related issues, e.g., local formability, indicating a need to improve the fracture resistance. This project aims at developing a novel strategy in microstructure engineering of Q&P steels, using the technique of flash annealing to push the limit of size reduction of the constituent phases. The internal size effects on phase stability, deformation heterogeneity and fracture resistance will be explored systematically. A guideline for developing AHSS with optimized mechanical performance will be developed in this research.

In this project, the novel technique of flash annealing will be used to develop an efficient process route for ultrafine-grained lamellar Q&P steels. Taking advantage of the ultrahigh heating rate, as well as the addition of the microalloying element of Nb and the design of nanoscale initial microstructure, UFG lamellar structure could be generated by thermal cycles. In addition, both lamellar DP steels and Q&P steels with similar features can be obtained for clear comparison. A systematic characterization campaign will be conducted to clarify the microstructure evolution under extreme processing conditions. The hypothesis of this microstructure engineering effort is based on the significant internal structure size effect on retained austenite stability, deformation heterogeneity and damage resistance. Therefore, the transformation kinetics and mechanism of the retained austenite are first investigated in order to correlate to the strain-hardening response. Micro- and meso-scale mapping of strain distribution and microstructure evolution will be integrated for a multi-scale understanding of the resistance to plastic localization of the novel microstructure.

Thereafter, fracture mechanics tests are designed to measure the resistance to crack initiation and propagation, in order to assess the fracture properties with physically-based quantities. High-resolution DIC and X-ray tomography will be applied to unravel the physical origin of the fracture resistance.

For more information about doctoral scholarship and PhD programme at Xi'an Jiaotong-Liverpool University (XJTLU): Please visit

<http://www.xjtlu.edu.cn/en/study-with-us/admissions/entry-requirements>

<http://www.xjtlu.edu.cn/en/admissions/phd/feescholarships.html>

### **Supervisor Profile:**

#### **Principal Supervisor:**

Dr Tianhong Gu is presently an Assistant Professor in Materials Science and Engineering at Xi'an Jiaotong-Liverpool University (XJTLU). Previously she pursued material research in the UK as a Research Associate at Imperial College London and a Research Fellow at the University of Birmingham, with a focus on material microstructure control & design, in-situ micromechanical testing & microstructural characterisation and materials modelling to develop cross-disciplinary solutions for the next generation high-performance and substantial-reliability engineering materials in aerospace, automotive, electronics and nuclear applications. She is a specialist in understanding micromechanical deformation and microstructure, as well as in-situ microscope methods and analysis.

#### **JITRI co-supervisor:**

Dr Qingquan Lai is a professor of Yangtze Delta Region Institute of Advanced Materials and Nanjing Tech University. He is interested in developing novel advanced steels with optimized balance of strength, ductility and fracture toughness, and in developing the structure-properties relationship of engineering materials with sophisticated microstructures. He has published more than 30 peer-reviewed papers in respected journals, including Nature Communications, Science Advances, Acta Materialia, and International Journal of Plasticity, and serves on the associate editorial board of Materials Research Letters and Acta Metallurgica Sinica. Besides the fundamental enthusiasm, he has been working closely with the industry (General Motors, Bao Steel, etc).

### **How to Apply:**

Interested applicants are advised to email [tianhong.Gu@xjtlu.edu.cn](mailto:tianhong.Gu@xjtlu.edu.cn) (XJTLU principal supervisor's email address) or [lai@njtech.edu.cn](mailto:lai@njtech.edu.cn) the following documents for initial review and assessment (please put the project title in the subject line).

- CV
- Two reference letters with company/university letterhead
- Personal statement outlining your interest in the position
- Proof of English language proficiency (an IELTS score of 6.5 or above)
- Verified school 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