PhD studentship (Full-time)

Institution	Xi'an Jiaotong-Liverpool University, China
School	School of Science
Supervisors	Principal supervisor: Dr Tianhong Gu (XJTLU) Co-supervisor: Professor Peng Jia (JITRI) Co-supervisor: Dr Guobin Gong (XJTLU) Co-supervisor: Dr Jiafeng Zhou (UoL)
Application Deadline	Open until the position is filled
Funding Availability	Funded PhD project
Project Title	On improving the mechanical and magnetic properties of Fe-based amorphous alloys by utilizing the memory effect 利用记忆效应改善铁基非晶合金力学以及磁学性能研究
Contact	Please email Tianhong.Gu@xjtlu.edu.cn or pjia@epm.neu.edu.cn with a subject line of the PhD project title

Requirements:

The candidate should have a first class or upper second class honours degree, and/or a master's degree with distinction or merit. For Chinese universities, GPA ≥ 3.5/4.0 or 80-85/100) (or equivalent qualification) in Materials Science, Metallurgy, or related fields. Proficiency in numerical analysis is a plus.

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.

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) Materials Academy, 长三角先进材料研究院. 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 Materials Academy, JITRI长三角先进材料研究院.

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 institute in Suzhou, the PhD candidate will be provided with a monthly living allowance at a standard RMB 5000 per month by JITRI.

Project Description:

On improving the mechanical and magnetic properties of Fe-based amorphous alloys by utilizing the memory effect

In the era of 6G communication and intelligent computing convergence, computing power, as the core engine of digital civilization, has become a strategic high ground in national technological competitiveness. The construction of high-performance computing systems imposes extreme demands on miniaturization, high power density, and high-frequency performance of inductors. Traditional silicon steel materials, limited by grain boundary eddy current effects, increasingly fail to meet the high-frequency magnetoelectric conversion requirements for 6G micro-base stations and smart edge devices. Fe-based amorphous alloys, with their ultra-high saturation magnetic flux density and superior soft magnetic properties (2-3 orders of magnitude lower in coercivity than silicon steel), have successfully resolved the conflict between high-frequency losses and power density. These alloys have already replaced silicon steel as the mainstream material in applications such as transformer cores.

Fe-based amorphous alloys are produced through rapid cooling of molten alloys, resulting in significant residual stress within their structure. The presence of residual stress significantly compromises their soft magnetic properties. Therefore, these alloys must undergo annealing below the crystallization temperature before practical application to relieve internal stress and optimize magnetic performance. Unfortunately, this annealing process typically induces structural relaxation (annihilation of free volumes), leading to material embrittlement. The embrittled cores are prone to material shedding during operation, causing incomplete magnetic circuits and short circuits. These failures not only directly threaten device reliability but also pose significant safety risks to public infrastructure. Consequently, resolving the embrittlement caused by structural relaxation represents a critical scientific and technological challenge for achieving safe and widespread application of soft magnetic iron-based amorphous alloys.

This project innovatively integrates the two-step annealing protocol required for activating memory effects into the thermal treatment of iron-based amorphous alloys. By implementing this approach, we aim to simultaneously eliminate residual stress and

achieve post-relaxation structural rejuvenation, thereby realizing concurrent enhancements in both mechanical and magnetic properties of the material.

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

Supervisor Profile:

Principal Supervisor:

Dr Tianhong Gu is presently an Assistant Professor in Materials Science and Engineering at Xian Jiaotong-Liverpool University (XJTLU). Previously she pursued material research in the UK at University of Cambridge, Imperial College London and 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 Peng Jia is presently a Professor in Yangtze Delta Region Advanced Materials Research Institute and Northeastern University. Previously she pursued material research in the Institute of Metal Research, Chinese Academy of Sciences. She has published more than 30 papers in high-level SCI indexed journals such as JMST, JAC, and Scripta, granted 3 national invention patents, conducted three National Natural Science Foundation projects. She is interested in the following research areas: a. Research on the structure and properties of amorphous alloys, b. Advanced manufacturing of amorphous and high entropy alloys, c. Research on surface structure and performance optimization.

How to Apply:

Interested applicants are advised to email Tianhong.Gu@xjtlu.edu.cn or pjia@epm.neu.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