TUS
Technological University of the Shannon:
Midlands Midwest
Ollscoil Teicneolaíochta na Sionainne:
Lár Tíre Iarthar Láir

POSTGRADUATE RESEARCH OPPORTUNITY

PhD Opportunities in Sustainable Energy Materials

Hydrogen Energy Innovation Research Group, Technological University of the Shannon (TUS), Moylish Campus, Limerick, Ireland

Website: Research Centres and Groups - TUS

We are seeking highly motivated candidates for two fully funded PhD positions in the field of advanced polymer composites and sustainable hydrogen storage materials. These projects will contribute to the development of innovative solutions for clean energy technologies and high-performance materials.

Project 1: Development and Characterisation of Environmentally Friendly Hydrogen Storage Composites with Enhanced Adsorption Capacity

Hydrogen is a promising clean fuel, but safe and efficient storage remains a major challenge. This project focuses on developing solid-state hydrogen storage composites by integrating magnesium hydride (MgH_2), carbon nanotubes (CNTs), sustainable carbon materials (SCMs), and polymers. The research will combine synthesis and fabrication of nanocomposites with structural and functional characterisation (XRD, SEM, Raman, FTIR, gas sorption analysis) to identify materials with high hydrogen capacity (>7 wt%), improved stability, and long cycle life. Computational modelling and machine learning will complement experiments to accelerate material optimisation, with applications in hydrogen fuel cells and sustainable energy systems.

Project 2: Multiscale Computational and Experimental Investigation of Polymer Composites for Enhanced Microstructural and Mechanical Properties

This project combines computational modelling and experimental validation to investigate the microstructural and mechanical performance of polymer composites reinforced with MgH_2, nanofibers, and CNTs. A multiscale simulation framework will be employed, ranging from atomic-scale molecular dynamics (bonding, diffusion, interfacial interactions), to mesoscale coarse-grained modelling (phase separation, self-assembly), to macroscopic finite element analysis (strength, stiffness, fracture toughness). Experimental techniques (SEM, XRD, Raman, TGA) will validate the models, enabling robust predictions of composite behaviour. The project aims to establish design principles for next-generation composites with optimised performance for advanced applications.

Funding & Support

- **€2000/month stipend**
- **Tuition fees covered**
- **Access to state-of-the-art laboratories and computational resources**
- **Interdisciplinary supervision in an international research environment**

Eligibility

- Master's or strong Bachelor's degree in Materials Science, Chemistry, Chemical/Mechanical Engineering, or a related discipline
- Background in nanomaterials, composites, modelling, or spectroscopy is an advantage
- Strong analytical, experimental, and communication skills

How to Apply

Applicants should send the following as a single PDF by Friday, 05/09/2025:

- **CV**
- **Cover letter (specify preferred project)**
- **Academic transcripts**
- **Application form**

Duration of Project: 48 months

Type of Degree Offered: PhD

Minimum Qualifications/Experience Necessary/Any Other Requirements:

Applicants should have a strong academic background in mechanical engineering, civil engineering, materials science, chemistry, chemical engineering, or related fields. Specifically, candidates should hold a bachelor's degree with a Minimum classification of 2.1 honours or equivalent in one of the following relevant undergraduate programs:

- Mechanical Engineering with a focus on materials
- Civil Engineering with a focus on materials
- Materials Science
- Chemical Engineering

The successful candidate should possess a strong foundation in the development of composite materials or a related field. Specifically, applicants should meet the following criteria:

- **Strong Analytical Skills:** Proficiency in analytical techniques and methodologies, including but not limited to SEM, XRD, and FTIR. The ability to use these techniques to confirm the incorporation of functional groups, assess porosity, and evaluate composite structural integrity is essential.
- **Experimental Aptitude:** Experience with experimental work, including handling laboratory equipment and setups, particularly in characterising material properties and hydrogen storage measurements.
- **Mechanical Understanding:** A solid understanding of material mechanics, with the ability to perform mechanical testing on polymer composite materials subjected to static compression, low-velocity impact, and blast loading.
- **Statistical and Machine Learning Skills:** Proficiency in statistical mathematics, multiscale modelling and an understanding of machine learning techniques, particularly in the context of developing empirical predictive models using ANN.
- **Sustainability Focus:** An interest in the sustainability aspects of energy storage materials and the broader applications in hydrogen fuel cells and energy technologies.
- **Team Collaboration:** Strong teamwork and communication skills are essential for collaborating effectively with fellow researchers and contributing to a cohesive research environment.

Applicants must have a minimum overall score of 6.5 on the IELTS test, with no individual component score (Reading, Writing, Listening, Speaking) falling below 6.0.

Research Supervisors:

Lead Supervisor: Dr Amit Haldar

For further information, please don't hesitate to contact Dr Amit Haldar at his email address: amit.haldar@tus.ie.

Download Application Form at

Applications will be accepted until a suitable candidate is identified. Early application is encouraged, as the position may be filled prior to a specific closing date.

Please submit your completed application: amit.haldar@tus.ie

Please reference Project Acronym **SEAI_Hydrogen** in all correspondence.