Information on Postgraduate Research Scholarship - Ref: Eng-PhD-15-25			
Faculty:	Engineering and Science	**Department:**	School of Engineering
Lead Supervisor:	Dr Ayse Cagla Balaban		
Project Title:	Demonstration of Absorption Contactors using Ionic Liquids in Sandwich Composite Materials for CO_2 Capture and Conversion		
Project Description: (maximum 500 words)	This PhD project explores a novel, interdisciplinary approach to carbon capture and utilisation (CCU) by transforming advanced sandwich composite materials into multifunctional CO_2 absorption and conversion systems. The research aims to repurpose carbon fibre and PVC foam/epoxy sandwich composites as mechanically robust, reactive contactor units capable of both capturing CO_2 and converting it into value-added products within a single integrated structure. Conventional carbon capture and storage (CCS) technologies are often energy-intensive, costly, and limited by solvent degradation and regeneration requirements. Integrating carbon capture directly with utilisation offers a more sustainable alternative, reducing energy demand while enabling the production of useful chemical products. This project addresses this challenge by combining expertise in composite materials engineering and chemical process design. The research will focus on the functionalisation of carbon fibre and PVC foam/epoxy composites with ionic liquids (ILs), which are recognised for their high CO_2 selectivity, thermal stability, and suitability as catalytic media. Certain ionic liquids are particularly effective in promoting cycloaddition reactions, enabling the conversion of CO_2 into cyclic carbonates, one of the few commercially viable routes for CO_2 utilisation. By embedding these reactive liquids within composite structures, the project aims to create multifunctional materials that provide both structural integrity and chemical functionality. Building on existing mechanically characterised flat carbon fibre and PVC foam/epoxy sandwich composites manufactured using vacuum-assisted resin infusion moulding (VARIM), the project will extend this foundation through surface activation and IL impregnation. In parallel, new curved composite specimens will be fabricated to investigate how geometry influences gas transport, capture efficiency, and long-term structural performance. Inspired by hollow fibre membrane contactors, which are widely used in gas–liquid absorption due to their high mass transfer area, the project seeks to replicate and enhance this functionality within structurally robust composite systems. The PhD will involve an experimental programme combining material functionalisation, CO_2 absorption–desorption testing, mechanical and fracture characterisation, and product identification. Computational		

	modelling using finite element analysis (FEA) and computational fluid dynamics (CFD) will support experimental findings and provide insight into structure–function relationships. This research offers a new direction for low-carbon materials engineering by merging advanced composites with reactive chemical systems. The outcomes will contribute to the development of sustainable CCU technologies, advance knowledge in multifunctional composite materials, and support the University's strategic themes in Advanced and Sustainable Materials and Net Zero Technologies. The project is well-suited to high-quality national and international PhD candidates with backgrounds in engineering, materials science, or chemical engineering, and provides a strong platform for future externally funded research. This scholarship is awarded competitively, and all applications are carefully reviewed. While we cannot guarantee an offer, we encourage strong candidates to apply.
Duration:	3 years, Full-Time Study or 6 years, Part-Time Study

Support available (subject to satisfactory performance):

A successful Home candidate will receive:

- A Full tuition fee waiver at the university Home-student rate for the specified duration of the scholarship

A successful International candidate will receive:

- A tuition fee waiver for 50% of the International-student rate for the specified duration of the scholarship.

Tuition fees are subject to annual increases.

This scholarship does not include funding for living expenses.

Person Specification of Essential (E) or Desirable (D) requirements:

Criteria:	**E or D**
Education and Training:	
• 1st Class or 2nd class, First Division (Upper Second Class) honours degree or a taught master's degree with a minimum average of 60% in all areas of assessment (UK or UK equivalent) in a relevant area to the proposed research project	**E**
• For those whose first language is not English and/or if from a country where English is not the majority spoken language (as recognised by the UKBA), a language proficiency score of at least IELTS 6.5 (in all elements of the test) or an equivalent UK VISA and Immigration secure English Language Test is required, if your programme falls within the faculty of Engineering and Science a language proficiency score of at least IELTS 6.5 overall with a minimum of 6.0 in all elements of the test or an equivalent UK VISA and Immigration secure English Language Test is required. Unless the degree above was taught in English **and**	**E**

obtained in a majority English speaking country, e.g. UK, USA, Australia, New Zealand, etc, as recognised by the UKBA.	
Experience & Skills:	
• Previous experience of undertaking research (e.g. undergraduate or taught master's dissertation)	**E**
• Experience or demonstrated interest in experimental, laboratory-based, or applied engineering research, including materials testing, process experimentation, or related practical investigations.	**E**
• Ability to analyse and interpret experimental or numerical data, with basic familiarity with data analysis, modelling, or simulation tools relevant to engineering research.	**E**
• Familiarity with numerical modelling and/or finite element analysis (FEA) software (such as ANSYS, ABAQUS, etc.) or a willingness to develop these skills during the PhD.	**D**
• Good written and verbal communication skills**,** with the ability to document research activities clearly and engage with interdisciplinary research teams.	**E**
Personal Attributes:	
• Understands the fundamental differences between a taught degree and a research degree in terms of approach and personal discipline/motivation	**E**
• Able to, under guidance, complete independent work successfully	**E**
Other Requirements:	
• This scholarship may require Academic Technology Approval Scheme approval for the successful candidate if from outside of the EU/EEA	**E**
• The scholarship must commence before 15th July 2026 (offers will be withdrawn if this condition is not met)	**E**

Closing date for applications:	***midnight UTC on 20th February 2026***
For further information contact:	***Dr Ayse Cagla Balaban*** ***Ayse.Balaban@greenwich.ac.uk***

Making an application:

Please read this information before making an application. Information on the application process is available at: https://www.gre.ac.uk/research/study/apply/application-process. Applications need to be made online via this link. **No other form of application will be considered**.

All applications **must include** the following information. **Applications not containing these documents will not be considered.**

- **Scholarship Reference Number (*insert reference*)**– included in the personal statement section together with your personal statement as to why you are applying
- **a CV including 2 referees** *
- **academic qualification certificates/transcripts and IELTs/English Language certificate if you are an international applicant or if English is not your first language or you are from a country where English is not the majority spoken language as defined by the UK Border Agency** *

**upload to the qualification section of the application form. Attachments must be a PDF format.*

Before submitting your application, you are encouraged to liaise with the Lead Supervisor on the details above.

September 2021