

Department	School of Engineering and the Built Environment
Supervisors	Prof. Islam Shyha, Dr Suha Jaradat
Project Title	Recycling Polymeric-based Composites for Construction Applications

PROJECT DESCRIPTION

In the UK, glass fibre-reinforced plastic (GFRP) contributes to 75,000 tons end of life waste in addition to 6,200 tons of production waste. Because 90% of the UK's FRP currently goes to landfill, the development of recycling solutions for composites is necessary. This is also due to the recent adoption of strict environmental legislation (such as the EU's End of Life Vehicles Directive which aims to reduce the automotive waste disposed of in landfill by setting targets for reuse, recycling, and recovery of materials). This has also led to increased restrictions and costs of composite landfill disposal (Composite in Manufacturing, CIM December 2019). On the other hand, the use of composite materials is considerably rising in many industries including construction, aerospace, automotive, sports and medical equipment. Polymeric composites, such as carbon fibre-reinforced plastic CFRPs and GFRPs, are typically manufactured by laying up pre-impregnated sheets and hence machining processes are necessary to achieve the required geometrical & dimensional accuracy and create features such as holes for assembly.

Roughly construction creates a third of the world's overall waste. This interdisciplinary project aims to critically investigate different methods of recycling/reusing composite waste (either as production waste or end-of-life waste) to develop strategies for manufacturing functionalised construction structures entirely/partially made from waste. The project is experimentally based and will include the use of equipment such as 3D printers, a CNC machining centre, and optical and electron microscopy. The models will be validated using experimental results and then will be used in a detailed parametric study. Finally, a new set of design equations based on experimental and numerical studies will be developed to determine the structural capacities of GFRP and CFRP composite structures made of recycled materials that can be used in different fields including construction.

Perspective applicants are encouraged to contact the Supervisor before submitting their applications. Applications should clearly refer to the project you are applying for and the name of the supervisors.

Academic qualifications

A first degree (at least a 2.1) ideally in Mechanical or Materials Engineering with a good fundamental knowledge of Materials Science, Sustainable Design and Construction.

English language requirement

IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. [Full details of the University's policy](#) are available online.

Essential attributes:

- Experience of fundamental materials, manufacturing and CAD
- Competent in conducting experimentations in the lab and working in a team
- Knowledge of engineering design, sustainable building design and construction practices
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:

Some understanding of materials processing, testing and composite materials, and architectural engineering.

Indicative Bibliography	https://doi.org/10.1016/j.aiepr.2021.03.001 https://doi.org/10.1016/j.compositesb.2021.108689 https://doi.org/10.1038/s41598-022-09932-0
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