CORE

A world first?

A team of academics has created a high performance racing kayak out of recycled carbon fibre and entered an International Canoe Race.

A team of academics (engineers and scientists) has developed new techniques to recycle composite materials to make high performance goods.

They processed waste carbon fibre to produce sufficient material to make a racing kayak to a high specification, which was manufactured by specialist kayak makers in Devon. They put the kayak to the ultimate test by entering the International Canoe Race from Devizes to Westminster.

The making of the kayak from reinforced composite materials is believed to be a world first. The team from the EXHUME project is doing this to show that goods with a high specification can be manufactured from recycled composites.

Composites are very difficult to recycle. The team, led by Professor Gary Leeke, at Cranfield University and an honorary researcher at University of Birmingham, has developed a technique to recover a super strength fabric from recycled composites.

Professor Leeke is also an enthusiastic kayaker and, having previously taken part in the International Canoe Race, he thought that creating a kayak out of the new material would be a good way to showcase it.

Professor Leeke was so confident in the kayak that he raced it 85 miles non-stop with his teammate Professor Liam Grover.

EXHUME is a partnership between the Universities of Birmingham, Cranfield, Exeter and Manchester, funded by the Engineering and Physical Sciences Research Council (EPSRC). It is a project to develop new and resource efficient, composite recycling and re-manufacturing processes in collaboration with industry.

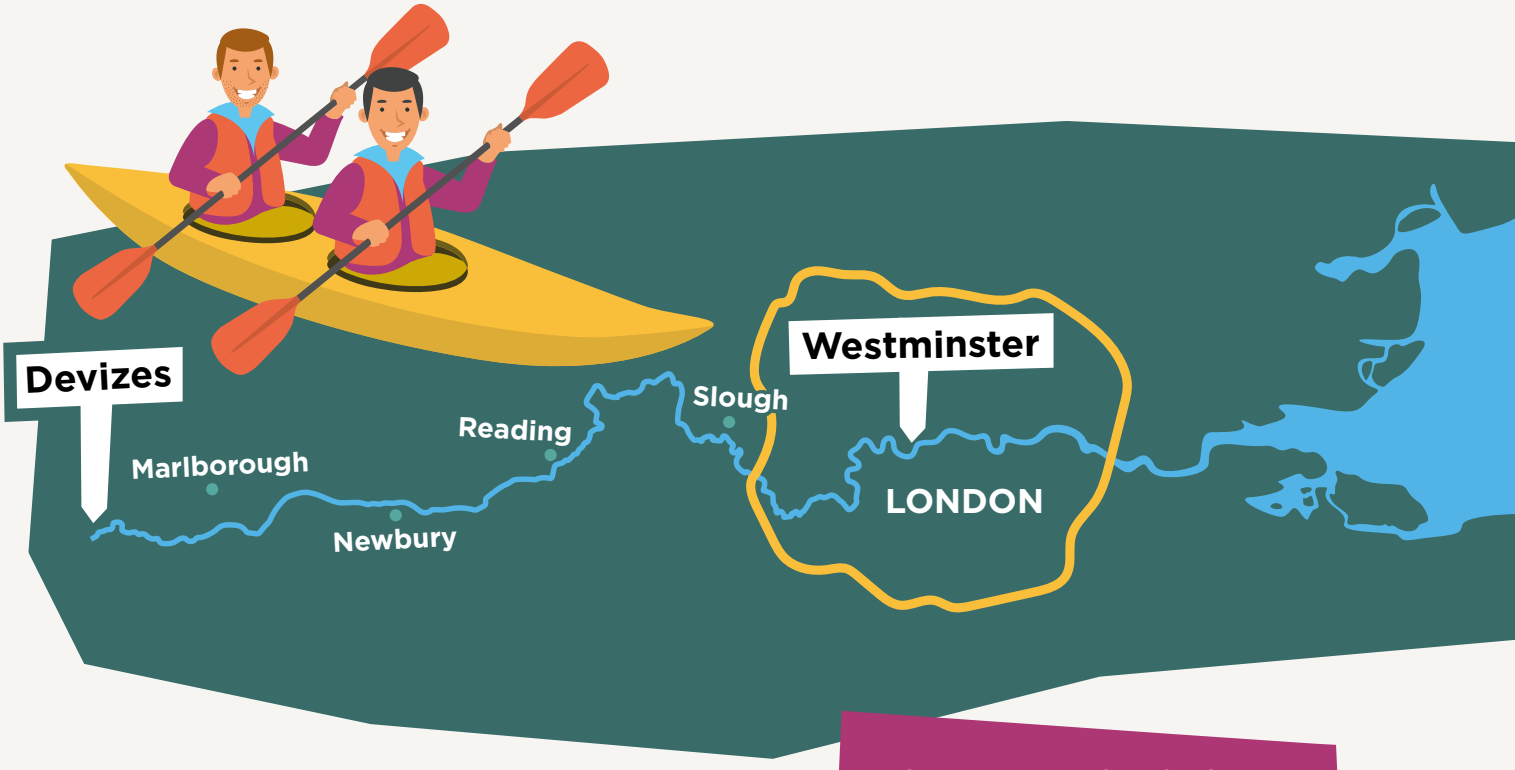
Creative Outreach for Resource Efficiency (CORE) helps the EXHUME project to communicate its work and promotes understanding of the circular economy and resource efficiency to the wider public. CORE helps academics to 'get out of the lab'.

International Canoe Race
The Devizes to Westminster International Canoe Race starts in Devizes, Wiltshire, finishing just downstream of Westminster Bridge in central London, opposite the Houses of Parliament. The race, which is 125 miles long and has 77 portages, has been held over Easter Weekend since 1948.

The first 52 miles are along the Kennet and Avon Canal to Reading, the next 55 miles are on the River Thames to Teddington. The final 17-mile section is on the tidal portion of the Thames.

The race is a severe test of planning and skill as well as physical and mental stamina. It is compared to climbing Everest. The team paddled for 16 hours non-stop and had to retire due to injury, not helped by the appalling weather conditions of Storm Katie.

However, the kayak excelled and Professor Leeke and Dr Grover are already planning to enter the kayak next year.



Making the kayak
It is believed to be the first time in the world that a carbon fibre kayak has been made out of recycled composites and it is one of a few products made out of recycled carbon fibre that exist worldwide.

Professor Leeke and his team developed a process to recycle composite material. They processed the material using a solvent-based technique. It was then taken to Kirton Kayaks in Devon where it was made into a high performance lightweight kayak.

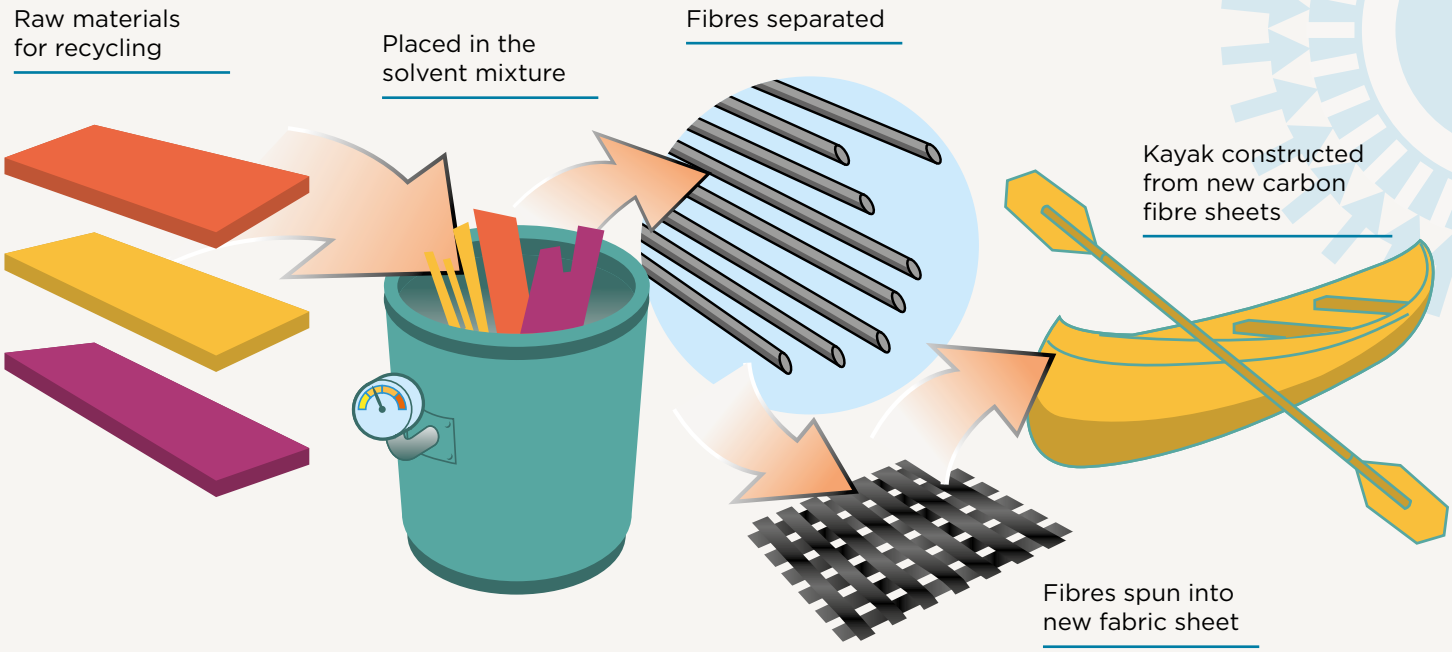
The material is light, extremely strong and hardwearing and can be used to make high performance sporting goods. It can be developed for use in manufacturing with other industries such as automotive, aerospace and renewable energy.

How has the kayak fabric been made?

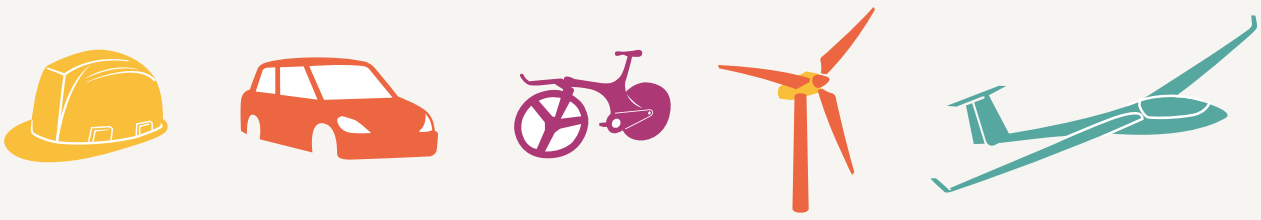
The recycling technology developed by Professor Leeke and his team is based on a process called solvolysis, which uses a solvent mixture to degrade the resin and release the fibres. It is multidisciplinary and requires knowledge in heat and mass transfer, thermodynamics, fluid mechanics, materials science, process engineering, chemistry and manufacturing.

Different ways to reuse reclaimed fibres have also been tested in order to identify the most suitable applications; one use has been the kayak. It is hoped that the kayak will showcase the material and illustrate its uses as well as highlighting the issue of the increasing volume of waste composites.

How can this be applied to manufacturing?
The making of the kayak from recycled composites demonstrates that recycled materials can be used in remanufactured applications. It can provide material security and give confidence in the use of recycled materials.



Recycled composites could have a large part to play in the future of manufacturing within industries such as automotive, aerospace, renewable energy and construction. The technology is proven and is ready for the next stage of scale-up. Further work with companies is necessary to reach that goal.



What are the challenges?
There are still challenges in bringing such processes and products to market. There is the need to undertake expensive tests and create or change standards for products to be accepted with recycled content. Questions about waste volumes, provenance, how to maintain a consistent supply of waste and whether companies will pay for that waste to be recycled are unclear and waste management licenses need to be acquired.

Why is it important?
Most composites are not biodegradable, so currently these materials are landfilled rather than recycled. This has a huge impact on the environment. Recycling thermoset composites (synthetic materials that strengthen through being heated) is difficult, because the resin in them can't be re-melted.

Sending materials to landfill is becoming forbidden in countries such as Germany. It is expected that by 2025 it will be illegal to send composites to landfill in the UK. Legislation on EU waste management, coupled with the increasing price of waste management methods, means that an efficient and sustainable way of recycling waste generated from the composites industry is necessary.

Composite materials are difficult to recycle due to their structure. They can be recycled using three different methods: solvolysis, pyrolysis or mechanical.

Composites in manufacturing
Composite materials are made from two or more materials. When combined, these produce a new material with characteristics that are different from the original components. They are often stronger, lighter or less expensive than traditional materials. These materials are used in all kinds of industry and construction applications – from buildings and bridges to racing car bodies, as well as aircraft and spacecraft. Their properties allow for innovative design and functionality, as well as high fuel efficiency. The increased use of composites in manufacturing inevitably leads to waste, and the question of what to do with it.

What is Creative Outreach for Resource Efficiency (CORE)?
Creative Outreach for Resource Efficiency (CORE) is a partnership between the Universities of Cranfield, East Anglia, Edinburgh, Loughborough, Manchester Surrey and Warwick. Creative Outreach for Resource Efficiency (CORE) supports the delivery of a vibrant and creative outreach programme to encourage public and user engagement in resource efficiency and promote understanding of the circular economy. It is funded by the Engineering and Physical Sciences Research Council (EPSRC).

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