



Rapid curing of composites

By weaving in fibre optics and using these to distribute ultra-violet light, researchers have found a much faster and more even way to cure complex composite materials used in ships, cars and construction – opening up a multi-million pound market.

Key benefits

- a faster, more even way to cure thick composite materials used in construction and in car and boat manufacture
- a breakthrough in the development of composite materials which will give significant competitive advantage to the UK partner members and licensees
- a chance to open up a market worth around £75 million a year in the UK alone

A new way to cure (toughen or harden) composite materials used in construction, automotive and marine industries could give a group of UK companies significant competitive advantages and valuable intellectual property.

The CURE-TEX team has found a way to improve curing using ultraviolet light distributed through the material using fibre optics.

Using Ultraviolet (UV) light is a much quicker way to cure composites compared to chemical reactions and use of heat. It's also cheaper and uses less energy.

However, this is very difficult to do with thicker composites over 20mm, because the UV light

can't penetrate the material evenly. The new technique solves this by weaving fibre optics into the materials. The UV light is distributed evenly throughout the materials – by sending it down the fibre optics.

Leading the project at innovation company Pera, Paul Tranter says: "The potential impact of this research could be huge. People are already beating a path to our door as information on our research has been put into the marketplace. In addition to those in the consortium, several big companies have approached us already."

Pera is the lead partner in the project. Other partners are: Uvasol Ltd, Ciba Speciality Chemicals Ltd, Formax Ltd, Composites Integration Ltd, LiteTec Ltd, VT Halmatic Ltd, BI Composites Ltd and the University of Nottingham.

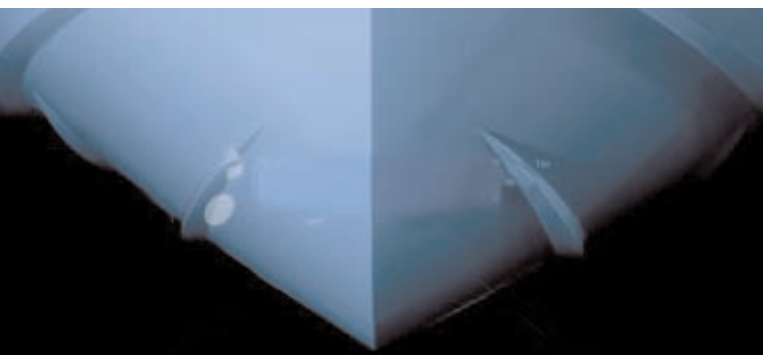
The project started in March 2005. The total cost of the research phase is £1,050,000, with the Technology Programme providing half of this.

Objectives

The aim is to develop a new method for curing thick composite materials, to make them easier and cheaper to produce, using less energy. There is also the potential for creating 'smart' materials which give continuous feedback on their condition.

These composites are typically used in marine and automotive manufacture – for example ships hull, car panels and so on. The materials are also commonly used in construction, for example in cladding.

The market for composite materials in construction, marine and automotive in the UK is around £770 million. The CURE-TEX team estimate capturing



at least seven to eight per cent of this over three years. This makes a market with an annual value of around £75-£80 million.

“There will be a big competitive advantage for the manufacturers in the project team because they will be the first to market. Of course, the intellectual property involved in these techniques is protected,” says Mr Tranter.

There are also potential environmental benefits to the technology, with an estimated reduction in emissions of volatile organic compounds (VOC) of one third, compared to current state-of-the-art technologies.

Solutions

Curing refers to the toughening or hardening of a composite made from several different materials. This is achieved using chemical additives, heat, or with the use of ultraviolet radiation.

UV curing has certain advantages, especially reduced curing time. It takes minutes rather than hours. However, it is very difficult to UV cure materials over 20mm thick because the light can't be absorbed evenly.

In addition, thick section composites usually contain glass fibre, which makes it difficult to cure the materials using UV light. Because of their nature, they block the UV rays.

The CURE-TEX team has hit on the idea of using these same glass fibres, already present in the material, as fibre optic cables to carry the ultraviolet light and distribute it evenly throughout the composite. The curing process is therefore much faster and more even – giving a stronger, more reliable product which can be produced more efficiently and cost-effectively.

“Our method distributes light evenly through the composite at once, so the curing is even,” says Mr Tranter.

The fibre optics are woven into the composite itself, and serve three functions: to distribute the light for curing; as strengthening material; and potentially as a way of continuously measuring the strain on the material.

“We do get people asking why no one has ever done this before,” says Mr Tranter. “It's something we even had to look at ourselves at first when we were checking out patents. When you get that kind of response, then you know you are onto something special.

“But, of course, the truth is that this is not easy to do. There are many technical challenges and hurdles to overcome.

“Actually doing this in an industrial process, and making sure you connect up all the fibres is very tricky. It's vitally important, too, because otherwise the light won't be evenly distributed and you'll get an uneven cure.”

Results

CURE-TEX is at its halfway point and has successfully demonstrated that laminates can be cured using both silica and polymeric optical fibres.

“We have proved the principle works already, by the mid-term of the project. We know it works, and have cured mouldings to prove it,” says Mr Tranter.

Now the team is working on further investigations to see if the technique still works with more complicated mouldings. There will also be validations taking place in workshops – with mouldings and composites companies testing the techniques to see if they will work as desired in industrial processes. The team will also be involved in mechanical and environmental testing.

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