Innovation with Fibre Reinforced Plastics

A history of innovation

Fibre Reinforced Plastic (FRP) was hailed as a wonder material when it first found commercial applications in the early 1950s. Subsequent decades have seen FRP meet these high expectations by bringing innovative solutions to a whole range of industries.

As an infinitely shapeable material, FRP brings high levels of design freedom, enabling intricate and complex shapes to be made. Entire new industries have grown up around FRP, exploiting the unique combination of desirable properties that this versatile composite brings. The following selection are examples of innovative FRP applications where traditional materials and construction methods have largely been replaced by composites.

Boat building

One industry that has been completely transformed since the arrival of FRP in the 1950s, is boat building. Especially in the leisure boat sector, FRP has largely replaced traditional wood and steel building methods by providing greater flexibility, superior performance and faster production speed. The mouldability of FRP enables sleek dynamic hulls to be produced that are low in weight and high in strength. Power cruisers, sailing yachts and almost every other vessel now has a hull, deck, superstructure and even a mast made of composites.

FRP has revolutionised the leisure boat market enabling faster, sleeker and more manoeuvrable boats to be built.

Innovative developments over the past 20 years in resin and gelcoat technology, combined with improved laminate know-how, have greatly improved the surface quality and durability of FRP against attack by water ingress and UV light.

Windmills are getting larger and more powerful requiring longer sails. Composites are meeting this need with innovative solutions.

Windmill rotor blades

The windpower generation industry hardly existed 25 years ago. Now it's a dynamic and vital alternative energy resource. The Danish producer of rotor blades for windmills, LM Glasfiber, has produced a 54 metre wing blade for a 4.2 MW prototype windmill. At the time of writing this is the world longest windmill blade yet it weighs just 13.5 tonnes. The company is already designing a 61.5 metre wing for a 5 MW windmill being developed by a German producer. Denmark is one of the world's largest producers of windmill technology and installed wind energy generates 20% of the country's electricity.

As blades get larger they need to be stronger to cope with the additional stresses. Producers rely on partnerships with their composite suppliers to deliver innovative solutions to these complex challenges.

Sewer renovation

Beneath the world's major cities lie mile after mile of sewer systems, many of which are more than 100 years old and in a poor state of repair. Since most sewer lines run beneath the main roads, the cost and disruption caused by excavating and replacing old sewer networks can be enormous. Fortunately an ingenious alternative solution is available thanks to the versatility of FRP. Various companies have developed their own systems around the common principle of relining. This involves drawing a resin-impregnated composite liner through the tunnel, expanding it to line the walls, then curing the matrix with either hot water, steam or UV light. This trenchless process enables sewers to be relined in

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a fraction of the time and at a fraction of the cost needed for 'open trench' replacement. The use of corrosion resistant unsaturated polyester and vinyl ester resins ensures that the new liner will have a long, low maintenance service life. As well as civil infrastructure projects, relining is also extensively used on chemical sites and other areas of restrictive access.

The relining process uses a composite liner that is fed into the sewer line through a convenient point such as an inspection chamber.

Roofing

Liquid applied roofing membranes based on flexible UP resins have brought advanced technology to the flat roofing market. They provide a seamless and highly durable alternative to traditional roof coverings such as felt and bitumen. The fact that FRP roofing is cold applied is an added benefit from a safety and environmental viewpoint, since there are no naked flames. A FRP roof has a tough hardwearing, waterproof finish that withstands regular foot traffic and is ideal for balconies and roof gardens.

FRP composites provides a permanent waterproofing solution for flat and inclined roofs. This roof encapsulates all fitting and protrusions in a seamless waterproof membrane.

Vehicle design and build

FRP brings many benefits that car and truck manufacturers need, especially design freedom, low weight (saving up to 40% over steel), mechanical strength and reduced system costs.

For manufacturers of lower series vehicles such as vans, trucks, SUVs and specialised sports cars, composites offer all these advantages as well as lower tooling costs - facilitating more frequent model changes. Recent innovations by UP resin producers have improved Class A finish to a level comparable with steel, making FRP composite sheet moulding compound (SMC) a choice material – especially for complex body parts like tailgates and decklids. Fixing and inserts can be moulded in to a multi-functional part that replaces many separate metal components. FRP parts can be on-line painted and engineered to give extra strength where it's needed. Structurally composites offer high dimensional stability and resistance to hot oil, making them ideal for underbonnet applications such as engine sumps. FRP composite is also recyclable: an important consideration for the automotive industry.

Left: SMC moulded decklid for Mercedes SLK.

Below right: multi functional micro filter housing.

Above: The UK built TVR 350 like many other exotic sports cars, has an FRP monocoque body shell. Lower weight means increased performance and improved fuel economy.

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