Advanced
Composites Group
umeco composites

Prepregs for Renewable Energy Applications

Wind, Wave and Tidal Energy Generation


Courtesy Dr I J Stevenson

SeaGen Tidal Project

Hailed a major success in tidal energy production, SeaGen, manufactured by Marine Current Turbines Ltd (MCT), is now generating 1.2MW of power, sufficient to meet the demands of approximately 1,000 homes.

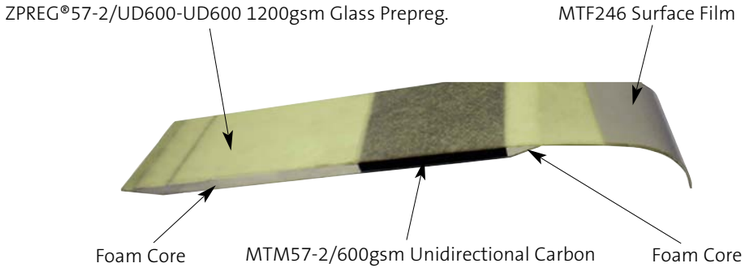
SeaGen, which is operating in the mouth of Northern Ireland's Strangford Lough, uses ACG's technologically advanced Variable Temperature Moulding VTM®260 Series prepregs for the thick structural carbon spars, the critical elements that add strength and rigidity to the glass reinforced turbine blade skins.

Because of their length, the spars had to be made using a material that possessed the requisite performance characteristics of high strength and stiffness, but with minimal mass.

From a processing standpoint, the chemistry of ACG's VTM260 Series prepregs results in a safe, low temperature cure processing route, making them ideally suited for this particular application, where overall composite thickness could, under other circumstances, result in severe exothermic reaction.

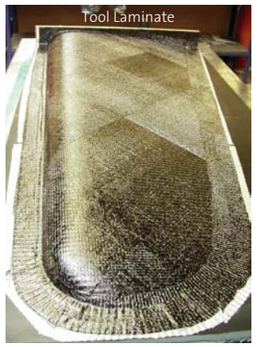
The scale of the project meant that excellent handling and out life characteristics were significant factors in ACG's VTM260 Series prepregs being chosen.

Aviation Enterprises Ltd. (AEL) was responsible for manufacturing the colossal blade assemblies.



TB750 tooling block bonded using ACG AS105 adhesive and then CNC machined and sealed using ACG CS711B.


Tool Pattern


Tool Laminate

Laminated using ACG LTF318 GF1200/GF2300 surface ply and LTM®317 GF0700 bulk ply 1-8-1 construction.

Bagged for curing using Richmond-Aerovac consumables.


Vacuum Bagged

Turbine Blade Demonstrator

ACG has developed a range of epoxy resin matrix systems and rapid lay up prepreg formats specifically targeted at large structures such as those used in the renewable energy market.

Based on the Group's already successful MTM®57 prepreg, two new 80 to 120°C curing variants, MTM®57-2 and MTM®57-3, have been developed.

Here, on the ACG Turbine Blade Demonstrator, MTM57-2 on a glass 1200gsm ZPREG® rapid layup format is combined with an in-mould surface primer film, MTF246, to form the glass fibre skins of the turbine blade.

MTM57-2 heavyweight unidirectional (UD) carbon reinforcement is used to form the integrated spar, which is combined with a PVC foam core.

A final layer of 1200gsm ZPREG is laid into the inner surface prior to vacuum bagging and curing; autoclave processing is unnecessary.

ZPREG has been optimised for ease of handling and does not require intermediate processing (debulking) prior to the final curing cycle.

This technique allows a turbine blade to be manufactured in a low cost, one-shot operation.

Quiet Revolution' Wind Turbine

The Quiet Revolution 'qr5' wind turbine was designed for optimum performance in urban environments, where wind directions change frequently and quiet, low vibration operation is essential.

The 'qr5' wind turbine was designed and developed by Quiet Revolution Ltd. in conjunction with ACG's client Aviation Enterprises Ltd. (AEL).

ACG worked closely with AEL to provide optimised low pressure processing VTM® prepregs tailored to the nearest % of resin and curing as low as 65°C. Keeping the weight of the blades to a minimum was critical due to centrifugal forces of up to 200 G and ACG's VTM prepregs helped AEL accomplish this goal.

During spinning tests at 300rpm the blades required virtually no balancing at all, proving the consistency and accuracy that ACG prepregs offer.

The rotating section, which is 5metre high and 3.1metre in diameter, has been designed to withstand wind speeds up to 120mph.

The 'qr5' has a peak power of over 7kW and a typical installation is capable of generating 4000 to 9000kWh per annum, i.e. enough to supply energy to a 10 person office.


www.quietrevolution.co.uk

COMPREHENSIVE COMPOSITE TOOLING PACKAGE

The process of manufacturing composite tooling for colossal structures such as wind and wave power generation systems requires the application of a combination of specialised materials, techniques and expertise.

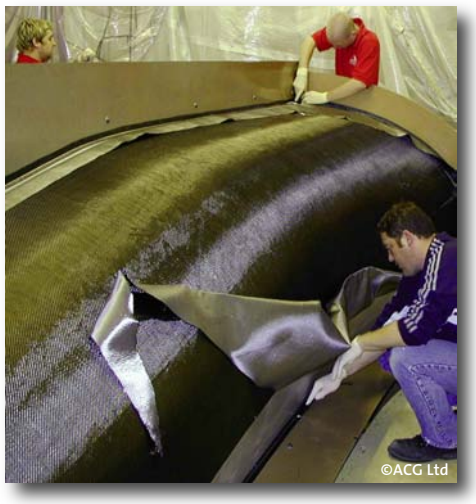
To cater for the evolving demands of this burgeoning market sector, and the increasing scale of future projects, ACG has developed a new generation of innovative, rapid layup, vacuum only processing tooling materials capable of withstanding the rigours of workshop handling.

Selective impregnation techniques and syntactic plies make the laminating and curing of Out-of-Autoclave (OoA) prepregs a rapid and cost effective solution which results in the production of large, accurate, long life tooling.

Two tooling products with recognized pedigrees for very large tools in the alternate energy arena are ACG's LTM®317 and VTM®260 Series prepregs.

LTM317 has an out life of 21 days, a minimum cure temperature of 65°C and an end use temperature of 170°C.

The VTM260 Series of prepregs, while not specifically developed for tooling, has proved popular as a low cost, entry level system for tooling applications where high temperature end use is not required.



ZPREG® . . . THE COMPOSITE TECHNOLOGY FOR TURBINE BLADES

ACG ZPREG® uses selective, striped impregnation of the fibre reinforcements (or multiple layers thereof), which retains the fabric's excellent inherent drape characteristics whilst introducing air transport paths. When compared to traditional, fully impregnated products, this material format speeds up the lay-up process and removes lengthy de-bulking cycles.

Ultimately, ZPREG facilitates the production of high performance, high quality finish and low void content components avoiding the compromises required with other multi-layer systems and standard prepregs.

ZPREG can be formatted to meet any number of specific processing and performance profiles for tooling and components. The ACG resin technologies used in ZPREG gives a broad processing window from 65 to 150°C and allows low temperature initial cure of very large structures on relatively simple patterns. The step ahead Tg allows freestanding post cure if required, or very fast turn round of smaller components at higher temperature from the same resin system.

When compared to traditional fibre reinforced systems cured in conventional ovens, ZPREG offers a reduction of up to 60% in manufacturing time.

MTM®57-3 UD CARBON FIBRE PREPREG ATTAINS 'STATEMENT OF APPROVAL' FROM GERMANISCHER LLOYD FOR WIND TURBINE APPLICATIONS

MTM®57-3, a reduced temperature sensitivity and controlled tack carbon fibre prepreg, has been granted a 'Statement of Approval (WP0930036HH) by Germanischer Lloyd under their Rules for Classification and Construction II – Material and Welding Technology Part 2 Non-Metallic Materials, specifically for wind turbine blade applications.

Germanischer Lloyd develops guidelines for Renewable Energy Projects and is one of the leading certification bodies worldwide harmonising requirements for wind farms, wind turbines and their components.

ACG MTM57-3 is a toughened, reduced tack, 80 to 120°C (175 to 250°F) curing, epoxy matrix offering flexible processing specifically developed for sided impregnation.

MTM57-3 can be supplied on a range of reinforcements and is available in standard prepreg and ACG ZPREG® partially impregnated formats. Moreover, it exhibits excellent toughness and, after a suitable cure, can be used at temperatures up to 90°C (194°F).

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