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trends

Wind-assisted ship propulsion has created a need for certified composite materials

As part of this issue containing a focus on the composite materials used in the marine sector, JEC Composites Magazine approached Tom James, Marine Business Development Manager at Hexcel, for a more detailed insight into some of the trends and material developments noted in marine composites.

Tom James,
Marine Business Development Manager
Hexcel

JEC Composites Magazine: Historically, the composites industry might perhaps connect Hexcel more with the Aerospace and Wind Energy markets than with Marine applications but recently we have seen a number of product innovations targeting the Marine sector. What is the main driver for this trend?

Tom James: Hexcel has been active in marine for nearly 50 years now. Throughout this period, the company developed a wide range of composite materials to meet specific marine industry requirements. Weight reduction and structural performance have always been key drivers for builders looking to take advantage of the properties offered by Hexcel carbon fibres, prepregs, honeycomb cores and reinforcement fabrics. More recently, we have focused on material solutions that add value and enable faster and more cost-effective processing. Strong demand from wind-assisted ship propulsion (WASP) system builders has created a need for robust, certified composite materials and processes that can be fully industrialised. There is also considerable development in the foiling craft market in race boats, leisure craft and in commercial applications such as fast ferries. These flying vessels are very fuel-efficient when up on their composite foils, with various design concepts also incorporating clean hydrogen-fuelled or electric propulsion. Lightweight composite hull and deck structures are often a key part of these foiling craft design concepts, extending the range and increasing passenger or battery capacity.

All carbon fibre reinforcements used in the Gunboat 68 hulls and decks are made by Hexcel and supplied by SF Composites

The WASP market is certainly an interesting one for composite technologies. Which materials and processes tend to be preferred in such applications?

T.J.: The sector is developing fast and there are still many different concepts and approaches – some metallic and fortunately many featuring extensive composite materials usage. Hexcel is currently working with a number of manufacturers on carbon spars, wing components and solid sails. Many of these projects are considering carbon fibre prepregs to maximise structural performance and minimise the weight added aloft. Infusion of stitched multiaxial fabrics, both carbon and glass fibre, is also seen in some components, however, prepreg parts seem to be an attractive option for high-powered WASP applications. Hexcel has worked with both DNV-GL and Bureau Veritas (BV) to certify a full range of marine prepreg products, assisting builders with the class approval of composite structures still seen as unusual by a shipping industry dominated by steel. G-Vent technology, launched earlier this year, was created with exactly these sorts of components in mind, and provides an out-of-autoclave solution that the commercial marine sector will require if it is to adopt composite rigs and solid sails on an industrial scale.

Can you briefly explain what G-Vent is and what it does?

T.J.: G-Vent is a microscopically thin layer of material that can be integrated within Hexcel marine prepregs and which acts as a network of pathways to let the material vent. As the resin cures, any air trapped inside automatically leaves the composite component via these pathways, resulting in a high quality, compacted composite component without the use of a high-pressure autoclave. This means that an unlimited number of layers of prepreg can now be laid on top of one another without debulking, and then do not need to be cured in an autoclave. As you can imagine, this drastically reduces the build time for thick section carbon fibre parts such as masts, spars and foils and it also opens up the possibility of boatbuilders who do not have access to a large autoclave constructing cutting-edge composite parts. For shipyards working on much larger structures such as WASP components, it also enables the production of huge, ultra-high-quality, carbon fibre structures that would not be commercially feasible to produce in an autoclave.

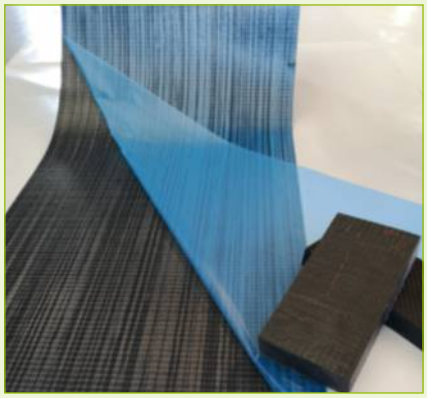
In terms of how a boat or shipbuilder would integrate G-Vent into their production, do they need to switch all prepreg materials to G-Vent versions?

T.J.: That's a great question. No, builders don't need to switch all materials to G-Vent versions and we generally wouldn't advise that, you can use it where you need it. G-Vent materials using a low-exotherm resin system like HexPly M79 are best suited to laying up and curing thick sections without an extended dwell time, or to parts whose size or tooling type prohibits an autoclave cure. Other sections of the laminate structure could remain in standard HexPly prepregs or incorporate specific surfacing technology like HexPly XF if a paint-ready surface is required straight from the mold.

We can imagine that large scale WASP programmes are particularly interesting to manufacturers like Hexcel, but are you also still focusing on and developing materials for smaller scale marine applications?

T.J.: Definitely. Hexcel has been an established supplier to the marine industry since the 1970s and our involvement today continues to cover a broad range of applications. Racing yachts and high-performance structures are another key focus for Hexcel with the development of prepreg products that aim to maximise the advantage on the racecourse. HexPly M79 prepregs with Hexcel IM2C fibre provide the highest modulus allowable for boats under the rules of the 37th America's Cup and are now being used in structures as the teams launch their test boats before the next Cup begins in Barcelona in 2024. Hexcel is also providing new options for builders in the leisure marine market, particularly those who may not have large freezers for prepreg storage. HexPly M79 SuperFIT® materials are semi-preg materials that don't require debulking and which are able to be stored at room temperature for up to 8 weeks which simplifies logistics and makes a huge difference for the boatyard.

Hexcel has leveraged its experience in aerospace and wind energy to develop its G-Vent technology for OoA processing of highly loaded, thick section marine structures such as masts, foils, and wind-assisted ship propulsion (WASP) components



HexPly M9.6 prepregs satisfied all the requirements of the Silenseas consortium's mast-section manufacturers for quality, mechanical performance, and processing characteristics, while also proving to be cost effective

Lastly, do you think the expansion of advanced composite material applications in the marine sector will continue and which areas in particular do you expect to see the most technology development?

T.J.: We certainly hope to see the current trends continuing, with advanced composite lightweighting contributing to both performance gains and sustainability improvements across a range of vessel types. From a Hexcel perspective, the marine market appears strong as a whole, but a combination of regulatory emissions targets and the need for industrialised material solutions in the commercial shipping sector suggests that this sector is likely to see continued growth for composites applications. It is also great to see steady growth in natural fibre composites within the marine market. This is a focus point for Hexcel too, having launched the HexPly Nature range of natural fibre-reinforced bio-derived epoxy prepregs at JEC World earlier this year. The relatively fast development cycles and eagerness of the marine market to engage with new material technologies provide a great opportunity for material development. In addition, leveraging the expertise developed in the aerospace and wind energy industries helps create solutions that enable faster and more cost-effective manufacturing routes for large marine structures with no compromise to performance. □

More information:
www.hexcel.com