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New surfacing technology enabling high-quality paint-ready surfaces

Hexcel recently released its latest HexPly® XF surface technology that significantly reduces shell manufacturing time within the wind blade surface finishing process. According to the company, HexPly XF increases overall blade manufacturing efficiency as it reduces time in the mould by up to two hours and eliminates surface defects that require rework before painting. Other markets are also targeted for this new product.

The HexPly XF surface technology was formulated to address the limitations of current blade shell surfacing techniques whereby pinholes and other surface defects have to be repaired by hand to achieve the perfectly smooth surface required for painting. It introduces a new material format as the surface finishing layer, eliminating the need for a traditional in-mould gelcoating process.

HexPly XF for infused rotor blades is a lightweight non-woven semi-preg construction comprising an epoxy resin matrix that co-cures with standard epoxy infusion systems. The product has a successful track record in prepreg blades and has now been adapted for infusion processes (Figure 1).

Smooth surface, smooth manufacturing

Easy to handle and supplied in a ready-to-use roll form, HexPly XF can be quickly applied by hand or with semi-automated layup equipment. Once the material has been positioned, the lay-up of the blade shell structure can start immediately, and the laminate can be infused. After curing, the blade is de-moulded, providing a pinhole-free surface that needs minimal preparation before painting. The material is less than half the weight of a typical gelcoat per square metre, reducing the overall weight of the blade. Additionally, the consistent areal weight and thickness of the prepreg film provide a completely uniform surface coating, ensuring blade weight distribution and balance are maintained, which is critical as rotor diameters continue to increase. With no need to handle or mix liquid chemicals as in the gelcoat process, HexPly XF also improves the health and safety conditions or workers on the shop floor.

The material has a shelf life of six weeks at ambient temperature, which also minimizes cold storage requirements and helps to reduce scrap.

In the interview below, Achim Fischereder, Hexcel Industrial Marketing Director, says more about this new product. □

More information:
www.hexcel.com

Achim Fischereder,
Industrial Marketing Director
Hexcel

JEC Composites Magazine: Could you give us a brief introduction to the HexPly® surfacing technology? What type of product is it and how does it benefit the composite manufacturing process?

Achim Fischereder: In composite material terms, HexPly® XF is a lightweight, non-woven, semi-preg, epoxy resin material that replaces traditional in-mould gelcoats used in the manufacture of composite components such as wind turbine blades. For the end-customer, it is an innovative surface technology that removes the need for gelcoat and the time-consuming refinishing work typically required to obtain a paint-ready surface. In short, we are pleased to report that HexPly XF reduces costs and produces lighter, more consistent parts with shorter cycle times and a cleaner working environment.

Several challenges exist in the composites world at the moment, from raw material supply chains through to end-customer demand. How have these challenges impacted Hexcel's product development strategy and which markets are you targeting with HexPly XF?

A.F.: This is absolutely right. There have certainly been some challenges regarding raw material supply chains in the glass fibre and chemicals markets during the past months, although we have worked extremely hard to minimize the impact on deliveries to our customers. Coupled with this tight-

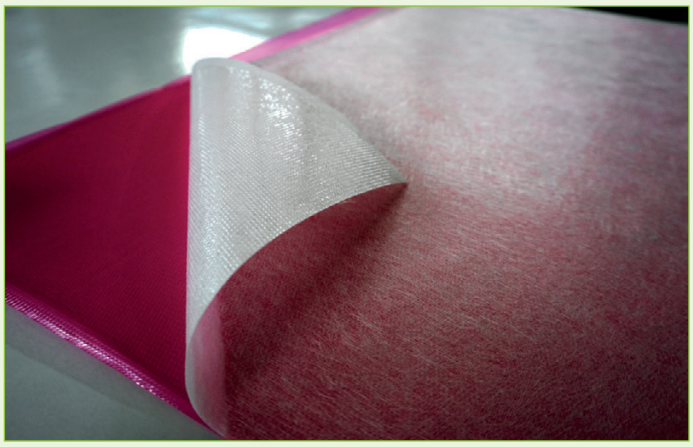

Fig. 1: The HexPly XF

ening of availability in the supply chain, demand in the industrial composites sector has remained strong. Hexcel developed HexPly XF to improve production efficiency, ultimately saving time and reducing costs for manufacturers, which is going to be a key driver for the most successful wind energy OEMs in the future.

Wind energy is certainly a key market but our technology is definitely not limited to wind. We have great feedback on the production benefits of HexPly XF from part manufacturers in both marine and industrial markets, too.

With wind energy production being a key driver for the HexPly XF technology, can you give us more detail as to how this new material fits into the blade building process? Is it suitable for prepreg and/or infusion blades?

A.F.: We developed two variants of the HexPly XF material, one is compatible with prepreg and the other with the infusion manufacturing processes (typically, we are talking about customers curing with mould temperatures > 60°C for infusion). The prepreg version came first and has been well proven by key wind OEM prepreg users, while the infusion version is the product that we have recently launched.

For both the prepreg and infusion versions, HexPly XF is the first material applied into the release-agent-coated mould. Easy to handle and supplied in a ready-to-use roll form, it can be quickly applied by hand or with semi-automated layup equipment.

One side of the product, clearly indicated by a removable protective film, is the self-adhesive surface finishing side that goes down against the mould surface. Once the HexPly XF material has been positioned, the layup of the blade shell structure (fabric or prepreg layers) can start immediately, and the laminate can be infused. After curing, the blade is easily de-moulded, with the manufacturer benefitting from a paint-ready surface.

Does the HexPly XF prepreg let the resin go through during infusion or does it behave like a resin-tight material?

A.F.: The functionality of the XF technology is achieved with a modified surface resin layer in combination with specific surface veils. The material is designed to stay as an intact surface layer after infusion of the backing plies.

Outside of the wind energy market, could HexPly XF be used in other composite applications? What sort of component types did you identify and can you give us some examples of HexPly XF success stories?

A.F.: HexPly XF can be used just as effectively in other prepreg or infused composite structures. Some of Hexcel's marine customers have been using it to improve surface quality and reduce time and material costs when fairing and finishing parts for the final paint finish.

A nice example of this type of application was seen at a leading UK superyacht builder who was able to significantly reduce the paint preparation time for a large hardtop sun canopy by demoulding the part with a pinhole-free HexPly XF outer surface. This technology also has the potential to remove the need for a cosmetic barrier coat (typically non-structural layers of chopped strand mat used to avoid print-through in production boat builds), hence saving weight, too (Figure 2).

XF technology is also well adopted by the automotive sector for the manufacture of high-quality Class A body panels – an application with the highest surface quality standards in the composites industry. Each year, thousands of high-performance cars are built using HexPly XF products, demonstrating the exceptional surface quality performance of HexPly XF (Figure 3).

With global production and supply capability for HexPly XF's surface technology, as well as the option to customize the solution – for example in wind energy – HexPly XF for infusion can be produced with the first structural non-crimp fabric ply attached. Hexcel's latest surfacing technology innovation can be adapted for a massive range of applications.

Fig. 2: XF technology provides a paint-ready surface finish

Fig. 3: XF Technology for Class A body panels

How easy is it to incorporate HexPly XF into the production process? We could perhaps imagine that some potential users who are not experienced with prepreg materials might be nervous about a prepreg material and its cold storage requirements.

A.F.: HexPly XF is a very robust prepreg system. Typically, no cold storage capability is required. Customers will require only temperature-controlled storage, which is normally required anyway to store widely-used resin components. With an outlife of up to six weeks at ambient temperature, HexPly XF provides an easy-to-adopt solution, even for those not currently using prepregs. With all of the material mixing and measuring done by Hexcel on the prepreg line, HexPly XF is potentially easier to use than a gelcoat, removing the chances of a mixing or application error. In addition, customers will not have to invest in the mixing equipment required for gelcoat application.

How does the HexPly XF surface technically compare with a traditional polyester or vinylester gelcoat? Does it provide a more durable surface?

A.F.: There are several technical benefits to using HexPly XF as a surfacing technology. Machine-produced prepreg materials are calibrated for thickness online, so not only is the material lighter than a gelcoat (typically 50% lighter per m^2 than gelcoat), but it is also more consistent than a hand-applied or sprayed product that is very operator-dependent. This completely uniform surface coating is particularly important in large wind blades, ensuring that weight distribution and balance are maintained, which is critical as rotor diameters continue to increase. The cured HexPly XF surface is also more durable than the gelcoat it replaces, and it minimizes print-through from the reinforcement layer. All of these improvements are achieved while also removing the liquid handling, exothermic reaction and harmful vapour hazards present on the shop floor when mixing and applying gelcoats.

What could be the total weight reduction on the giant blades we see these days?

A.F.: With the HexPly XF surface technology being so much lighter than a gelcoat, today's very large wind turbine blades will benefit from a significant weight reduction. Depending on the blade design, weight savings of up to 200 kg are possible on blades longer than 70 m.

How should we understand "minimal preparation for painting"?

A.F.: HexPly XF surface technology provides an excellent surface quality straight out of the mould, with only minimum effort required to prepare surface for painting. In addition, this technology is compatible with conventional (sanding and grinding) surface preparation technologies used by customers, but already provides a paint-ready surface out of mould, requiring only the removal of mould release residues.

In the future, do you think you could add further functionality to the surface layer, perhaps to reduce abrasion, provide lightning strike protection or add de-icing properties? With CNT, graphene or other nano-materials within the material?

A.F.: Hexcel is continuously evolving the HexPly XF surface technology and is pro-actively investigating additional functions that can be added to the product to increase value for our customers. We are very eager to work closely together with them on tailored solutions such as integrating structural materials, enhancing surface functionality and further improving the finishing and painting processes.

What key financial benefits do you forecast if users switch to a HexPly XF solution for their component finishing? Is it purely a production time reduction in the finishing stages or are there other factors?

A.F.: We developed HexPly XF to provide a better surface finish to finished composite parts but, of course, we had to demonstrate that it could be cost-competitive and also save time in the overall manufacturing process. Blade manufacturers can save up to five hours per blade (up to 50 man hours) using HexPly XF in an infused blade, so the benefits are significant. The material's roll format also means that dedicated mixing equipment used for traditional gelcoats (along with consumables such as brushes and rollers) is no longer required. In addition, the working conditions on the shop floor are improved with no need for vented tents or spray booths to protect workers from hazardous fumes during gelcoat application. These additional indirect savings could provide a blade factory with annual cost reductions of up to €1,000,000.

HexPly XF is our most technical surfacing solution, providing a high quality, pin-hole-free, paint-ready surface straight from the mould, for a massive range of large infused or prepreg composite component applications.