SOLUTIONS

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DIAB

http://www.diabgroup.com

New Products & Core Infusion Special

NEW PRODUCTS

The Next Generation of High Performance Core Materials

INTRODUCTION

For more than thirty years foam core materials have been the natural choice for building sandwich structures destined for service in the marine, wind energy and transportation markets. Very good mechanical properties and ease of processing combined with good thermal stability and a reasonable price have made them the material of choice for the vast majority of composite component manufacturers.

In recent years, however, 'traditional' wet lay-up has started to be replaced by more advanced manufacturing methods such as prepregs, resin infusion and RFI. All these processes require vacuum consolidation, often at elevated temperature or with high exotherm peaks due to the large amount of laminate that is being consolidated at the same time.

This has put new demands on core materials to deliver better thermal stability and strength properties at elevated temperatures. In addition, irrespective of the chosen processing method, the composites industry is always looking to produce components and structures that are lighter and stronger than the previous generation.

DIAB has responded to this challenge not only by considerably enhancing the performance properties of its popular Divinycell H and Klegecell R Grades but has also developed an entirely new core material, designated Divinycell HP, that sets new bench marks in terms of processability and mechanical properties.

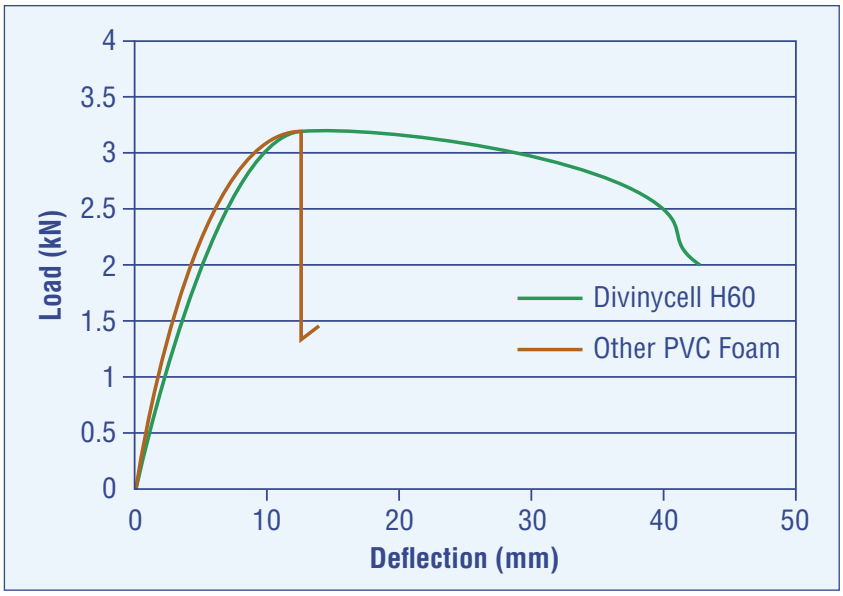


Figure 1: Four point bending comparison between H60 and a rival PVC core.

This article provides an overview of both the upgraded H Grade and the new HP material and, where appropriate, compares their performance against other commonly used PVC and SAN foam cores.

DIVINYCELL H GRADE

As with their predecessors, the new improved H and R Grade are intended to be used for the vast majority of composite applications where both hand laminating and closed molding processes such as infusion are employed.

With the new H Grade, major improvements in all significant performance areas have been achieved. Strength properties have increased by an average of 10% whereas the shear properties (normally the most important for a sandwich core material) have seen even higher gains. Shear strength has increased by up to 20% and elongation to break has risen by up to 50%.

The ductility of H has also been markedly improved (see Fig. 1). Ductility can be a very important parameter for panels loaded in fatigue or subject to slamming or impact loads. Where a more brittle core material might well shatter or delaminate as result of an impact, a more ductile core, such as the upgraded Divinycell H, absorbs the energy when deflected without any structural failure.

Both the thermal and dimensional stability of Divinycell H have also been significantly improved.

Divinycell H can now be processed at up to 90°C with minimal dimensional changes.

The chemical resistance has also been upgraded with particular reference to improving resistance to attack from styrene and other solvents.

Another major improvement is a 50% reduction in the core's cell size. This will not only reduce resin usage but will also save weight.

Divinycell H is still available in a very wide range of densities 45, 60, 80, 100, 130, 160, 200 and 250 Kg/m^3).

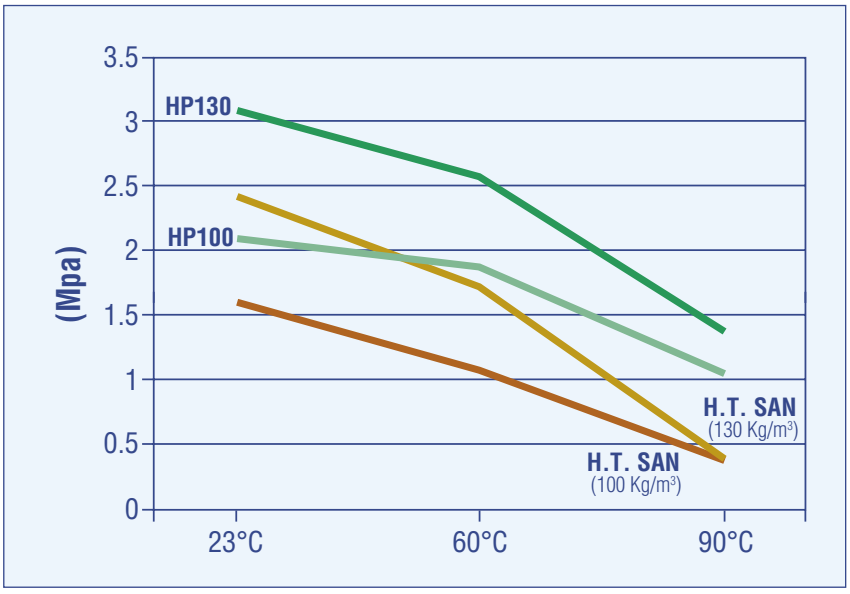


Figure 3: Compressive strength versus temperature.

DIVINYCELL HP

With its 130°C processing temperature, Divinycell HP has been developed to be fully compatible with low and medium temperature prepreg and RFI systems.

Temperature Performance

As can be seen in Figure 2., Divinycell HP can be processed at a much higher temperature than other polymer core materials in general use, making it suitable for not only low but also medium temperature prepregs.

This temperature performance, however, is not just beneficial to prepreg users. Closed molding methods such as infusion can easily produce sandwich structures with up to or even exceeding 10 kg/m^2 of reinforcement per skin. Even though the fiber fraction will be much higher than for hand lay-up, the laminate will still contain a sufficient resin volume to experience higher exothermic temperatures. Temperatures in the range of 80-120° C are not uncommon and, if combined with a pressure load (i.e. a vacuum), could lead to the collapse of a core material with a lower thermal stability. Divinycell HP has significantly higher mechanical properties in this temperature range which means that it can withstand a higher temperature or the same temperature for a longer period (see Fig. 3).

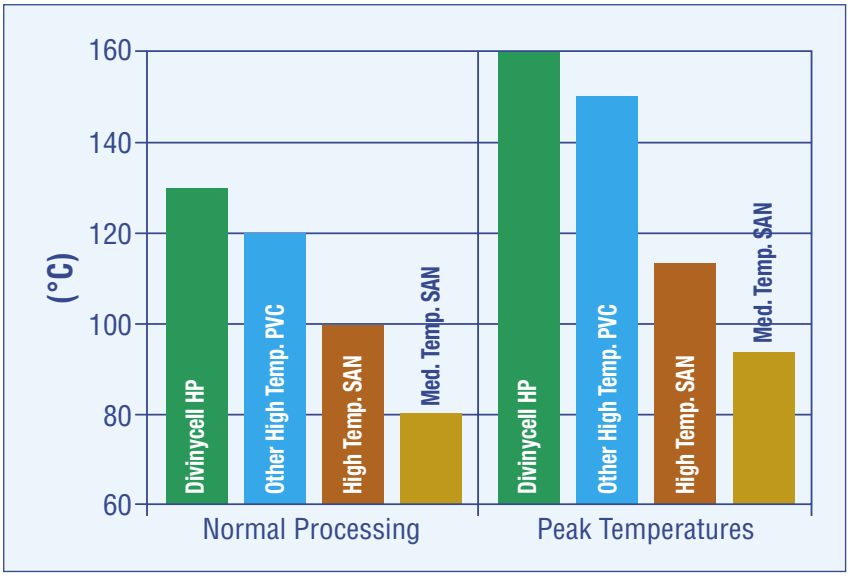


Figure 2: Normal processing and peak temperature performance

HP's elevated temperature performance also extends to the 'in service' life of the component. Divinycell HP will retain a high percentage of its mechanical properties despite long term exposure to high ambient temperatures. As many a boat builder will testify, the surface temperature of a boat hull with a dark gel coat, sailing in the tropics can readily exceed 90° C.

Mechanical Properties

Perhaps even more significant than the processing improvements,

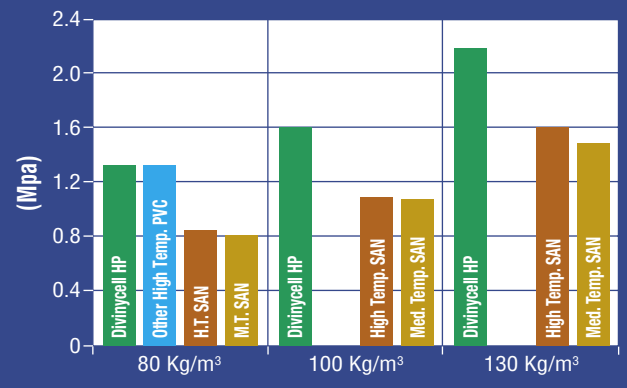


Figure 4 - Shear strength comparisons.

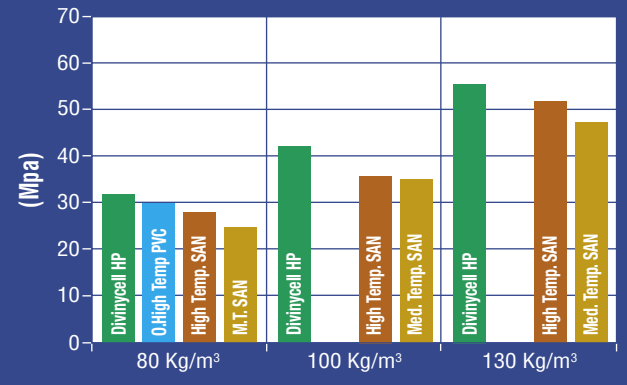


Figure 5 - Shear modulus comparisons.

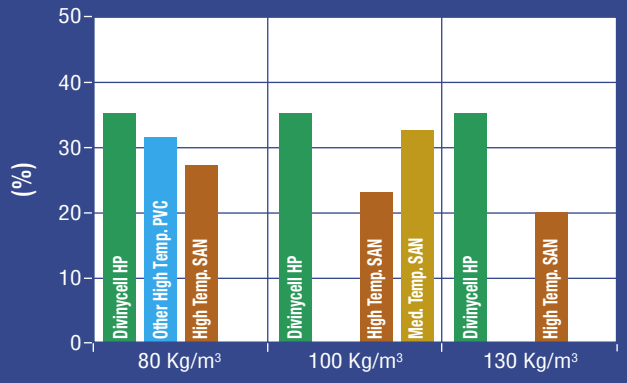


Figure 6 - Shear strain comparisons.

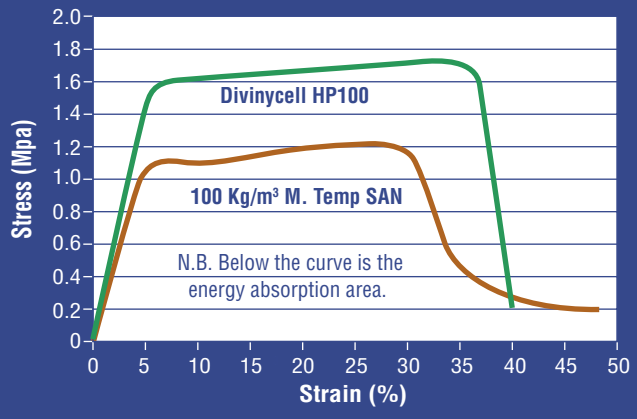


Figure 7 - Stress/Strain curve - Divinycell HP versus SAN.

is that the strength performance of HP has not been compromised to achieve its elevated temperature properties. Major performance gains (compared to other PVC and SAN cores) have been achieved in all critical areas.

Shear Properties

As can be seen in Figure 4 and 5, the shear strength and modulus values are better than other commonly used 'elevated temperature' core materials. Similarly the figures for shear strain (see Figures 6 and 7) show the ductility and the higher energy absorption of HP compared to SAN core.

Strength Properties

The strength properties of Divinycell HP both in terms of Compressive Strength (Figure 8) and Compressive Modulus (Figure 9) also compare well with rival materials.

Adhesion

Another critical area where Divinycell HP excels is in adhesion. Tests carried out on core that had been sanded (to create a 'worst case' scenario) prior to the skins being laminated revealed that the peel strength of HP was almost twice that of a rival core material. The test was carried out using SE84 prepreg.

Dimensional Stability

The dimensional stability of Divinycell HP is also exceptional (See Figure 10). Taking HP80 as an example; at 60°C dimensional changes are hardly measurable,

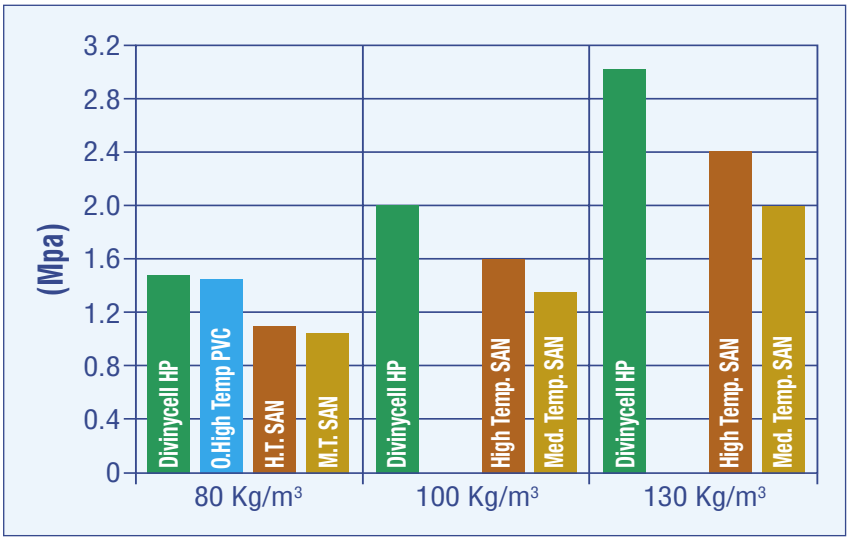


Figure 8: Compressive strength comparisons.

less than 0.1%. Even at 90°C, the dimensional change for HP80 is still less than 0.5%.

Large dimensional changes (more than ±3%) effect both density and mechanical properties as well as causing problems during manufacturing.

Small Cell Size

As is the case with Divinycell H and Klegecell R, Divinycell HP also features a small cell size (up to 50% smaller than other competing cores) thereby reducing resin usage and structural weight.

Wide Range of Densities

Divinycell HP is also available in a much wider range of densities than other elevated temperature cores. It is also available in greater maximum thicknesses than other high temperature foams. Currently HP is produced in densities from 80 to 200 Kg/m³ but plans are well advanced to extend the range even further.

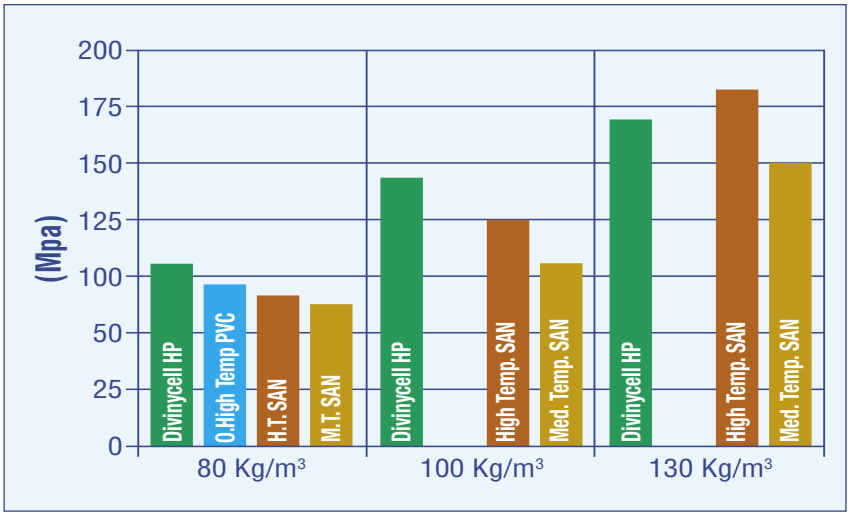


Figure 9: Compressive modulus comparisons.

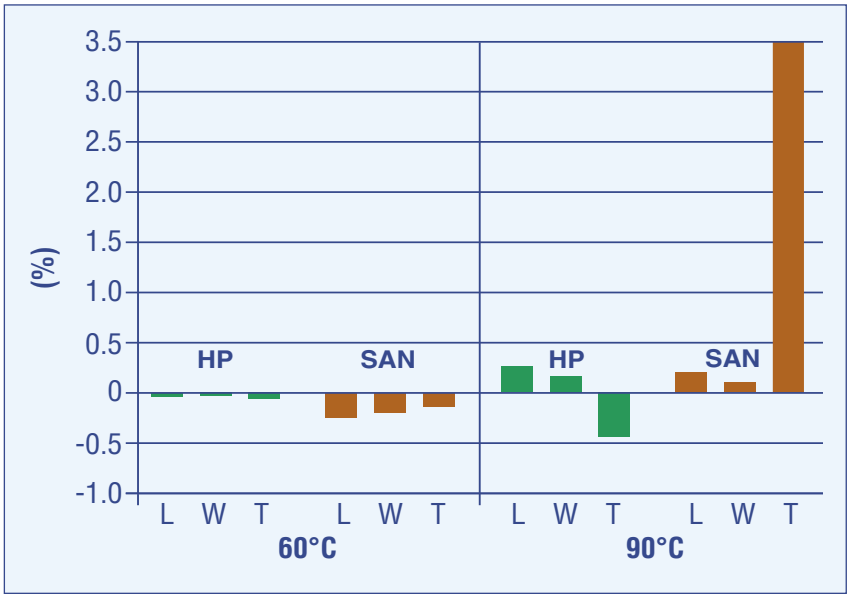


Figure 10: Dimensional stability comparison - Divinycell HP versus SAN.

CONCLUSION

Divinycell HP is very much the next generation, high performance polymer core material for designers, engineers and fabricators.

With its unique combination of features - low weight /high strength, wide processing envelope and competitive price - it is ideal for a wide range of applications in the marine, wind energy, transportation and industrial markets. Provisional data sheets covering Klegecell R and Divinycell H and HP are available from the DIAB web site:

www.diabgroup.com

AZIMUT SWITCHES TO DIAB CORE INFUSION TECHNOLOGY™

The decision by Azimut Yachts to switch from hand laminating to DIAB Core Infusion Technology™ is a major watershed for both the reinforced plastics industry and the marine industry. As Europe's biggest motor yacht manufacturer and the world's largest producer of luxury motor yachts over 24 meters, this move to closed molding is undoubtedly being watched closely by other major builders. Over the next few years there is likely to be a wholesale switch by the production boat building industry from open to closed molding for the manufacture of hulls, decks and superstructures with infusion likely to be the favored route. There is little doubt that this move by Azimut will speed the conversion process.

The production of an Azimut hull using DIAB Core Infusion Technology™.

Equally significant is Azimut's decision to use this manufacturing technology as a key element of a major marketing campaign to both its dealers and consumers. At the Genoa Boat Show the company heavily promoted its new manufacturing technology and intends to continue this throughout 2005.

Azimut maintains that the major drivers towards infusion molding were its desire to further improve quality, cut build times, reduce weight and provide a better working environment for its personnel.

The development programme took an elapsed period of 18 months and comprised more than 10,000 hours of research and development time. Over 250 laboratory tests were carried out to verify the performance of the trial moldings that were produced for the Azimut 42, 50, 55, 62 and 68. In addition the company made extensive use of ultrasonic testing to confirm the integrity of the skin to core bond lines; a method that will be used in the future as part of Azimut's quality control systems.


The distinctive lines of an Azimut luxury motor yacht. In this case a 68S.

The first task of the Azimut R & D team was to carefully evaluate a variety of closed molding technologies that were considered suitable for the serial production of large moldings. These included SCRIMP, SPRINT, RTM Light and, of course, DIAB Core Infusion. The team's conclusion was that core infusion offered significant advantages over the other systems for the serial production of marine composites. Specifically, core infusion requires substantially fewer resin inlet lines than SCRIMP, offers greater production flexibility and lower investment than RTM Light (as matched molds are not required) and does not require an

oven for curing as is the case with the epoxy-based SPRINT system.

Azimut says that core infusion brings together all the benefits of sandwich composites such as lightweight and high strength with the processing, performance and health and safety advantages of closed molding.

In particular the company contends that the process allows consistent and repeatable results to be achieved and provides optimum bonding between the core and the laminate. It also allows further weight reductions to be achieved without compromising structural integrity.

From an environmental standpoint the process virtually eliminates VOC emissions thereby improving working conditions.

The process also allows faster flow rates than other infusion methods and as a result enables the production of very large components, such as complete hulls and decks, in a single shot while substantially reducing lay-up times. With the DIAB system the specially grooved core not only enhances the structural performance of the composite component, allowing high fiber volume fractions to be achieved but also acts as the resin transfer medium. By eliminating the requirement for sacrificial distribution mats or nets the cost of consumables and waste is significantly reduced.

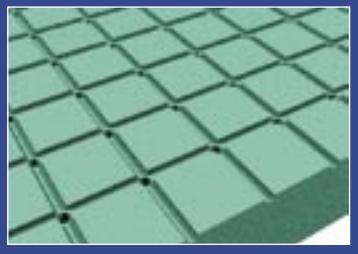
WHAT'S NEXT ?

A brand new model, the Azimut 40, is the first in the company's range to be built with the new technology. Azimut is currently introducing the process progressively for molding the hulls, decks and superstructures across its entire range. Another first for Azimut is that the new 40 features a fully-cored hull. In addition to improving the strength to weight ratio of the hull, the core in the hull bottom facilitates and speeds the infusion process by markedly reducing the number of resin inlet lines.

Compared to the previous technology employed by Azimut, the company expects to achieve significant reductions in fabrication time. For example, savings of up to 45% are expected for the production of the hull for the Azimut 40. These time savings should be even greater for larger vessels in the Azimut range.

THE CORE INFUSION PROCESS IN DETAIL

DIAB Core Infusion Technology™ is based on using an integral part of the sandwich composite – the core – as the transfer medium.



The special DIAB 'infusion' core.

This is achieved by machining the core surface to produce a series of carefully positioned grooves to facilitate resin distribution. As a result the need for a sacrificial distribution net or mat is completely eliminated, as is the requirement for peel ply and release film.

The first stage of the process is to apply the gel coat in a conventional way, followed by a skin coat. The skin coat is a relatively thin layer of surface mats that are applied and then cured in order to enhance the surface finish. Next dry reinforcements for the outer skin are positioned in mold.

Placing the core.

Then the pre-cut and shaped DIAB Infusion Core (supplied to Azimut in the form of ready to use kits) is placed into the mold and the dry reinforcements for the inner skin are laid up.

The infusion process underway.

The next stage is to install the primary and secondary resin feeder lines followed by the vacuum line. Finally the vacuum bag is installed and sealed along the edge of the mold flange. The vacuum is then applied and the resin inlet valve is opened to allow the infusion process to begin.

Core Infusion Developments at Sunseeker International

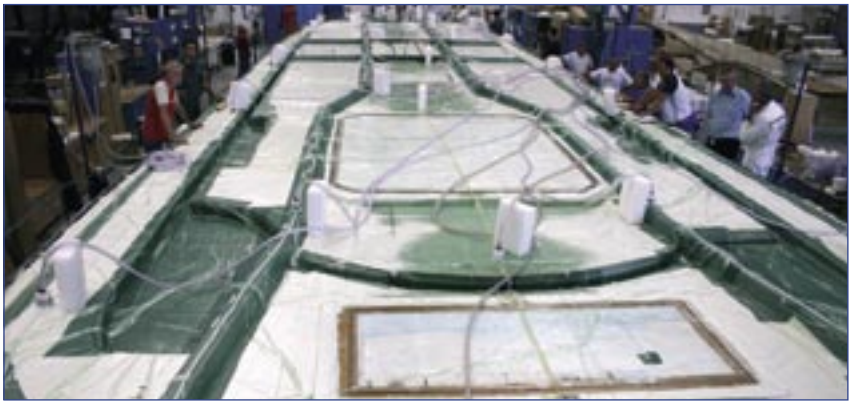
The Sunseeker name is probably one of the most recognizable power boat brands in the world. It is a name that is synonymous with quality, performance and innovation.

Innovation is more than skin deep at Sunseeker's main manufacturing base in Poole, Dorset, UK. For the past three years the company has been working closely with DIAB Technical Services to progressively introduce core infusion technology for a variety of components ranging from hatches to complete deck moldings.

An example of a Sunseeker flybridge motor yacht.

Although Sunseeker's standard manufacturing method has served the company very well, there is a constant drive to reduce structural weight without compromising on strength or durability. Such reductions can enable the fitting of more elaborate interiors, improve performance and maximise stability on flybridge boats. The company's first production use of core infusion technology was when it was producing a special version of its 105 model that featured an enclosed wheelhouse on the flybridge. As a result there was a need to reduce topside weight in other areas. It was decided that significant weight savings could be made by producing the 105's three large deck hatches from carbon-foam sandwich composites using core infusion technology. By going this route the weight of the hatches was more than halved and the required stiffness levels were easily achieved.

Another project that demonstrated the value of the infusion process was to produce a lightweight special Predator 75 using core infused bulkheads in order to help meet the owner's insistence of running at 50 knots in the Gulf!



Core infusion of a Sunseeker 105 deck.

Core infusion has allowed Sunseeker to produce extremely large and light, yet very stiff floor panels for a number of recent models. This helps the company to reduce or eliminate any stiffening to maximize headroom in the cabin below.

Today all engine hatches and a number of bulkheads are infused on all the large boat models.

At the time of writing the company is switching to core infusion as the standard manufacturing process for the decks of its 105,108 and 66 models – where significant weight savings and reductions in labor hours have been seen . There are further plans to infuse the hull and superstructure moldings on new models later this year.

www.sunseeker.com

Core Infused Ambulance Boat

The 'Rygerstril' ambulance boat is the latest high speed vessel to be produced by innovative Norwegian builder, Brødrene Aa. The vessel features DIAB infusion cores and vinylester/carbon skins. Both the hull and the super structure were infused in a single hit operation that took less than an hour.

The combination of carbon fiber, DIAB cores and the infusion manufacturing process, has resulted in a structural weight reduction of 40% when compared to the composite materials that would have been previously used for a vessel of this type. With the increased strength and reduced weight, the 19.6 meter (54.4 ft.) vessel has a top speed of 44 knots and an operational speed of 38 knots. As is the case with DIAB, Brødrene Aa has been named as one the finalists in the 2005 JEC Composite Innovation Awards.

The core infused ambulance boat that has just been 'launched' by Brødrene.

www.braa.no

JET-TERN MOVES TOWARDS INFUSION

DIAB is now working closely with leading Chinese yard, Jet-Tern Marine Corp to assist them with the implementation of Core Infusion Technology™. DIAB Technical Services personnel have carried out a series of training sessions that have included the production of a large internal bulkhead for one of the company's motor yachts. In addition DIAB engineers have been working with Jet-Tern to redesign their laminates to make them more suitable for the infusion process and, at the same time, reduce weight.

Combining old world craftsmanship with new world technology, Jet-Tern Marine Corp. produces the Selene® series of ocean going, trawler-style, motor yachts that range in size from 11 to 20 meters (36 to 66 ft.). The company has seen an impressive growth rate in recent years. In 1999 it delivered six yachts whereas last year it produced 34. With the opening of its new Zhu-hai facility in February this year, to compliment its existing Hou-jie shipyard, Jet-Tern expects to increase production in 2005 to 53 yachts. Looking further ahead, the company is hoping to build 100 boats a year by 2008.

One of Jet-Tern's Selene® range of trawler-style motor yachts.

The Jet-Tern 'infusion team' plus Todd Henry and Forest Song from DIAB with the infused bulkhead.

www.jetternmarine.com

Cobalt Boats

Number One in Customer Satisfaction

In the influential J.D. Power and Associates 2005 Boat Competitive Information Study, Cobalt Boats, based in Neodesha, Kansas, has yet again ranked the highest in customer satisfaction among owners of large runabouts (6 to 8.8 meters [20-29 ft.]).

As has been the case in all previous years of the study, Cobalt has outperformed other manufacturers of runabouts in both overall satisfaction and the individual factors from which the rating is derived. Cobalt Boats received particularly high marks for the design/styling, ride and handling of its runabout range.

A Cobalt 272 - one of the company's high performance runabouts.

Cobalt President Pack St. Clair identifies 'value' as the principal factor in the company's ongoing ability to satisfy what are increasingly knowledgeable consumers in the boating marketplace. "We know that, in comparison to the competition, Cobalt owners pay a small premium for their boats," he said, "but we work very hard to ensure that purchase price becomes, over time, a minor consideration in the long term enjoyment of the boat. We work to deliver a boat with essentially no problems in its operation or maintenance, a boat supported throughout its long life by dealers committed to enduring customer satisfaction."

Established in 1968 by Pack St. Clair, Cobalt Boats is one of the oldest privately-owned boat manufacturers in the United States of America. The company builds luxury boats ranging from a 6 meter (20 ft.) day boat to an 11 meter (36 ft.) performance cruiser. Currently output from its nearly 800 strong team at Neodesha averages around eleven boats a day.

An essential part of its drive towards customer satisfaction, is the fact that the company makes no compromises in terms of the quality of its workmanship or the materials it uses. As a result every Cobalt vessel features as standard a Divinycell sandwich cored deck in order to achieve a lightweight yet ultra-high strong component.

www.cobaltboats.com

Flyak - A New Concept in Kayaking

The totally new and exciting concept of hydrofoil kayaking is being developed by former world kayaking champion Einar Rasmussen from Norway. Although the kayaks are not yet commercially available a 'proof of concept' prototype (shown here) has already been demonstrated at the International Canoeing Regatta held in Duisberg, Germany. Called appropriately the Flyak, the first models are expected to be ready for sale this summer. Lightness and strength are obviously critical performance criteria and therefore the Flyak team will be making extensive use of DIAB sandwich cores.

Einar maintains that the Flyak has the potential to be much faster than a conventional kayak and more stable than a racing kayak.

www.foilkayak.com

'Jennipher'

Combining Traditional Craftsmanship & Modern Technology

Founded in 1983, Thore Berntsson Båtbyggeri AB has established a reputation as one of Sweden's leading wooden boat builders. The yard's latest creation - 'Jennipher' - is an 8.5 meter (28 ft.) sports/day boat that uniquely blends traditional craftsmanship with modern materials and technology. At first glance her 'polished' mahogany finish, classic lines and curved transom are very reminiscent of the speed boats and yacht tenders of the 1960's that were very much at home in places such as Monte Carlo and Cannes.

However, in the case of the Ocke Mannerfelt-designed 'Jennipher', first appearances are very deceptive. With the assistance of the DIAB Technical Services team, Thore Berntsson has developed a special infusion manufacturing process that enables the creation of a boat which combines the aesthetic qualities of wood with the lightweight/high strength properties of a modern sandwich composite structure.

'Jennipher' showing off her good looks and her speed over the water.

HYBRID LAMINATE

Both the hull and deck of 'Jennipher' are manufactured from a hybrid laminate that comprises a multi-axial glass inner skin, DIAB infusion core, another layer of multi-axials and finally a laminated mahogany outer skin. Once the hybrid laminates are laid-up, they are infused with epoxy resin using a single shot process. The resulting laminates are then post-cured in order to further improve structural performance.

Once the infusion process is complete, the mahogany exterior receives multiple coats of epoxy and polyurethane to provide a durable, high gloss finish.

This method of construction makes 'Jennipher' a very light but immensely strong vessel capable of running at high speeds with good stability in high sea states.

In trials, her exhilarating performance even surprised Thore Berntsson and Ocke Mannerfelt. With six people on board and powered by a 310 h.p. Volvo Penta D6, Duo Prop-stern drive, she easily surpassed her design speed of 40 knots with a best run of 45 knots.

www.jennipher.se

www.ocke.se

DIAB WINS MAJOR CORE ORDER FOR SIX NAVAL SHIPS

The Swedish operation of DIAB has won a significant order to supply the core materials for six 43 meter (141 ft.) sandwich composite ships that are destined for service in the Danish Navy. DIAB received the order from the Karlskrona Yard of Kockums who will be producing the six hulls and superstructures for the Danish company Faaborg Vaerft A/S, the main contractor for the project.

An artist's impression of the new vessel.

Work has already started on the project at the Karlskrona Yard with the contract expected to be completed in 2007. Kockums designed and built similar hulls for the Danish Navy earlier, in the 1980's. More recently, Kockums was responsible for the modernization and upgrade of a Swedish submarine for the Danish Navy.

www.kockums.se

Southern Wind Shipyard

Southern Wind Shipyard specializes in the production of large, semi-custom cruiser/racer yachts designed by some of the world's top naval architects such as Farr Yacht Design and Reichel/Pugh. The yard, which is located just outside Cape Town, South Africa, has just been the subject of a major upgrade that has included the construction of three new buildings to compliment the main production facility. Currently the company employs upwards of 210 people.

'All Smoke' a Reichel Pugh Nauta 78 built by Southern Wind Shipyard.

To provide its yachts with race winning performance, Southern Wind makes extensive use of lightweight/high strength composite materials such as carbon and aramid fibers, epoxy resins and DIAB structural cores. The yard is also using the latest construction techniques (including resin infusion) in order to further reduce weight and maximize laminate properties.

As many of Southern Wind's customers are European, the marketing operation for the yard is based in Genoa and trades under the name of the Pegaso Yacht Division. The Managing Director of both operations is Willy Persico, a successful manager in various Italian industries with long term boatyard experience. He divides his time between the two locations.

www.sws-yachts.com

HSB MOTOR BOATS

Shenzhen Hispeed Boats Technology Development Co., Ltd. (HSB Motor Boats for Short) is one of China's leading manufacturers of fast patrol boats with vessels ranging in size from 6 to 16 meters (20 to 52 ft.) in length. The boats are typified by their deep 'V' hulls which provide excellent performance in open water and out at sea. HSB's largest vessel, the 16 meter (52 ft.) long HP1600, can achieve a top speed of 70 knots, cruise at 50 and has a range of 300 nautical miles. The vessels are used for a variety of roles including coast guard patrol, fishery protection, customs duties, pilot work and immigration. In the past the company's principle customer was the Chinese government. However, in recent times HSB has been selling more and more boats abroad.

One of HSB's range of fast patrol boats - the 65 knot HP1500.

In addition to its performance work boat activities, the company has recently developed its own range of speed boats for leisure activities and is also producing its first sailing yacht.

HT Blade Production In China

The wind energy market in China is expected to see significant growth in the next few years. One company that is set to take advantage of this upsurge in demand is blade, nacelle and spinner producer Zhong Hang (Baoding) Huiteng Windpower Equipment Co, Ltd. ('HT' for short). This is a China-US cooperative enterprise that was established in 2001 by Baoding Huiyang Aviation Propeller Factory, China Aviation Gas-Turbine Power (Group) Corporation and Tang Energy Group of the USA.

A section of HT's modern production facility.

The company, which is located at Baoding in Hebei Province, currently employs 120 people and produces blades for 600 kW and 750 kW turbines plus associated GRP components such as housings. Blade rigidity, frequency and fatigue tests on both blade models indicates a service life of more than 20 years and a 'survival' wind speed of 70 meters per second. HT is currently developing blades for both 900 kW and 1 mW machines.

With its heritage of producing aeroplane propellers, all HT blades are designed in-house by its own team of engineers and aerodynamicists. The production facility is certified to ISO 9001 and all blades are built to comply with international approval standards.

As the case with nearly all the world's blade producers, HT makes extensive use of sandwich cores to produce blades that are light, stiff and offer excellent fatigue properties.

Although current production is destined for Chinese wind farms, the company expects to be exporting blades in the future.

HT blades in action on a Chinese wind farm.

TEST CENTER

HT has its own comprehensive test facility that is capable of carrying out fatigue, rigidity and frequency tests according to IEC61400-23 (Full Scale Testing of Rotor Blades for WTGS).

Such are the capabilities of the HT test facility that it is designated by the China Classification Society (CCS) as the Large Size Wind Blade Test Center

www.htblade.com

Hemispherical Sandwich Composite Radome for Nippon Antenna

At the beginning of November 2004 aerial maker Nippon Antenna Co. Ltd. (EU) formerly opened its European Test Center in Northern Germany. The new radome that protects the test unit has a diameter of 26.14 meters (86 ft.) and is manufactured almost entirely from sandwich composites. It will be used to test the next generation of complex automotive aerial systems.

Often this type of construction uses multiple-segments that are bolted together via flanges on the edges of each panel. For optimum dielectric properties, Nippon Antenna required a dome that did not have any metal components and had a constant 'wall' thickness throughout.

The completed radome.

The solution proposed by Hahlbrock GmbH and accepted by Nippon Antenna was the production of 86 Divinycell-cored sandwich composite panels that are glued together using a tongue and groove system thereby creating a seamless construction.

Each curved composite panel, measuring around 6.35 meters (21 ft.) in length, is manufactured to a very high degree of precision to minimize radio frequency losses and reflections. Once laminated, the edges of the core are machined on a 5-axis CNC router to create the tongues and grooves as appropriate.

The Divinycell-cored panels being 'slotted' into place to create the radome.

Such was the precision of the panels and the tongue and grooving system that the segments were assembled on site without the need for any re-working. Moreover, subsequent tests showed that the dielectric properties of the finished dome exceeded the results of the original simulation.

www.hahlbrock.de

HIGH PERFORMANCE BALSA CORED DOORS

With their ProBalsa core and glass fiber skins, doors from the Fib-R-Dor Division of Advance Fiberglass Inc. (Little Rock, Arkansas) offer a level of performance that makes them ideal for a wide range of tough applications in the food and processing industries. Guaranteed for 15 years against corrosion they combine scratch and impact resistant GRP skins with an end grain ProBalsa core. The end result is an industrial door that is light but incredibly strong - so strong that you can literally drive a truck over one without any structural damage. Approved by the US Food & Drug Administration, the doors also offer excellent sound/thermal insulation. Their smooth, self-colored gel coated surfaces are free of dirt/bacteria traps and can be readily cleaned.

A Fib-R-Dor under construction.

www.fibrdor.com

DIAB Cores for Falcon Jet Interiors

Dassault Falcon Jet's 52,397 square meter (564,000 sq. ft.) facility in Little Rock, Arkansas, USA, is the main completion center for all Falcon Jets worldwide. The aircraft are manufactured in France, then flown in 'green' condition to the completion center where optional avionics are installed, custom interiors are fitted and the exterior is painted.

Extensive use is made of DIAB cores for the interior of this Falcon Jet aircraft.

At Little Rock the company makes extensive use of DIAB structural core materials for the construction of interior walls, side panels and furniture. Used as a relatively low cost, lightweight, edge closeout material, DIAB polymer foam cores improve the damage tolerance, eliminate the risk of moisture absorption by the panel through its edges and provide excellent thermal/acoustic insulation. Dassault Falcon Jet also reports that DIAB cores are particularly easy to machine to intricate shapes, bond well and are fully prepreg-compatible.

Since the rollout of the first Falcon 20 in 1963, over 1,500 Falcon Jets have been delivered to more than 65 countries worldwide. The family of Falcon Jets currently in production includes four tri-jets and two twin-engine aircraft.

www.falconjet.com

DG - The World Leader in Self-Launching Gliders

In 1996 DG-Flugzeugbau GmbH was incorporated as the successor to the Glaser-Dirks Flugzeugbau (glider) company. Since this time it has gone from strength to strength and now offers an extensive range of both conventional performance gliders and motor gliders with retractable power plants.

In DG-Flugzeugbau's modern production facility at the Bruchsal Airfield, Germany, the company makes use of high performance composites such as carbon fiber and aramid reinforcements and Divinycell cores for both the wings and the fuselage.

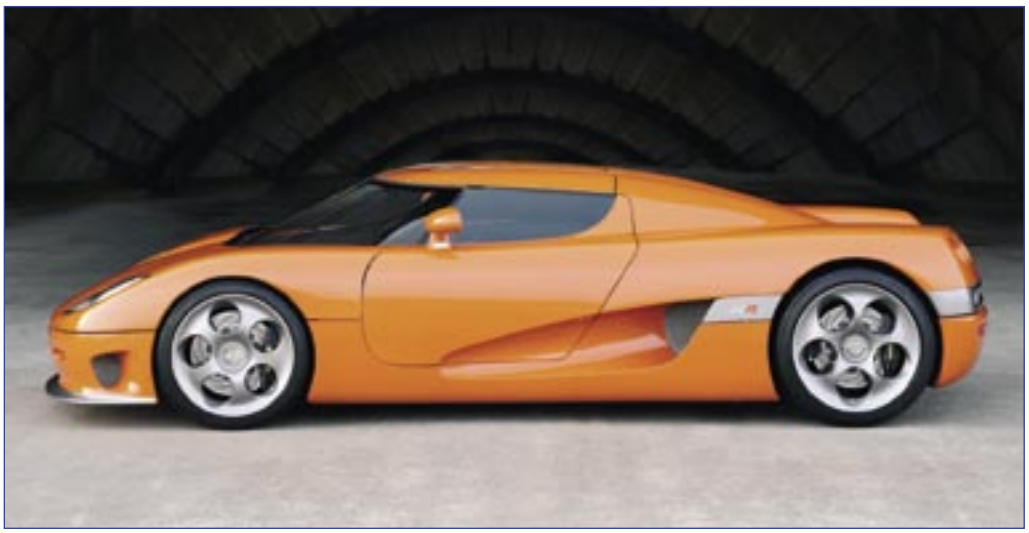
In the category of self-launching motor gliders, DG is the world's market leader, with the DG-808B being its flagship model. The design of the DG-808B represents the current 'state-of the art' in self-launching gliders with retractable power plants. With its gentle stall characteristics and outstanding gliding and climbing ability, the DG-808B is equally suitable for the recreational and competition pilot. Other features of the DG-808B are a comfortable safety cockpit with excellent visibility, a 'steerable' tail wheel and extremely low noise levels when under power.

A DG-808B in flight.

www.dg-flugzeugbau.de

Record Breaker

Koenigsegg CCR Captures World Speed Record for Production Cars



On February 28th 2005, at 12.08 local time, the Koenigsegg CCR broke the production road car speed record, achieving a new official top speed of 387.87 k.p.h. (241.02 m.p.h.) at Italy's Nardo Prototipo proving ground.

A team of five Koenigsegg engineers and mechanics together with the company's founder, Christian von Koenigsegg, ran a technically standard Koenigsegg CCR in order to take the top speed record for production road cars. The previous record was set in 1993 by a McLaren F1. Despite beating the record, the CCR was not at maximum revs. As a result Christian von Koenigsegg is even more confident that the CCR is capable of reaching its projected top speed of 395 k.p.h. (245.45 m.p.h.), or more, in a straight line.

Driver Loris Bicocchi was very impressed by the performance of the car. He was happy to finally prove the performance of the Koenigsegg. "This test was very important for the customers and owners of Koenigsegg cars. It confirms that their belief and faith in the small Koenigsegg company was fully justified".

Built near DIAB's production facility in Laholm, Sweden, the car is not only the fastest production car but also one of the strongest. The body is fabricated entirely as a carbon fiber monocoque and uses DIAB core materials in both the chassis and the body.

www.koenigsegg.com

DIAB is the world's largest producer of structural foam core materials with production facilities in Sweden, Italy, the USA, Australia and Ecuador.

www.diabgroup.com

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