A speedboat with a vacuum-infused and bonded foam sandwich design

By Samantha Bell, Global Marketing Manager, Composites Specialities, Scott Bader Company Ltd.
Marco Arcuri, Technical consultant and project manager Resintex Technology

The Revolver 42 is a polyhedric monohull speedboat constructed with high-performance composite materials by the Italian shipyard Anselmo Mauri, located in Sirmione, Lake Garda. The speedboat uses a vacuum-infused and bonded foam sandwich design that uses Scott Bader's Crystic® Resin and Crestomer® adhesive materials.

The Revolver 42 design is a collaboration between the top US speedboat hull designer Michael Peters Yacht Design, whose designs have won over two hundred Offshore Class 1 races worldwide, and the Milan-based studio H3O, who handled the interior design and all the concept engineering. The final design combines innovations in the hull and deck design, such as centrally positioning the three structural tanks made of a special aeronautical rubber in order to concentrate weight distribution in the middle of the boat.

The stylish, eye catching Revolver 42 speedboat, with dimensions of 12.6 metres long by 3.4 metres wide and a dry weight of only 7,500 kg, has now become a reality with its racing design pedigree enabling it to reach speeds of up to 68 knots.

With the hull design finalised, the H30 team worked closely with Resintex Technology Srl, the closed mould technology partner in the project, to specify the best combination of high-performance composite materials available to design and manufacture a light, stylish and very fast speedboat, which would also be comfortable and manoeuvrable at higher speeds, even in rougher sea conditions. They opted for a sandwich laminate structure for the main hull and deck, vacuum-infused using Crystic® vinyl ester (VE) resins and a Corecell™ M-foam core, with carbon fibre used at major load points on the hard top. To further reduce weight, the hull bulkheads were bonded with a Crystic Crestomer® structural adhesive.

Vacuum infusion production benefits

Resintex Technology's technical team recommended vacuum bagging as the best infusion process to produce the hull and deck glass fibre sections as vacuum-infused laminates are significantly lighter compared to hand layup, while also providing higher mechanical properties. The infusion moulding process improves the fibre-to-resin ratio so less resin is used and the resin is more evenly distributed through the

Fig. 1: Due to the use of high-performance composite materials and vacuum infusion, the Revolver 42 speedboat has a dry weight of only 7,500 kg and is capable of speeds of up to 68 knots

Focus

Resintex Technology, based in Frosinone, central Italy, specializes in providing vacuum infusion technical expertise, product selection advice and the distribution of a wide range of composite products from leading suppliers.

laminate, producing moulded parts with greater consistency. To provide a tough, marine-approved laminate construction for the hull and deck, Scott Bader's Crystic VE679-03PA infusion-grade low-shrink DCPD modified VE resin was specified in combination with a 'matched system' Crystic VE679PA skincoat. The supplier developed DCPD modified VE resins and skin coats to provide the mechanical performance needed for marine applications, while also reducing print-through to improve the aesthetic finish of the gelcoated surfaces of visible glass fibre parts; this is a key quality parameter for luxury power boat and yacht manufacturers.

In addition to significantly lower resin material costs compared with open-mould hand layup, the vacuum bagging infusion process provides converters with the added production benefits of reducing overall labour costs, increasing productivity and significantly improving environmental and shop floor health and safety working conditions. Styrene volatile organic compounds (VOC) emissions are typically reduced by over 70% in closed moulding.

Strong, low-weight laminate design

To help minimise the overall weight of the Revolver 42, carbon fibre fabrics were used to reinforce the maximum loading points in the cockpit hard top. Other critical performance areas subject to very high stresses and loads in the superstructure, such as the slamming area of the hull, were designed with a foam-cored sandwich laminate structure. The marine-approved Corecell™ M-Foam DC core material manufactured by SP-High Modulus, the marine division of Gurit, was specified for the infused hull and deck sandwich

Fig. 2: Corecell™ M-Foam was specified for the sandwich structure as it provides high strength, low density and very low resin absorption to significantly reduce laminate weight

constructions. This foam was selected because it provides a combination of high strength, low density and very low resin absorption to significantly reduce laminate weight. For easy moulding, the double-cut configuration of the foam provides flexibility in two directions in the mould; intersecting flow channels on both sides optimise resin flow and avoid resin accumulation in sections of the mould.

Structural adhesive further reduces hull weight

To further reduce the hull weight while improving the overall mechanical performance of the hull construction, Resintex Technology also recommended Scott Bader's long-established Crystic Crestomer 1152PA urethane acrylate structural adhesive to bond the structural bulkheads in the hull. By using this adhesive instead of over-laminating, the Revolver 42 hull weight was reduced by over 45%. This structural adhesive has a much higher fatigue resistance, flexural modulus and ultimate tensile strength than the glass fibre laminate sections being bonded together, so failure is always in the substrate, with no adhesive or cohesive failure.

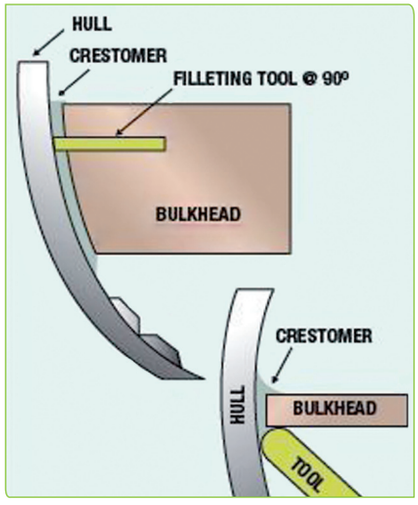

Fig. 3: The Crystic Crestomer 1152PA structural adhesives can absorb the enormous impact deformation and shock loading which occur in the most critical slamming area of the hull

According to the supplier's technical data sheet, fully-cured Crestomer 1152PA achieves a tensile strength of 26 MPa, with a tensile modulus of 500 MPa. Due to its high yield stress performance and a 100% elongation to break, the adhesive can absorb the enormous impact deformation and shock loading which occur in the most critical slamming area of the hull. This range of adhesives has Lloyds Acceptance, as well as DNV and RINA approvals for a variety of GRP marine bonding applications including bulkhead bonding. Resintex Technology was very confident to recommend it for this proven hull bulkhead bonding application as it has been specified for many years by leading luxury glass fibre boat builders.

Additional shop floor bonding benefits

In addition to significantly reducing the weight of the glass fibre hull, bonding in the bulkheads instead of over-laminating offers boat builders a combination of additional quality, shop floor and productivity benefits, such as improved external hull aesthetics by eliminating shrinkage print-through at bulkhead joints, reduced labour costs and increased productivity by avoiding the need to grind surfaces prior to joint over-laminating, and improved shop floor health and safety working conditions due to significantly reduced styrene emissions. ■

More information:
www.scottbader.com
www.revolverboats.com
www.resintex.it