



Gurit

shape

The Gurit Magazine for employees, customers and suppliers
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COMPLEX ENGINEERING FOR DOME OBSERVATORY
AEROSPACE: INTERVIEW
GURIT AT JEC WORLD IN PARIS
HYPERLOOP: THE FUTURE OF HIGH SPEED TRANSPORTATION
A LIGHTWEIGHT ELECTRIC PASSENGER FERRY
CONQUERING THE SUN

THE CONTINUED RISE OF WIND ENERGY⁰⁴ THE NEW ERA
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Content

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Dear Reader

During the last year Gurit has strengthened its presence in the wind energy sector both by organic and acquisitive steps to a level where three out of four dollars of sales which Gurit is billing goes to wind customers. Wind energy is our strategic key market, while Aero, Marine and Industrial businesses remain in full focus but are in total the one dollar of the four mentioned.

The Kitting acquisition (JSB Group) has been a major milestone. The stringent actions undertaken to position Gurit as the leading future PET-based core materials producer for wind energy turbine blades are equally important.

The thermoset synthetic core material (PVC, SAN) replacement by thermoplastics (PET) in Wind is imminent to happen in the coming years and we are undertaking all steps to be ready for it. To achieve this, Gurit is shouldering the biggest operational capital expenditure sum in a year ever since the start in composites. Equally it will be paramount to develop further the marine and industrial opportunities for SAN foam, sold under the brand name Corecell™. This is a material of choice for these markets due to its clear property advantages.

Going upstream to PET flake sourcing and the related Valplastic acquisition was the missing strategic stepping stone to achieve a "Recycled PET bottles to precision core kit" integral value chain unmatched in the market. We have the goal to achieve and defend cost leadership, global presence and to meet wind customer specifications. In the coming years we anticipate that Gurit will grow dynamically. The value chain steps are still different in relative strength – but the foundation is laid.

Our new Business Unit Kitting (JSB) has continued on its journey to be the global leading partner in kitting to the Wind Energy OEM's and their independent blade makers. Currently the JSB team is starting up a new site in Matamoros, Mexico. The central teams from Denmark and our Allentown site in the USA have supported this success. Congratulations!

There are many more Gurit missions underway and there is a lot of "positive stress" on all our teams globally, for example in coping with the 2019 demand growth in wind – targeting some 70 Gigawatt (GW) of rated capacity to be grid connected in 2019 versus some 50 GW in 2018. As a consequence, the materials are too short in supply. The mentioned capital expenditure projects need full attention, especially by the Composite Materials team as the volumes from these invests are already sold and are expected.

In Automotive, the UK site was consolidated into the Hungary plant in 2019. While painful for the good UK team, this step was a market and competitiveness necessity. The aerospace site in Kassel, Germany, is procuring yet another new prepreg tower for 2020.

You may have seen our financial results of the first quarter 2019 with strong growth. We are on track to reach the 2019 goals communicated to the financial markets – to exceed 500 million CHF in sales and an EBIT margin between 8-10%.

As you can see, Gurit is on the move to find its desired set-up and seize the market opportunities of today and tomorrow.

This Shape edition showcases some of the initiatives described and I wish you an interesting reading and foremost continued passion, energy and resulting success to build the present and future Gurit.

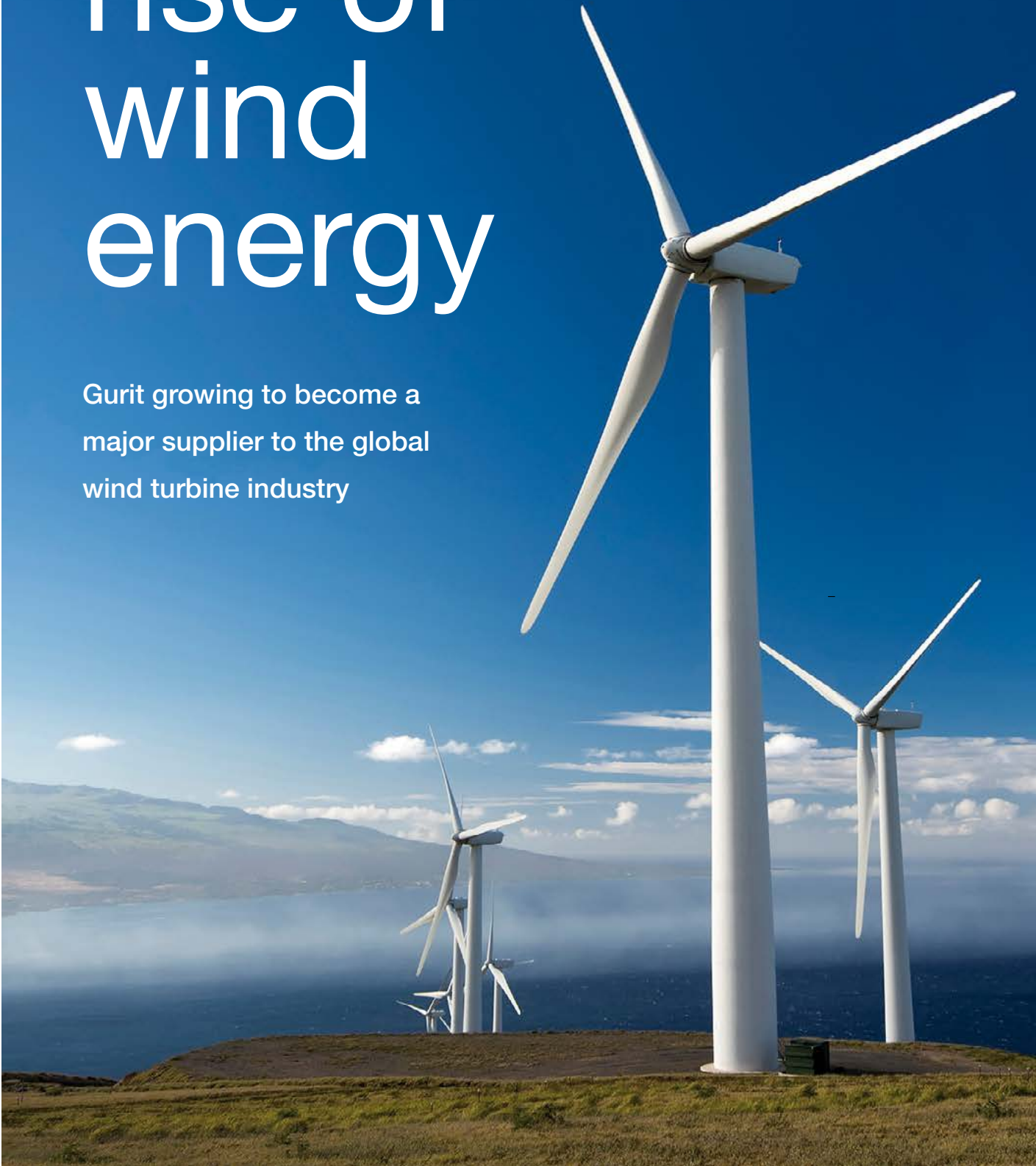
Yours sincerely,

Rudolf Hadorn CEO
July 2019



The continued rise of wind energy

Gurit growing to become a
major supplier to the global
wind turbine industry



The use of wind energy as a source of electricity generation has shown a strong growth since the mid-1990s. Last year installed wind power capacity worldwide reached 600 Gigawatts (GW) with China producing more than 200 GW and the USA producing close to 100 GW according to the World Wind Energy Association. The number of new wind turbine installations continues to grow, since 2017 the market experienced an annual growth of roughly 10%. The global energy agenda is green and the wind segment is key to its success. However, forecast for the 2018-2028 period show that the share of renewable energy hardly compensates for the growth of the world's overall energy consumption, so the overall CO₂-footprint will still not be reduced and further efforts will be needed to tackle climate change.

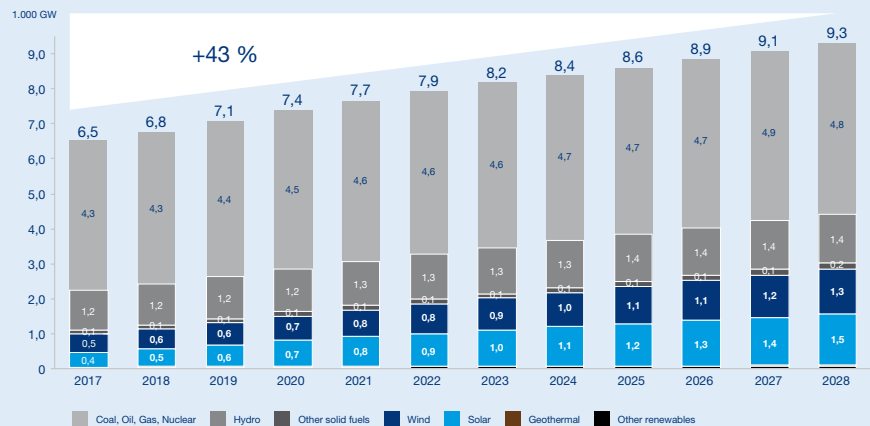
Currently, most of the wind energy is obtained onshore through wind farms located in areas with a high average wind speed, however, offshore wind farms are gaining popularity. In densely populated areas, where most energy is consumed, land resources are scarce, so it makes a lot of sense to build wind farms in nearby waters. This is expected to further increase the demand for the wind turbines in the near future.

Market dynamics

The total energy produced by wind turbines at the end of 2018 nearly met 6% of the global electricity demand. Production for new onshore and offshore turbines continues to grow. The installed capacity in terms of Gigawatts is on the rise for the 2019 – 2021 period, with an expected flatter development on a high level thereafter. The change in subsidies provided by the US government, the so called Production Tax Credit, will become effective in 2021. This is expected to temporarily reduce the demand within the US market. Generally speaking an environment without subsidies may further support growth and demand, as today renewable energy such as Wind has become more cost-effective than the traditional fossil fuels.

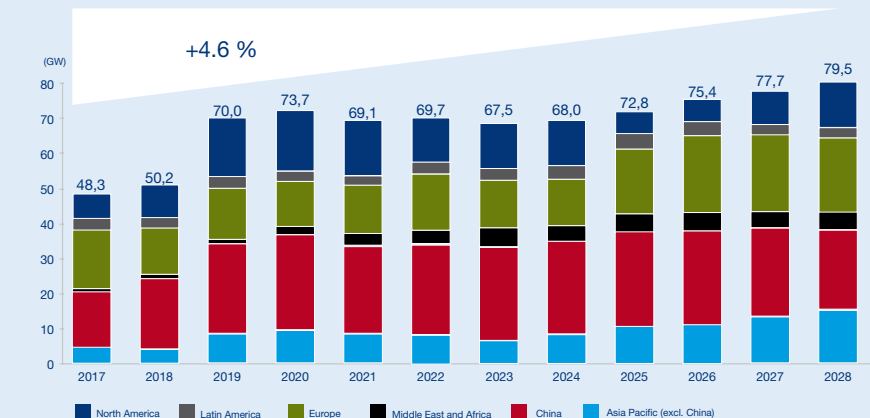
Gurit is well poised to meet the demand and has now re-focused its business strategy on Wind. For the last 30 years Gurit has been at the forefront of supporting key players with technological solutions and composite materials in the wind energy sector, which is today generating two-thirds of the

Wind and solar expected to grow more than 150% from 2018-2028 Global power generation capacity by fuel type



Non renewable sources still have the largest share in the global energy mix.

723 GW of new wind power capacity expected globally from 2019 to 2028 Global grid-connected base forecast (2018-2028)

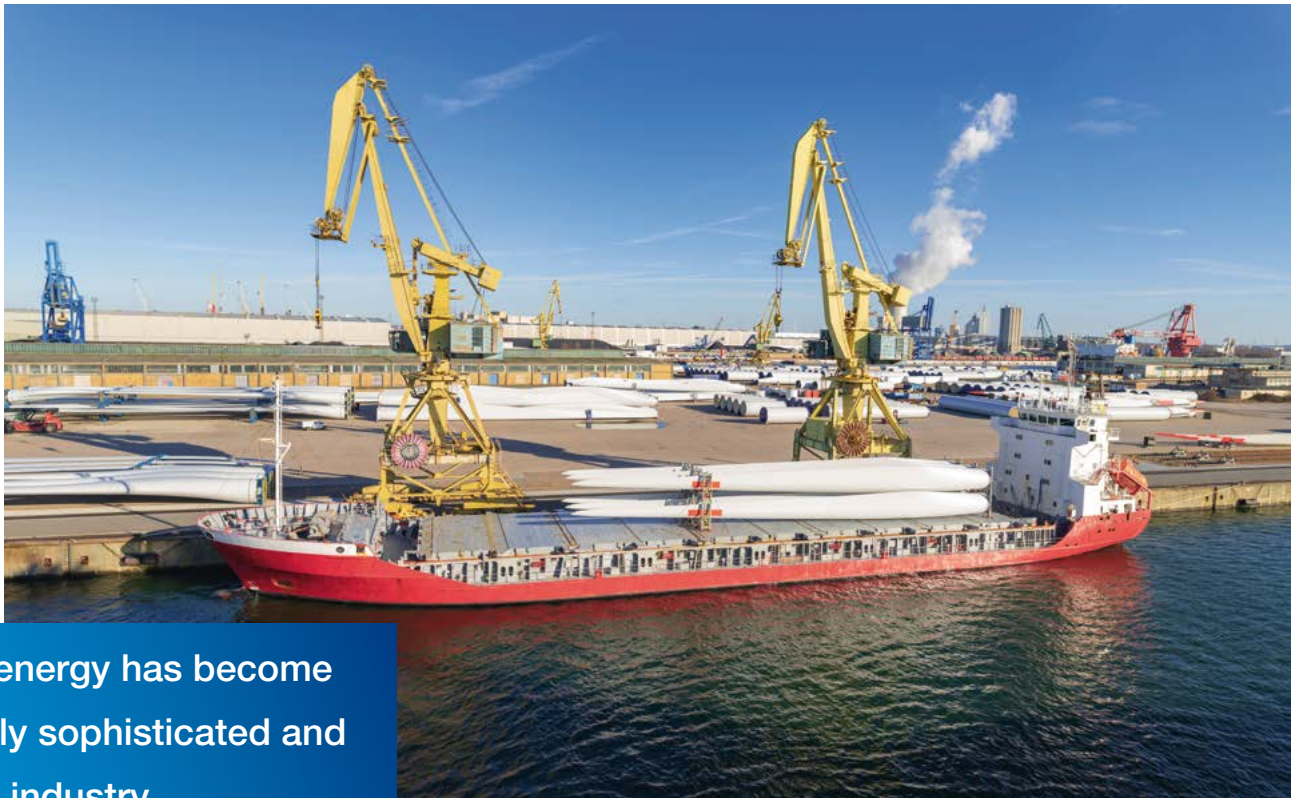


A forecast for the next ten years expects the Wind energy to grow each year by 4.6%. This means 723GW of additional wind power generation will be installed.
Source: Wood Mackenzie (2019)

company's turnover. Gurit has become a major player in the wind turbine industry.

A comprehensive offering for tooling, materials and kitting

Gurit provides wind turbine blade manufacturers with a complete offering, from turn-key tooling (the design, production and supply of wind turbine blade moulds and related equipment), to the development, production and supply of advanced composite materials, today with a focus on modern core materials such as balsa and recycled PET replacing PVC and SAN, as well as prepreg-based

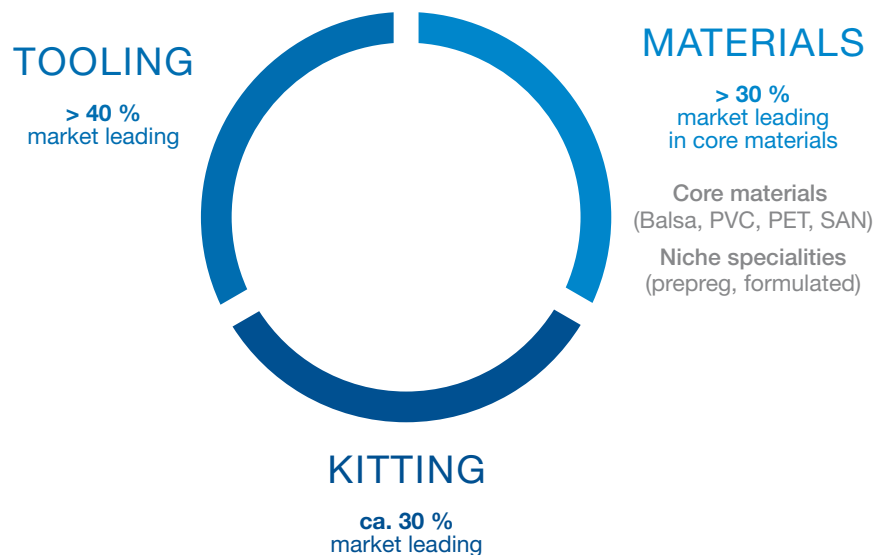


Wind energy has become a highly sophisticated and global industry.

solutions. However, with turbines becoming much larger and more efficient, we anticipate an overall decreasing or stable demand for materials. Therefore Gurit has invested into covering additional parts of the value chain, such as tooling for blade moulds as well as the design and production of complex core material kits for wind blades.

Tooling business unit at the forefront of efficiency and innovation

Gurit is, with its tooling business, the largest independent, fully integrated and highly specialised mould maker with a global reach. The offering comprises: the development and production of master plugs and moulds with an average length of 66 m to a maximum of over 100 m, to related products and services such as wind blade mould



Vertical integration for synergies and process innovation: Gurit offering for Wind market

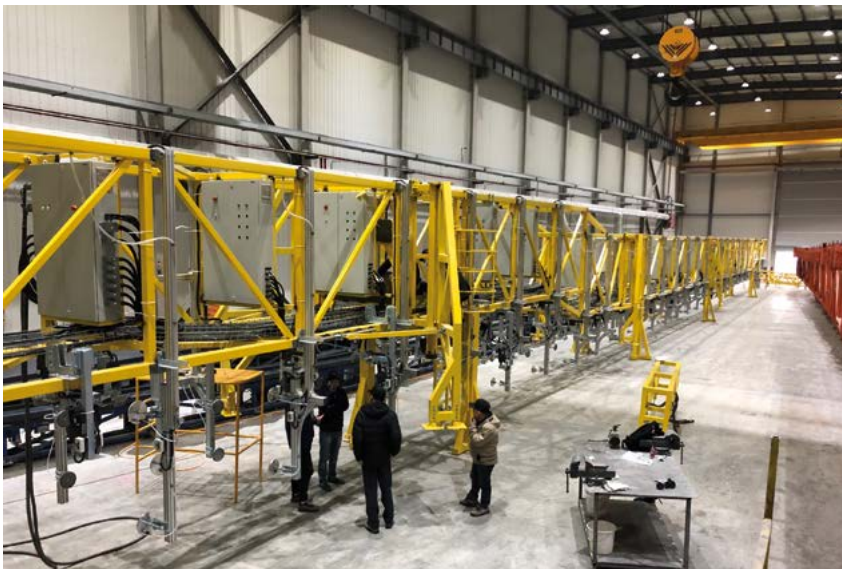
automation systems as well as installation services and transport systems for wind turbine blades and tower elements.

What matters to customers?

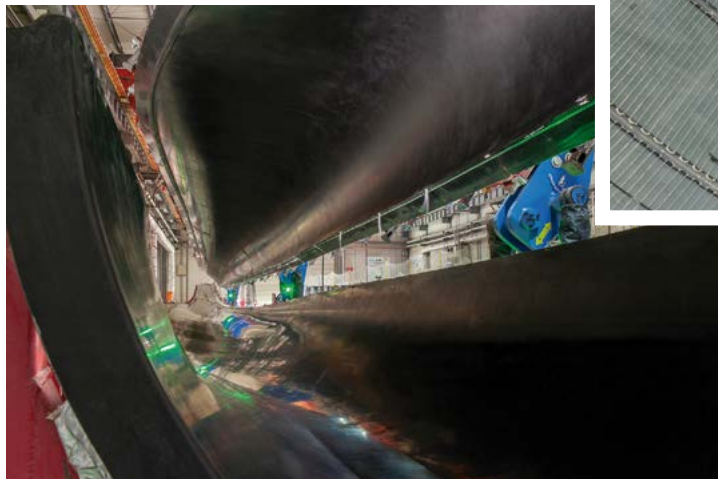
The design and operational reliability of the mould is critical for an efficient and fast production process, which has become a major competitive advantage in an environment where longer blades need capital-intensive installations and larger surfaces. The injection speed to produce, the time needed to install a mould, the uptime of gantries and moulds, connected real-time production processes and manufacturing support, all these aspects matter to our customers and will continue to challenge us as a unique full service supplier for this part of the value chain.

Sustainable Composite Materials for renewable wind energy

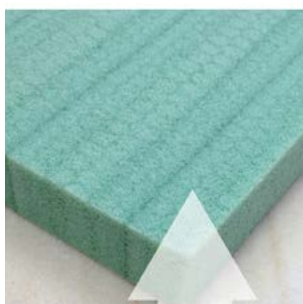
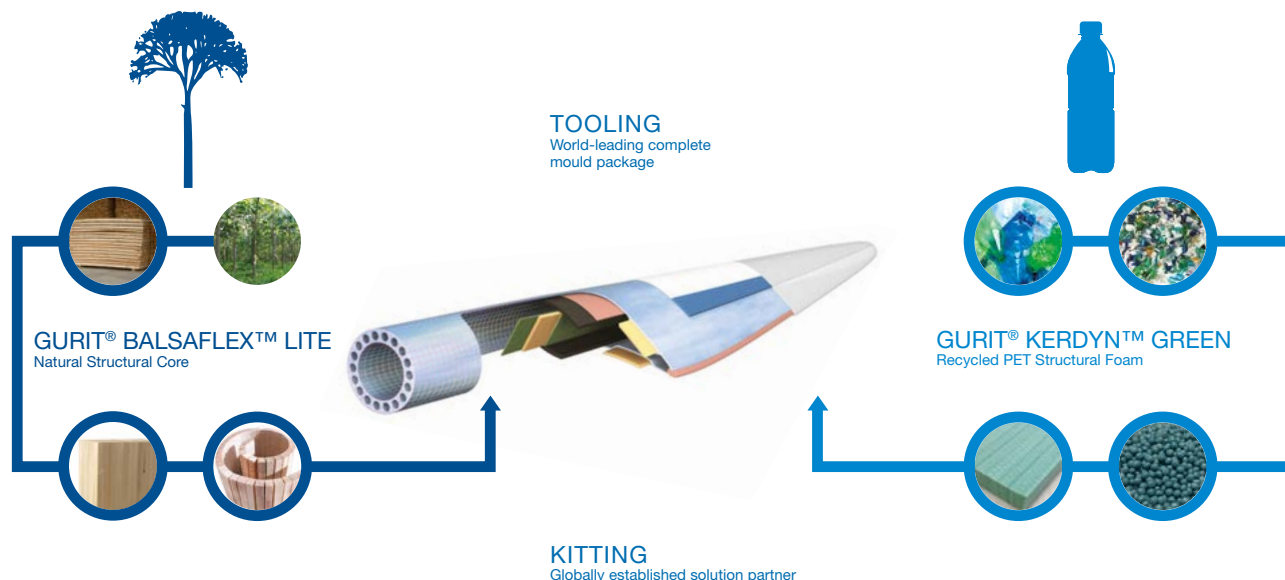
On the composite materials front, Gurit has developed solutions that have continuously contributed to the increasing efficiency of wind power installations worldwide. The challenge to be solved and improved continuously, even more so with the increasing length of the wind turbine blades, is to keep the weight of the blade as light as possible yet maximising strength, stiffness and durability. This is achieved by mixing a combination of materials used in different sections of a wind turbine blade. Gurit typically offers a range of core materials, with Balsaflex™ made out of balsa wood and Kerdyn™ Green produced from up to 100% recycled PET bottles being the most important ones looking forward. To secure its feedstock for this growing market, Gurit has recently acquired



Gurit Tooling: Gantry setting for a wind blade mould



A comprehensive offering for the wind industry

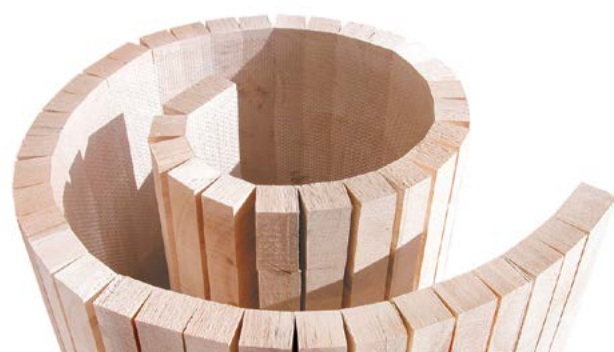


Kerdyn™ Green is Gurit's structural PET foam, made out of up to 100% recycled PET bottles.

a PET recycling plant in Italy and invests into its extrusion capacity to produce Kerdyn™ Green, a PET foam suitable for applications in the Wind sector as well as many other industrial markets. Gurit will add a few extruders to its global production capacity to meet the anticipated market demand and shift from other materials. While from an environmental as well as cost perspective unfavourable materials such as PVC and SAN remain today part of Gurit's product portfolio, and the end-of-life use of wind blades remains an unsolved challenge, the company is proud to have a real impact and make a very significant contribution to global environmental challenges with a strategic focus on recycled materials. Furthermore Gurit's co-location strategy reduces transport and utilises materials more efficiently. Overall, Gurit is heavily contributing to reducing the world's CO₂ emissions by being part of the global renewable energy sector.

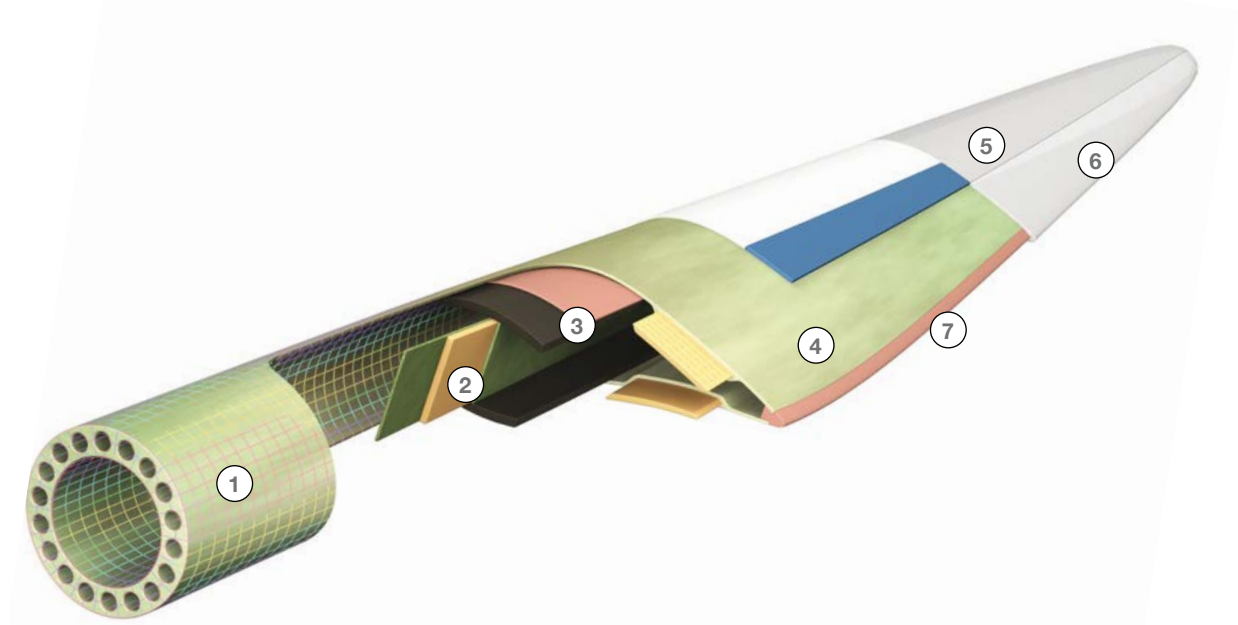
Gurit Kitting closing the value chain

Kitting is another important step in the wind blade making value chain. With last year's acquisition of JSB, Gurit is now represented in all major wind manufacturing clusters worldwide. The kitting of core materials is a complex and important production step, requiring know how and experience in engineering, design and advanced CNC capabilities. Core material kits consist of over 1600 unique items used to increase the durability and performance of wind blades. By combining the right thickness and sizes and cutting them into the right shapes, a kit becomes a lightweight yet sturdy component to support the wind turbine blade. A kit usually consists of shells for the lower and upper part of the blade and a vertical web in the middle for extra support.



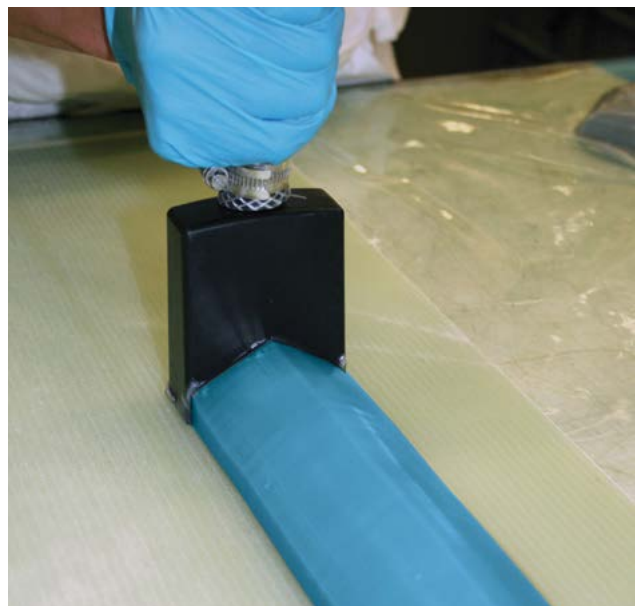
Balsaflex™ is a naturally grown core material Gurit sources and produces in Ecuador and Indonesia.

Materials for Wind Turbine Blade Manufacture



		STRUCTURAL CORE MATERIALS				PREPREGS	ADHESIVES	FILM ADHESIVE	LAMINATING	COATINGS	FILL / FAIR
		Kerdyn™	Gurit PVC	Corecell™	Balsaflex™						
WTG Blade Manufacture	1	Root	✓		✓	✓		✓			
	2	Shear Web	✓	✓	✓	✓					
	3	Sparcap				✓					
	4	Shell	✓	✓	✓	✓					
	5	Blade Coating								✓	✓
	6	Over-lamination							✓		
	7	Bonding					✓				

Core kits are typically made from a customer's choice of PET foam or balsa wood. Both are materials with a high stiffness-to-weight ratio, but while balsa is a natural wood grown in countries like Ecuador or Indonesia, PET is a foam made of recycled plastic all around the world. As the biggest independent core kitter worldwide, Gurit's kitting business unit gives wind blade manufacturers free choice of materials and suppliers, so each individual project can achieve maximum cost-competitiveness. The customer defines the specific requirements, on this basis kitting engineers develop an effective solution which then may be reproduced at decentralized production sites around the globe.



Gurit's Spabond™ 840 is a new generation of high performance and low toxicity material for manufacture and repair of turbine blades. It supports the blade's structural performance.



Rotor blades are getting longer

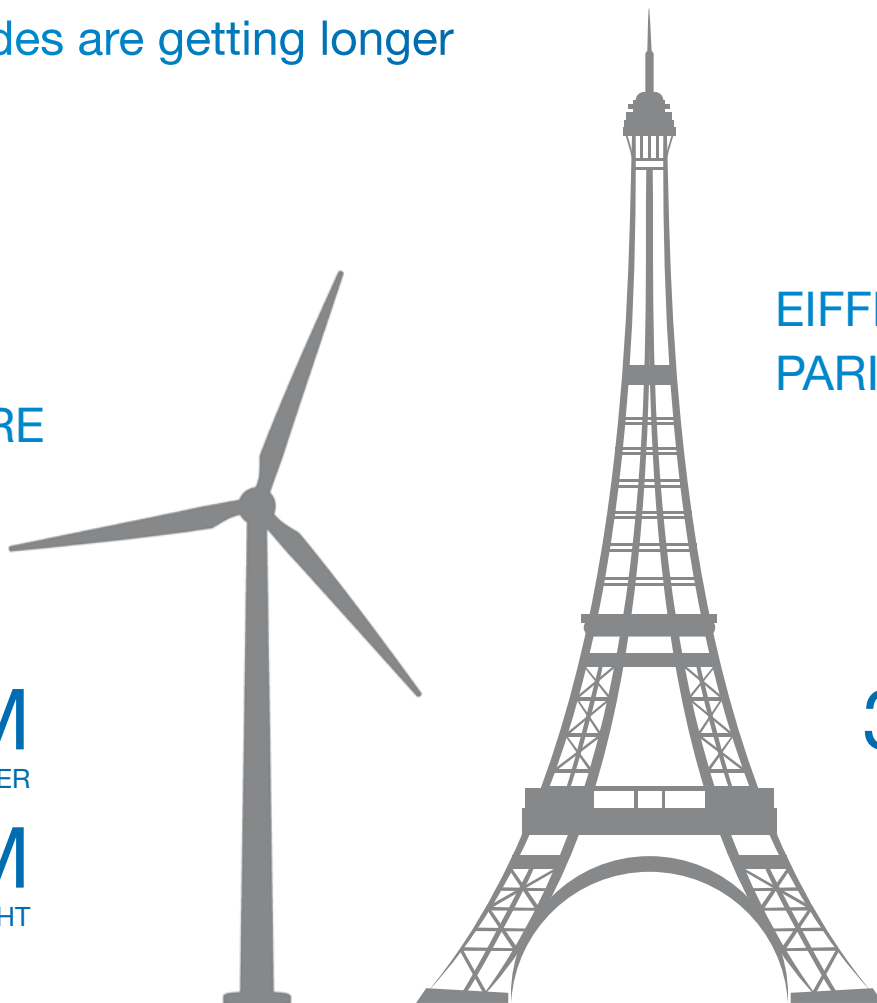
12 MW
OFFSHORE
TURBINE

220 M
ROTOR DIAMETER

260 M
HEIGHT

EIFFEL TOWER
PARIS

324 M
HEIGHT





Co-location strategy

Positioning the production of core materials at the same location as a kitting facility not only allows Gurit to cut down on transportation cost and related emissions, it also enables us to recycle materials cut away as part of the kitting process and reutilize them for the production of new material. This saves cost and helps improve our customers efficiency by shortening the production process. Therefore, Gurit now carefully examines co-location possibility for all its existing and future installations.



Kitting requires precision and comprehensive know-how

A comprehensive global offering: vertical integration as customer benefit

By positioning itself globally in all major wind production clusters and providing an integrated offering for the wind energy sector, Gurit adds value to its customers by combining know-how and saving time for improved processes and shortened logistics chains. Gurit looks towards a bright future, positioning itself as a major player in the global wind energy market.

Gurit's Wind energy offering:

 www.gurit.com

Gurit Kitting:

 www.jsbglobal.com

Global Wind Energy Association:

 wwindea.org

Foiling technology in sailing

The new era of IMOCA 60s

Gurit is not new to the yacht racing scene, having supplied high performance composite materials and undertaken world-class composite engineering on a number of high performance yachts. However, the latest generation of IMOCA 60s have evolved from straight daggerboards to foils, to what we today call native foilers. This presented some new design and engineering challenges.

Typically yachts are designed hull first with their components tailored to match; however, today's generation of IMOCA 60 yachts are designed first and foremost around their

foils. The performance of VPLP Design's latest IMOCA 60 built for the Charal Sailing Team fully relies on its foils for ultimate performance. This sets a new environment for structural engineering with different boat behaviour at sea, more complex ergonomic challenges and foil loads of unseen magnitudes.

Advanced foils

In order to design and build the highest performing IMOCA 60, Gurit and VPLP Design collaborated at very early

WHAT IS FOILING?

Hydrofoils are wing-like structures attached to the hull of boats. This generates vertical lift once the boat is in motion. With increasing speed boats then can be lifted completely out of the water, causing the boat to plane or fly at higher speeds.



stages of the design process. This collaboration enabled structural efficiency considerations to be integrated at the heart of VPLP's design process, alongside Charal Sailing Team's design choices and ergonomic considerations.

Charal's foils are designed to produce enough lift to sustain the entire mass of the boat, even at relatively low speed. As a result, the magnitude of the loads entering the composite structure is similar to that of a keel load. Gurit engineers came up with structural concepts tailored to the boat which are the result of foil shape, bearing position relative to hull chine and Charal Sailing Team's choices regarding the advanced actuation systems.

Keeping weight to the minimum

For any given foil size, a lighter boat will foil earlier and therefore travel quicker, which emphasises the need to optimise the structure and save weight. Minimising weight was particularly important on Charal as the weight was exacerbated by the fact that the foils, their systems and the support structure around them are larger and heavier than on previous generation IMOCA 60's. In minimising the weight, Gurit engineers focused their efforts on optimising areas that contributed most to the overall weight, namely, the deck and hull shells. The aim was to maintain a distribution of volume favouring stability, all without compromising structural behaviour or ergonomic considerations.

A global Finite Element Analysis (FEA) model of the resulting boat shape was built and subjected to various global sailing load cases. FEA was also used to study structural efficiency of various deck camber configurations.

In minimising the weight of the hull shell, Gurit engineers had to account for the evolution of the boat's behaviour at sea brought by the new foil configuration. A faster boat increases slamming loads and the presence of foils applies the slamming loads to different locations on the hull requiring engineers to identify which areas needed additional strength and which could be made lighter. This has been achieved with an advanced slamming analysis utilizing an in-house tool to predict transient slamming pressure distributions at different locations along the hull.

Different options were compared for the structural layout and shell laminate, including a single skin shell with densely spaced stringers and sandwich shell with fewer and deeper support beams. In order to be weight competitive against sandwich panels, the single skin option required the single skin shell thickness to be reduced down to a level that Gurit engineers were not prepared to accept. Moreover this option escalated the build complexity and meant that an imperfection could easily result in a significant structural issue.

On the other hand, the sandwich solution benefited from Gurit's in depth knowledge of the behaviour of Gurit® Corecell™ M foam when subject to high strain rate, typical of slamming response. This brought confidence in the ability of this solution to withstand the use and abuse to which IMOCA 60 hulls can be subject.

Construction

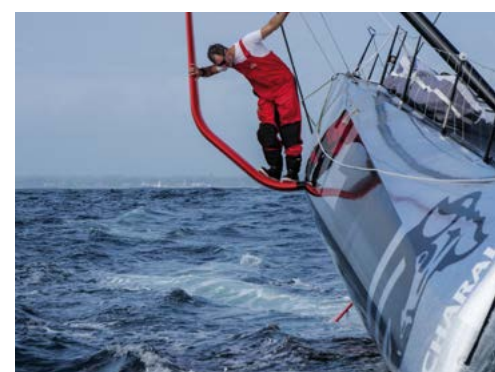
Like all ultimate performance racing yachts, Charal was constructed using only the latest and most advanced materials and techniques. Gurit was proud to be not only the principal engineers on the project but also a key material supplier, with Charal being constructed by CDK Technologies using Gurit's Corecell™ M foam; Nomex honeycomb core; SE 84 prepreg with a combination of IMC and HEC unidirectional and multiaxial carbon fibre and SA 80 adhesive films.

The results

Charal is the first native foiler IMOCA 60 to hit the water. The close collaboration between VPLP Design, Charal Sailing Team, CDK and Gurit has brought the innovation needed to tackle the challenges this new generation of Vendée Globe boats bring. Gurit's engineering work has resulted in a light, coherent structure with little compromises with the yacht capable of boat speeds above 30 knots and already showing an incredible potential on the water.



Foil of the IMOCA 60 Charal



Interview

Aerospace up to new heights

Durability and low weight are of significant importance to aircraft and aerospace manufacturers, so advanced composites are high up the list when it comes to selecting construction materials. This demanding industry was one of the first to use composite materials for an ever increasing range of applications, and remains at the technological forefront of composite development. Gurit has regrouped its Aerospace activities as a separate Business Unit and in January 2019 Michael Muser joined Gurit as the new Aerospace Unit Manager. Shape magazine has had the opportunity for an exclusive interview with him.



Michael Muser
General Manager BU Aero

Michael, can you tell us a bit more about your background prior to joining Gurit?

My background is in aerospace engineering, I graduated from the University of Stuttgart. My first job was in manufacturing engineering and R&D on composite components for the aerospace industry inside EADS, what is today known as the Airbus Group. After that I spent several years for a machine tool builder in the US, where I was responsible for the composite layup equipment. Customers were companies like Airbus, Boeing, Embraer and their suppliers. Before joining Gurit I was working on a full composite “flying boat” at Dornier Seawings.

Where are you based?

I am based in Kassel, Germany, in the headquarters of the Aerospace Business Unit. As I arrived recently and travel a lot I am still searching for a permanent place to stay.

What drives you?

My passion for sure is anything related to aerospace. I always have a desire to make things more efficient, and find solutions for any kind of problems.



Have you always been interested in aerospace? How old were you when you first boarded an aircraft?

I guess I had not much of a choice – my Dad also used to work in the aerospace industry, and was also flying gliders. I “boarded” an aircraft long before I could walk, but my first actual flight was probably around 10 years of age.

You have a pilot licence. Do you remember your first solo flight?

I actually do remember my first solo flight – it was a rainy day in Oberschleissheim, Germany.

What keeps you awake at night?

Especially right now – working too much, so I am happy about every minute of sleep I can get!

What encouraged you to join Gurit?

One of the most important factors was the chance of working on the material side of composites – after making parts and building equipment for producing parts. Even more important was the

opportunity to shape the aerospace side of this exciting and global company, and the challenge to make it more successful!

Michael, what are the trends you are observing in the aviation industry?

Probably the most obvious trend is the consolidation – both on the OEM and the supplier side. Examples are Airbus/Bombardier and Boeing/Embraer, but also UTAS/Rockwell Collins or Safran/Zodiac.

“Michael Muser’s appointment puts someone with in-depth aerospace knowledge at the helm of the Gurit aero business. This will help to further enhance customer value and growth.”

Rudolf Hadorn, Chief Executive Officer of Gurit



Gurit Aerospace provides materials for flooring, ducting and aircraft interiors

Boeing 787 "Dreamliner" made out of 50% composite materials.



Is the market growing?

The global aerospace market was and is currently steadily growing with an average rate of approx. 5% per year – however, analysts expect this to slow down to about 1-2% in a few years from now. We will certainly need to adapt ourselves to this dynamic environment.

Where do you expect the market to grow most in the next 5-10 years?

The fastest growing market is Asia, especially China, and currently the growth rate is only limited by capacities. The market is fully dominated by large commercial transport. The current situation is a cat-and-mouse game between Airbus and Boeing, where each of them is watching closely the next step of the other. This "Duopoly" will most likely be disturbed soon by Chinese products in this sector.

Another area though is the expected "boom" in "Urban Air Mobility" – so airborne taxis, most of them unmanned. We will certainly keep an eye on this development.

What is Gurit's value proposition in the aerospace sector? What do you see as Gurit's strengths in the market?

Our focus is and has historically always been on interiors, a niche market with significant lower prices compared to primary structures. As a differentiator to many of our competitors, we can offer an in-depth knowledge of interior applications, which allows us to develop the right products for the market. In addition, we try to be extremely flexible in terms of product variations and lead times, in order to fulfil the needs of any customer. Last but not least, we offer very knowledgeable customer service and tech support.

What items are being built using Gurit Aero composite materials?

Way too many to be listed here! Worth mentioning are interior components such as floor panels, to side walls/linings, to the ducting which is mostly hidden "behind the scenes", and up to luggage compartments.



Interior materials fulfil specific requirements regarding strength, smoke- and heat-release

Lightweight composites for an electric passenger ferry

With many nations looking towards a carbon neutral future, there has never been more focus on reducing greenhouse gas emissions.

Electrification of transport is one of the key ways that we will be able to reduce carbon emissions. High speed ferries, an integral part of the transport network of many cities pose a particular challenge but also massive potential in reducing emissions. When it comes to electric propulsion reducing the weight of the vessel is paramount.

Gurit is involved in a project of a 19m vessel being built by Wellington Electric Boat Builders (WEBB) for the ferry operator East by West Ferries in Wellington, New Zealand. Upon completion it will be the Southern Hemisphere's first large, fully electric, high speed zero emission commuter ferry. The ferry will operate in the Wellington area at 20 knots service speed on a return trip of 50 minutes, with charging available only at one end of the intended route. The vessel will use electricity from 100% renewable sources and will save around 14000 tonnes of carbon dioxide over its operational life.

Cutting down on energy consumption

On a conventional commercial ferry energy consumption followed by maintenance are by far the largest costs for the owner and operator over the life of the vessel and can easily be 4-5 times the purchase price of the vessel. As a result, minimising weight and improving efficiency can have a significant impact on the running costs.



Fully electric: East by West Ferries, New Zealand

Electric propulsion reduces operating costs with the energy cost being approximately half that of diesel per kWh. However, the on board Energy Storage System (ESS) are heavy to achieve the required endurance. This weight in turn increases energy consumption, so it is a careful balance of providing sufficient energy storage without over burdening the vessel. To compensate for the weight of the ESS, the logical option is to reduce the structural weight of the vessel to ensure maximum efficiency.

Lightweight engineering

With a key focus on minimising the ferry's weight, designers SSC Marine and Gurit selected carbon fibre sandwich panels for the construction. Preliminary design analysis showed that light weight carbon construction was the enabling technology that helped minimise vessel dead weight and therefore improving energy consumption.

Gurit's Hi-Panel system of pre-infused CNC cut flat panels were selected for the construction. The Hi-Panels are epoxy infused composite panels, in this case the wingdeck and hull were made from Gurit's Corecell™ foam for its excellent shock absorbing properties and high strength to weight ratio, with carbon fibre skins to minimise the weight.

The Hi-Panel method minimises tooling and labour costs in building a one-off composite vessel, while allowing flexibility in the construction process by not having to commit to large moulds. With the option of delivery as finished panels with maximum dimensions of 9 m x 2 m or cut to shape, the method provides for an easier and faster construction process.

Gurit looks forward to following the construction progress using the Hi-Panel system and to seeing the success of the high speed electric ferry once up and running.

Looking at the stars

Complex engineering in dome observatory

A new astronomy centre in Tekapo, New Zealand is set to house one of the world's most famous Victorian-era telescopes inside a custom observatory dome: the restored Brashear Telescope, named after the American astronomy-pioneer John Brashear. The telescope, which dates back to the late 1800s, stands up to 10 metres tall when measured from the base and as a result requires a suitably large dome to house it.

Gurit engineers were engaged to supply the structural analysis and laminate design for the structural composite panels

The 10.9 metre diameter fibreglass dome was built by Industrial Fibreglass Solutions and Gurit engineers were engaged to supply the structural analysis and laminate design for the structural composite panels that make up the dome. The dome presented some unique challenges for Gurit engineers, in that there are moving parts and a window for the telescope to view the stars.

The dome was designed to withstand heavy snowfall and strong winds up to 195 km/h which, when the window is open forces the air to funnel into the dome, making it act similar to that of a spinnaker on a large yacht. Such heavy winds usually have a prevailing direction however with the dome's ability to turn, allowing the telescope to track and locate objects in the sky, it needed to be sufficiently strong to withstand the wind coming from any direction without failure or inhibiting the dome's movement. Special attention was required to ensure the dome's base ring where it connected to the support structure allowed for thermal expansion in the heat and contraction in the cold.

Gurit engineers overcame these challenges using advanced analysis tools and a virtual 3D model of the dome to allow for releasing degrees of freedom and conducted non-linear analysis to ensure moving parts were kept unobstructed but sufficiently tight to ensure the dome didn't fly off in a stiff breeze.

Construction of the dome was completed using one of Gurit's fire resistant PET structural foams in conjunction with Gurit's fire resistant Ampreg™



epoxy laminating system. This epoxy resin was critical in achieving good thermal stability and avoiding cure distortion, enabling a seamless assembly of the segments. The dome was produced using only three main moulds: one for the 3 m x 7 m curved segments, one for the shutter panels, and one for a base ring flashing. The dome was fully assembled at the factory and then separated into half sections to be transported on-site to be reassembled before being lifted and installed via a crane.



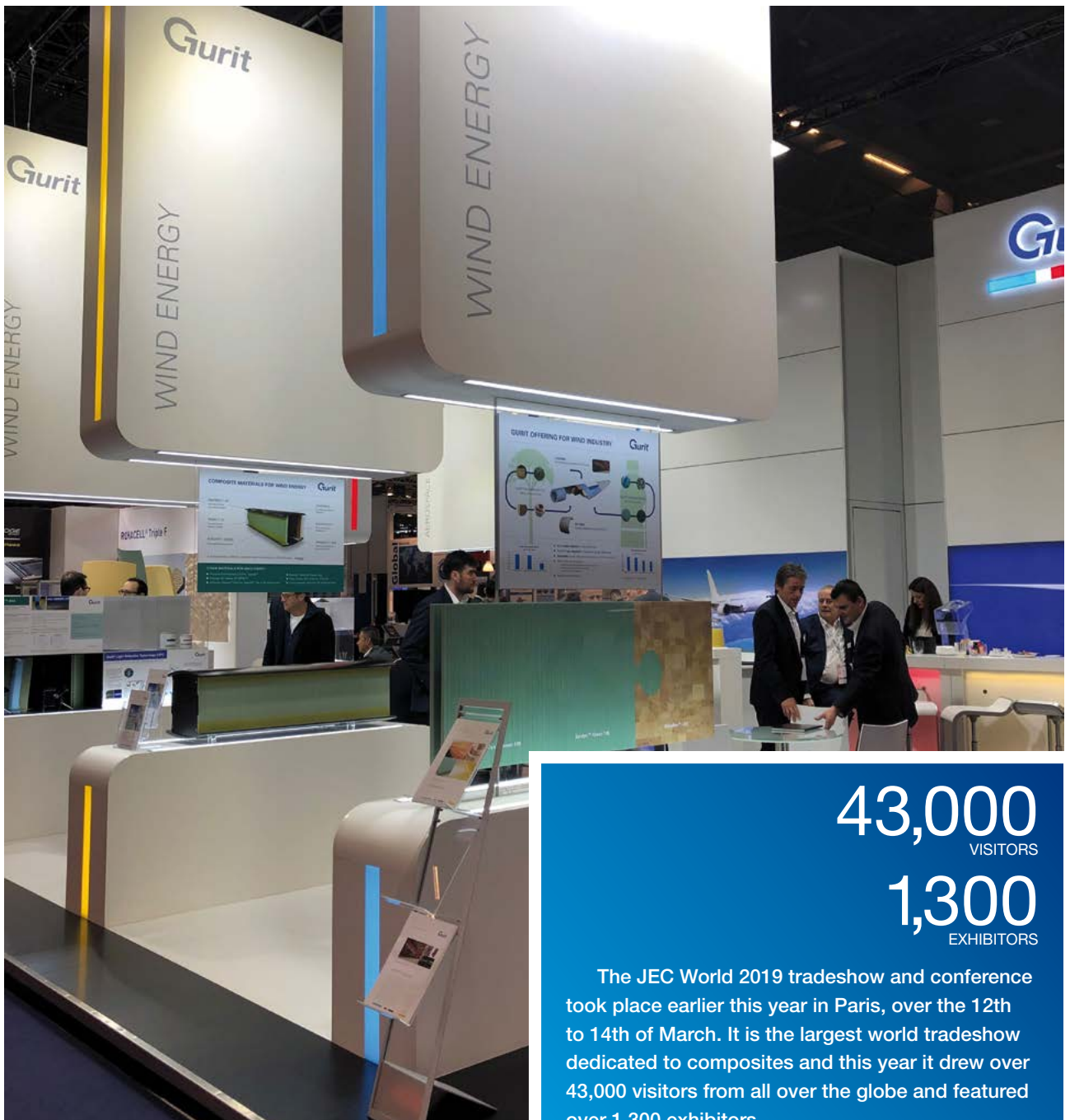
Tekapo, New Zealand

Gurit is proud to have been a key partner for materials and engineering and looks forward to seeing the dome in action.



Looking back:

JEC World in Paris



43,000
VISITORS

1,300
EXHIBITORS

The JEC World 2019 tradeshow and conference took place earlier this year in Paris, over the 12th to 14th of March. It is the largest world tradeshow dedicated to composites and this year it drew over 43,000 visitors from all over the globe and featured over 1,300 exhibitors.

The tradeshow features everything around composites: ground-breaking, innovative products and solutions as well as a three-day technical conference where expert speakers come together to share information and ideas. This year the conference focused on additive manufacturing, aerospace, architecture and construction, automotive, design as well as sports and leisure.

Gurit hosted a large booth showcasing its expertise in wind energy, aerospace, marine and other industrial applications. On display was Gurit's comprehensive offerings for wind turbine blades, including the environmentally friendly Kerdyn™ Green and Balsaflex™ core materials. Also featured was Gurit's innovative and safety conscious new adhesive systems, including the Ampreg™ 3X Series laminating system.

Showcased alongside the core materials and formulated products was a range of exhibits such as wind blade spar cut-through view, a passenger aircraft floor panel as well as a rail panel produced from new 130FR prepreg materials.

Gurit further cemented its expertise in composites with Design Engineer, Raphael Gerard presenting at a conference hosted by our supplier Altair. The presentation covered Gurit's material supply and the in depth engineering of an ultimate efficiency student built solar car where minimising weight was paramount to the team's success (see article on page 25).

Following the event Shape caught up with some of the Gurit team at JEC World. Gurit's Regional Director Americas, Lance Hill mentions *"this year's JEC World in Paris has been different from past years. We had American customers from all industries, but especially from the aerospace sector. This reflects the hard work that Gurit has been doing to achieve OEM qualifications."* Mark Elliott, Gurit's Sales Manager Tooling was also pleased with the events success quoting *"I am impressed with JEC World, it was very productive with great customer conversations."* Gurit's General Manager Business Unit Composite Materials, Stefan Gautschi thanks all customers and business partners for a great JEC World 2019 and advises *"It has been vibrant, the industry is there, Gurit is there and we would love to support the industry long term."*

The tradeshow was a great success for both Gurit and the composites industry with a strong turnout from customers in wind energy, aerospace, marine and rail industries. You will find Gurit again at JEC World in Paris, **March 3-5, 2020** at the same booth location.



Max von Bistram
Sam Pickard
Technical
Support Team



Rudy Jurg
Regional Sales
Manager



Refreshing
fruit cocktails
at the Gurit bar



William Tian
Mark Woodruff
Sean Jeffery
Asia-Pacific Team





Hyperloop pod
unveiling event,
May 29, 2019

The future of high speed transportation



SpaceX headquarters, Hawthorne, California

Billionaire industrialist, Elon Musk, the CEO of aerospace firm SpaceX and founder of Tesla hypothesized the concept of a Hyperloop transportation system over 5 years ago where he mused on the need for an additional form of transport between pairs of high traffic cities around 1500 km (900 miles) apart. The idea was to create a transportation system safer, faster, more convenient and lower cost to transportation options available today. The idea was coined the Hyperloop and consists of a pod moving at a very high speed through an enclosed tube. The first documented thoughts of transportation in a vacuum tube go back to 1812 by George Medhurst. And since the 1970s various concept studies were drafted, such as the Swissmetro, but all abandoned for cost reasons or unresolved technological issues.

The Hyperloop idea is an “open source” concept still in development phase with a number of organisations working to develop a safe and reliable model. To support the development of functional prototypes and encourage innovation the Hyperloop Pod Competition was created in 2015 where teams are challenged to design and build the ultimate high-speed ground transport pods.

Student teams from around the world come together to share their pod designs. Designs are then judged by SpaceX and *The Boring Company* with top teams selected to progress onto the build phase where students turn their designs into functional pods. The competition then culminates at the SpaceX Hyperloop Test Track in California where the completed pods are raced and judged solely on one criteria: maximum speed with successful deceleration.

In order to achieve maximum speed and safe deceleration, minimising weight is crucial to the pod's success. Gurit is pleased to sponsor the EPFLoop team of the Swiss Federal Institute of Technology in Lausanne, Switzerland, providing them with engineering support and advanced composite materials for the 2019 Hyperloop Pod Competition.

The team has successfully submitted a design and along with 20 others has been selected to progress onto the build phase.

Lorenzo Benedetti, team Leader of EPFLoop states: *“Since the first contact back in October 2018, Gurit has been a strategic partner of the EPFLoop team. In a constant research of performance, our engineering students strived to create a structure for the prototype which is capable of resisting extreme accelerations and intense vibrations and, still, being the lightest possible. We had a very fruitful exchange with Gurit engineers, in particular Luke McEwen. Together, we analyzed step by step our structure and optimized the use of the prepreg carbon fiber material. The products identified as suitable for our case were the biaxial prepreps XC411 and RC200, whereas for the sandwich construction the M80 and M200 Corecell™ foams. After the design review, the final prototype structure reduced substantially its weight, down to one third from the EPFLoop prototype of 2018, while maintaining the safety level required by SpaceX.”*

The EPFLoop team has been ranked as one of the top three teams in last year's competition. This team of enthusiastic and motivated engineers strives to push the boundaries in terms of innovative pod design and construction and gives a glimpse of what the future of transportation may look like. Gurit is delighted to be part of this effort.

— E P F | O O P —



THE HYPERLOOP CONCEPT

A Hyperloop is a sealed tube or system of tubes through which a pod transporting passengers or freight may travel free of air resistance or friction, allowing people or objects to travel at high speed while being very efficient.

In current concepts pods would be propelled at a speed of 760 mph (1,200 km/h), allowing passengers to travel a 560 km route in only 35 minutes – considerably faster than current rail or air travel times.



 www.epfloop.ch

 www.spacex.com/hyperloop



Providing a safe workplace



Hannes Haueis
EC Member and Head of Group Human Resources will take care of Gurit's new occupational health & safety initiative.
E-mail: hannes.haueis@gurit.com

Gurit considers occupational health and safety of its employees and visitors as one of its most important topics. This is achieved by maintaining safe and healthy working conditions and by fostering a culture focused on awareness, open communication, safety education and supervision, and safe working methods. Our ambition is to have zero work-related injuries and illnesses.

Safety is one of our number one priorities; we will do everything in our power to protect employees and visitors' health. The Group Management has now decided to further formalize and deepen this commitment with a Corporate initiative that will be launched before the end of 2019 under the responsibility of the Executive Committee member Hannes Haueis, also in charge of Group Human Resources.

Safety-first culture

The main focus of the initiative will be to introduce international occupational health and safety (OH&S) management systems as well as environmental ISO standards at all sites. Even more important will be to implement and live a "safety first culture" throughout our organization, amongst all our employees and business partners, and across all hierarchical levels. We will follow-up on this new initiative in our next edition of SHAPE.

What is your view?

Share your ideas on where health & safety matters most and how you think these aspects can be improved most effectively. Send your suggestions to Hannes Haueis.

Conquering the sun

For over 30 years the Bridgestone World Solar Challenge has inspired student teams to push the limits of technology to build a vehicle to travel across the Australian outback powered by the energy of the sun. Gurit is pleased to have been supporting the Western Sydney Solar Team with materials and in designing and optimising their latest vehicle, “Unlimited 2.0”.

3000 km across Australia

The competition traverses 3000 km across Australia’s unforgiving outback from Darwin to Adelaide with the only power source being the energy from the sun or recovered from the kinetic energy of the vehicle while underway and a nominal 5 kW hours of stored energy.

Teams must travel as far as possible until 5:00 pm each day where they will camp in the desert, wherever they happen to be. At the end of the seven day competition the team with the fastest time to Adelaide, or the team closest to Adelaide is crowned the winner.

Aerodynamic lightweight solar cars

The Western Sydney Solar Team entered the Challenger Class, where single-seat solar cars are designed to be fast, aerodynamic masterpieces. Strict size limits governed the maximum dimensions of the cars along with a 4 m² maximum solar array.

The Western Sydney Solar Team approached Gurit engineers seeking support with optimising

the roll hoop. In optimising the components engineers were required to adhere to strict rules which set aside minimum g-force strength requirements to ensure driver safety.

Composite engineering at its best

Gurit engineers undertook a topological optimisation of the roll hoop, which produced the most efficient design, capable of withstanding the minimum g-force requirements.

Where the first phase produced a model identifying the most efficient places to put material, in the second phase a size optimisation model identified how much material was needed to be placed in each area to ensure the no failure constraint was met.

However the degree to which the model was optimised made it unachievable for any manufacturer to produce the exact layout of the carbon plies. This issue was addressed in the third phase, ply cleaning, where virtual carbon tapes and patches compatible with the building method were created and added to the model.



Max Mammone
Team Captain Western Sydney Solar Team



Unlimited 2.0, Western Sydney Solar Team

Materials used for top performance

Construction of the solar car was undertaken using Gurit SC 110 high performance prepreg with RC200 carbon fibre for the outside shell and Gurit SE 84 prepreg for the remaining structural plies. Gurit Corecell™ M foam was used in areas subjected to impact and honeycomb core in the remainder of the structure for minimal weight.

The three-phase optimisation process conducted by Gurit Composite Engineering reduced the composite weight from previously 80kg to only 42kg, contributing only 19% to the total vehicle weight.

The Western Sydney Solar Team performed well in “Unlimited 2.0”, placing 6th in the Bridgestone World Solar Challenge 2017 despite some challenging weather conditions, and improved upon their performance winning the highly contested 2018 American Solar Challenge. The next World Solar Challenge race from Darwin to Adelaide will take place **October 13 – 20, 2019.**

This year Gurit is working with two Australian university teams in an advisory role and providing engineering design for the chassis and safety cell for the upcoming events. Gurit is thrilled to be involved in furthering the design of alternative energy vehicles and supporting these student engineers in gaining a firm understanding of advanced composite materials.

Converting recycled PET bottles into renewable energy generation



Gurit's commitment as an environmentally responsible business continues into 2019 where Gurit acquired the PET recycling production facilities from Valplastic in Italy.

Valplastic is specialised in the recycling of polyethylene terephthalate (PET) bottles and the production of recycled PET-flakes and granules which are later used for the extrusion of recycled PET core materials. The acquisition is in line with Gurit's product stewardship, ensuring that environmental and health and safety impacts are minimised throughout the supply chain.

The transaction provides Gurit with the security of high quality and cost effective raw material supplies for the new range of Gurit® Kerdyn™ Green which is produced using up to 100% recycled PET materials.

Alongside the secure supply line, the acquisition brings wind customers confidence that the PET materials used to produce the blades on their wind turbines complements the environmentally friendly nature of wind energy. With the new plant,

discarded PET bottles are recycled with the recycled PET-flakes and granules transported to Gurit's factory in Volpiano, Italy where the recycled materials are extruded and converted into Kerdyn™ Green. The structural foam is then used for wind blades as well as many other applications.

Shape spoke with Rudolf Hadorn, CEO of Gurit Group who mentioned *"with this transaction Gurit can connect the value chain from purchased recycled bottles out of the collection network down to a precision core kit for the global Wind OEMs. It allows Gurit to secure feedstock, quality of product through content control and strong cost competitiveness. We welcome the team in Carmignano-di-Brenta to Gurit and look forward working all together to grow the recycled PET business as a sustainable product to serve the global Wind Energy Industry on its important mission."*



Antonio Maistrello (Plant Manager), Stefan Gautschi (General Manager BU Composite Materials), Cristian Vecchiato (Commercial and Administration Manager) with the new Gurit logo in front of the PET recycling facility in Carmignano-di-Brenta, Italy.

Formulated product range

At the forefront of Health & Safety

As a company continually focused on innovating and improving products, processes and technology, Gurit is always looking for ways to improve the status quo. Through this innovation Gurit has launched the new Ampreg™ 3X Series laminating system and the AMPRO™ multi-purpose Epoxy range.

The release of the Ampreg™ 3X Series replaces and improves upon Gurit's legacy range of wet laminating systems for the manufacture of large composite structures in the marine, wind and construction industries. It comprises a single range of low toxicity, blend-able Ampreg™ 30 hardeners that can be used in conjunction with any of the new Ampreg™ 3X resins.

produce hulls with excellent consistency in quality as well as having dependable uniformity characteristics which have been crucial in a one design yacht class."

Gurit also launched the new AMPRO™ multi-purpose Epoxy range earlier this year. Available with an AMPRO™ standard resin or AMPRO™ BIO, an accredited bio-based resin as a more environmentally friendly option as well as three hardeners speeds, fast, slow and extra slow, and the water resistant AMPRO™ Colloidal Silica. Again, health & safety is a key feature of this range and as a result workers can be sure they are not in contact with any carcinogens, reprotoxins or mutagen chemicals.

The series has been reformulated to provide greater user health & safety and comes equipped with Light Reflective Technology (LRT) as standard. The LRT serves as a risk monitoring feature for users, enabling contamination to be easily detected by means of a simple, low-cost LED UV torch or through automated vision detection systems.

Successful market introduction

Fibre Mechanics, a custom yacht builder have successfully integrated Ampreg™ 30 into their construction of a fleet of Melges IC37's, a 37ft one-design racing yacht. At the time of writing the Fibre Mechanics team were moulding their 13th hull and selected Ampreg™ 30 for its ease of handling and curing as well as the health and safety advantages it provides. Shape spoke with Fibre Mechanics' Projects Director and Co-Owner, Adrian Gillitt who mentioned *"the combination of Gurit's resins and M-foam cores [Corecell™ M Foam] has been a real success, allowing us to*

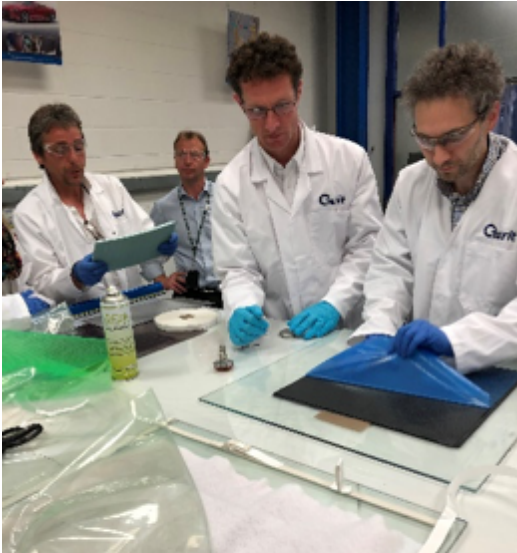
The new products also provide a number of performance benefits over legacy systems. New chemistry has been developed that enables lower temperature curing (+5°C overnight curing) and improved through cure at ambient temperatures. As a result coatings are blush, bloom and tack free after an overnight, room temperature cure, reducing the need for further cleaning and sanding. The AMPRO™ resin matrix also has increased flexibility whilst maintaining good strength and stiffness properties, making it ideally suited to wooden boat construction and structural applications.

A complete bio product range

Gurit has uniquely brought together low toxicity, accredited bio-based chemistry, sustainable core materials and natural fibres in order to be able to offer materials for a complete bio panel solution.



The new AMPRO™ BIO range



Expert laminating workshop
for Gurit sales staff

“We are very excited to be working with Bcomp who share our core values in placing environmental & social awareness at the forefront of our innovations without compromising on performance. Together, we now have all of the key ingredients to deliver a bio-based composite panel solution for multiple industries.”

Stefan Gautschi, General Manager Gurit Composite Materials

Bio-based resin technology

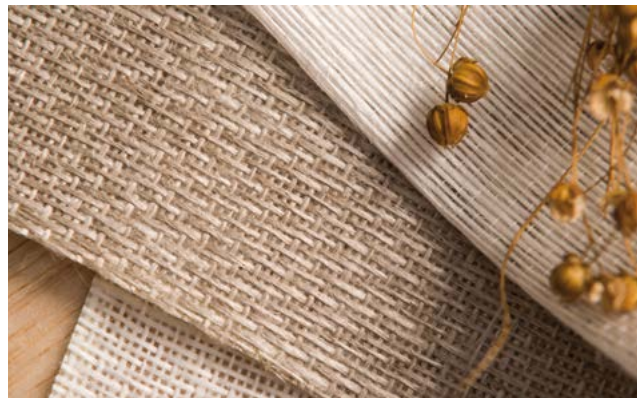
Gurit's new AMPRO™ BIO resin retains all the features of the standard AMPRO™ resin, however was developed using plant-based materials derived from sustainable by-products of the food chain. This provides a more environmentally friendly resin that does not compromise on performance and due to the >40% bio-content results in a richer colour which further enhances the natural grain of the wood being coated. For more information on how the new Ampreg™ 3X Series or AMPRO™ Multi-Purpose Epoxy Range could benefit your next project, contact your local sales representative.

Bio-range complemented with natural fibre solutions

Gurit has recently started a collaboration with Bcomp, a Swiss high-tech start-up specialised in sustainable lightweighting materials, applying the latest composites knowledge to natural fibres. With immediate effect Gurit will start selling ampliTex™ and powerRibs™.

The proprietary powerRibs™ technology is an extremely lightweight natural fibre reinforcement. Inspired by leaf veins, it provides maximum stiffness at minimum weight by creating a rib structure on one side of a thin-walled shell element. It is a revolutionary technology perfect for high performance applications.

Bcomp's ampliTex™ range of technical fabrics enable innovative composite material solutions for various applications. It includes different technologies - non crimp, low twist, no twist, braids and ampliTex™ fusion, and are popular to double as visual layers for design, marine and sports applications thanks to their stunning finish.



ampliTex



powerRibs

 www.bcomp.ch/en/products/amplitex
 www.bcomp.ch/en/products/powerribs

Design freedom through composite materials



Gazechim Composites Ibérica, Gurit's distributor in Spain, is a leader in the distribution of raw materials for the composites industry throughout Europe. When it came to developing a canopy for their headquarters in Valencia, Spain, naturally it had to be built from composites and thanks to their high strength to weight ratio the canopy was also able to feature a design unattainable using traditional materials.

The object of the headquarters building is to represent and reflect the benefits of composites. The 340 sqm self-supported cantilevered canopy was instrumental in doing this with the self-supported double curvature providing the illusion that the canopy is held up by the air. This design was only achievable through the high strength to low weight ratio of composites with the completed canopy weighing only 6,000 kg.

Instead of using traditional materials the canopy was produced using Gurit® Kerdyn™ Green FR. This structural core is produced using up to 100% recycled PET and provides an environmentally friendly alternative to traditional PET foams. Thanks to the addition of fire retardant additives the foam

also features excellent fire, smoke and toxicity (FST) performance designed to comply with marine, civil and transportation requirements.

Shape spoke with Gazechim who advised they selected Kerdyn™ Green FR due to a combination of its excellent mechanical properties and for its lower carbon footprint as a recycled PET product. The Gazechim Composites Ibérica team also had confidence in the products quality: *"Gurit is a leader in quality and the size of the canopy required us to use top quality products"*.





The structure was built by Graphenano Composites who built the canopy using four main moulds to produce the upper and lower panels of the structure. The moulds were first lined with dry multi-axial E-glass before being layered with Kerdyn™ Green FR. Vacuum assisted resin infusion was then used to pull the resin through and impregnate the panels. Graphenano Composites also incorporated a graphene nanotechnology into the selected polyester resin which provided further structural benefits in terms of lightness, strength and durability.

The canopy was installed in October 2018 and the structure has proven a success withstanding some heavy loads exerted by strong winds during the winter.

Gazechim Composites Ibérica have done a superb job showcasing the benefits of modular construction and design freedom afforded by composite technology, as well as providing another example of the advantage of composites over traditional steel and concrete materials.

“Gurit is a leader in quality and the size of the canopy required us to use top quality products”

Jaime de Muller, New Business Development



Events Agenda

Second half-year 2019

July 3-5	JEC Forum Bangkok Bangkok, Thailand
July 11-14	The Foiling Week Garda Fraglia vela Malcesine, Italy
September 3-5	China Composites Expo Shanghai World Expo Exhibition & Convention Centre (SWEEC), Shanghai, Hall 1, Stand 913  www.chinacompositesexpo.com
September 12-22	Southampton Boat Show Southampton, UK (represented by our distributor Marineware)  www.southamptonboatshow.com
September 24-26	CAMX 2019 Composites and Advanced Materials Expo Anaheim, CA, USA  www.thecamx.org
October 1-3	IBEX International Boatbuilders' Exhibition & Conference Tampa, Florida, USA: Booth 3-942  www.ibexshow.com
October 8-9	KOMPOZYT EXPO Krakow, Poland (represented by our distributor Chem4pol)  www.kompozyty.krakow.pl/gb/
October 17-18	CANZ Conference Christchurch, New Zealand
November 19-21	METSTRADE leisure marine industry tradeshow Amsterdam  www.metstrade.com
November 28-30	Eurasian Composites Show Istanbul, Turkey (represented by our distributor Neva Marine)  www.eurasiancomposites.com



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