Issue 40 • November 2015

Connection

The official magazine of Composites Australia

Inside

Luxury boat builders ride market rise

Delivering The Right Solutions

Australasia's leading manufacturer and distributor of composite materials, unsaturated polyester and vinyl ester resins, gelcoats and flowcoats.

To complement our own products, we nurture long-standing supply relationships with highly respected global composite material suppliers. We are proud of our 50 year heritage of developing innovative products and supporting them with the most comprehensive supply chain and technical support available.

Partners With
The Right Chemistry

nuplex.com/composites

Contents

Issue 40 • November 2015

Front Cover
Australia's leading luxury boat builders report sales growth, creating jobs and boosting the economy. Image courtesy Riviera.
See Page 6

Feature article

After years in the doldrums, leading Australian luxury boat builders Riviera and Maritimo report strong domestic and export market growth, creating jobs for composite technicians.

6–7

Publisher: Kerryn Caulfield, **Chief Executive**

Editorial inquiries: Liz Tunnecliffe

Advertising inquiries: Anna Civiti

Design: Stefan Morris, Tel. 0411 708 279

Connection Magazine
is the official magazine of Composites Australia Inc.
ABN 28 611 244 813
Next issue: March 2016

Composites Australia
17 Rooney Street, Richmond, Victoria 3121
Tel. +61 (0)3 9429 9884
Fax. +61 (0)3 9421 5516
www.compositesaustralia.com.au

The 2015-16 Board of Composites Australia

President
Genelle Coghlan
Colan Products

Vice President
Martin Nikolas
Marky Industries Pty Ltd

Treasurer
Stephen Brennan
B I Glassfibre Pty Ltd

Roger Cater
PARTEC Institute - Composites Training Centre

Frank Cristiano
Tricomposites

Mike Leggett
Oceania Composites Engineering

Tanya McKimmie
Nuplex Composites

Mark Pontil-Scala
Regina Glass Fibre

Leona Reif
Fibreglass Design Panels Pty Ltd

Keith Stanistreet
Pacific Resins

Brian Stick
NCS Composites Pty Ltd

John van der Woude
Penguin Composites

President's letter

Small businesses play a significant role in the Australian economy, particularly in terms of their contribution to employment and production. While we all know this, it was good to see a recent economic overview produced by the Reserve Bank stating that: "Through innovation and expansion, small businesses are a source of employment growth and competition."

Certainly the instant asset write-off, whereby small businesses can immediately deduct any asset costing less than $20,000 — announced in the May budget and slated to cost $1.8 billion – demonstrates that small business is at least on the radar in Canberra.

As somebody who is running an Australian manufacturing firm, I welcomed Prime Minister Malcolm Turnbull's announcement that he will release a national innovation plan by Christmas and I hope that it includes aggressive and deliverable commitments to advanced manufacturing and "knowledge-rich" industries such as ours. Innovation, as we know, is crucial for maintaining the dynamism and resilience of our businesses. Future challenges are impossible to predict, but what is certain is that the composites sector is adept at switching gears, innovating solutions, and re-deploying equipment and staff for worthy orders.

This edition of *Connection* features several company case studies that demonstrate the resilience of the composites sector during difficult times and its ability to overcome challenging market conditions. Each case study has a common thread: a commitment to excellent customer service and understanding and interpreting customer needs to develop high quality products that stand out from the competition. In each, innovation plays a significant role in growing their market share.

This is certainly the case with the feature in this issue on the country's leading luxury motoryacht manufacturers, Riviera and Maritimo, who are starting to enjoy buoyant export and local markets after being hit hard by the GFC and the high Australian dollar. Their stories make interesting reading, as do the other articles on Australian boat builders large and small who are leveraging the benefits of composite materials and processes to make inroads into new markets.

Composites Australia continues to profile Australian-made composite products and processes through its annual schedule of trade nights and workshops. The 2016 Calendar is published on Page 19. I urge you to set aside the dates in your diary, especially the 2016 Advanced Composites Innovation Conference to be held in Melbourne in April.

All the best for a safe and happy festive season.

Genelle Coghlan

NEWS

CST Composites' $5.7m expansion project gains government support

Advanced carbon fibre filament winder and pultruder, CST Composites has secured a $1.4 million grant from the Australian government, as part of a $5.7 million project investment to increase production capacity, continue development of its filament winding process technology and enter new markets.

The grant is part of the government's $50 million Manufacturing Transition Programme that provides assistance to help manufacturing businesses become more competitive and sustainable, enabling a move or expansion into higher value or niche manufacturing activities. The program awards funding through a highly competitive, merit-based process, informed by an expert technical committee to ensure the projects have a sound commercial basis.

Local MP and now Treasurer, the Honourable Scott Morrison, visited CST in September this year, on announcement of the grant. "It is great to see this award-winning company employing local people, offering a globally unique product and supplying carbon fibre products to leading companies all across the world from its Sydney base," Mr Morrison said. "This grant will support CST Composites to increase its capacity, employ more people and develop further innovations in both niche and mainstream markets."

(L-to-R) Mr Clive Watts, Managing Director CST Composites with local MP and now Treasurer, The Honourable Scott Morrison.

CST Composites Managing Director Clive Watts welcomed the government support: "We have invested heavily over many years to develop our filament winding technology and automation. This grant support and investment enables us to take the next step in growing our business.

The timing of the grant is also important, as we have just acquired a second, larger production facility, which allows us to achieve greater economies of scale and gives us increased capacity. This will enable the company to continue its push into new, larger markets, including automotive, oil and gas, mining and defence." A weaker Australian dollar had also seen demand increase from overseas, Mr Watts said.

More information: www.cstcomposites.com

Defence contract boost to Aussie manufacturers

Thales Australia has won the $1.3 billion contract to supply The Hawkei next-generation protected vehicle to the Australian Defence Force, giving a much-needed boost to the country's manufacturing sector.

Advanced composite manufacturers Quickstep and RPC Technologies are among the long list of suppliers holding agreements with Thales to supply components for the state-of-the-art 4 x 4 vehicle designed to be light enough to be deployed by helicopter and to increase protection and mobility for Australian troops.

The contract involves the delivery of 1100 vehicles and over 1000 trailers. The three-and-a-half year production phase is scheduled to begin from mid-2017, with first deliveries expected towards the end of that year.

Hawkei follows the life-saving success of the larger Bushmaster vehicle, manufactured by Thales in Bendigo.

On the signing of the contract in October, Chris Jenkins, CEO of Thales in Australia, said: "This is a great day for the ADF and for Australian industry. Hawkei is a highly capable vehicle that will serve this country well for many years to come, and we are delighted that the Department of Defence has recognised the importance of this vehicle by reaching this milestone.

"We also thank our many suppliers on the program – companies in Australia and overseas that have been with us on this long journey, and who have played a significant role in shaping the Hawkei and contributing to its success. It's a great story about what Australian industry and international partnerships can achieve."

Quickstep says it will manufacture the bonnet, side skirts and mud guard components at its new automotive plant in Waurn Ponds, Victoria. The agreement with RPC Technologies is to supply composite dashboard assemblies for the Hawkei. RPC has also previously been involved with the Bushmaster program and Thales Underwater Systems.

Thales Australia's Hawkei has been selected by the Australian Defence Force as the next-generation armoured vehicle for Australian troops. Image: Thales Australia

Luxury boat builders buoyed by market demand

After years in the doldrums, having been hit by the high Australian dollar and GFC, Australia's leading luxury boat builders Riviera and Maritimo are reporting a resurgence in sales.

Australia's 2015 Marine Industry Exporter of the Year, Riviera, this month announced the introduction of a fifth manufacturing line at its Coomera, Queensland plant. Riviera has also launched a recruitment drive to meet the growing international and domestic demand for their luxury motor yachts.

Among the 30 new positions are jobs for composite technicians to join the 450-strong team of designers, engineers and master craftspeople at the modern 14-hectare Coomera, Gold Coast facility.

Chief Executive Officer Wes Moxey said, "Increased global demand is allowing us to grow our dedicated team across the entire business and that is great for Riviera, great for manufacturing in South East Queensland, and great for Australia's export trade."

"We believe strongly in the future of the Australian marine industry and we are leading our industry in nurturing Australia's future master craftsmen and women."

Riviera currently has 36 apprentices, including eight composite technicians training at Partec in Brisbane and 28 in other trades training at the Gold Coast Institute of TAFE Marine Training Centre, located at the company's Coomera property.

Chairman and owner of Riviera, Rodney Longhurst – who returned the company to private ownership in 2012 – said greater refinement, increased luxury, impressive new models and class-leading innovation and dependability were key drivers of increased global demand across the five Riviera model collections.

The recovery drive has included the

Australian excellence on the water. Above: Riviera's 57 Enclosed Flybridge. Below: Maritimo's latest model, the M65 cruising motor yacht.

launch of five new models, including the largest and most luxurious Riviera ever, the 77 Enclosed Flybridge. A new Sports Motor Yacht design had six buyers purchase the 67-foot model off the plan within six weeks of its announcement. A further new model is scheduled for launch at the largest boat show in the world, at Fort Lauderdale in Florida this month.

Riviera's place in the highly competitive market is driven by an active marketing campaign with a busy schedule of international boat shows from Mandurah in Western Australia to Cannes in France; from Auckland in New Zealand to Newport in the United States; Barcelona in Spain to Fort Lauderdale in Florida.

Mr Moxey said he had no desire to return the company to the boom of $400 million annual turnover and 1300 people. "That's not my passion, to be the biggest," he told *Business First* magazine. "The focus is on building a high quality product. Since we've been back (2012), we've really pushed the quality boundaries rather than the size boundaries. There's nothing better than having a high quality product that is sought after and people are prepared to wait for it. I think that's really the driving force for where we will be in the future."

Maritimo's Bill Barry-Cotter, AO, is also enjoying the turn-around in fortunes. "The market has picked up dramatically in the US and here in Australia, and Europe is gaining momentum. Today there is a great interest in boats. You just have to keep changing to survive economic changes."

For Maritimo that has meant harnessing new technologies to achieve production efficiencies and fuel economy in the boats, securing a leading US based agent and a marketing campaign that capitalises on Australia's reputation for building luxurious craft, engineered for long range capabilities and to withstand the roughest seas.

A new model, the M65 cruising motor yacht, debuted in May this year, with five sold before the first hit the water.

In his constant quest to build the best boats, quality is paramount and customer service essential, says Mr Barry-Cotter. The 2015 Queens Birthday Honours recognised his service to the maritime construction industry, to powerboat racing and as a benefactor and supporter of charitable organisations.

"You have to listen to what people want. A lot of the changes and innovations we make come directly from the customer. Sometimes even the quirkiest requests for custom-built boats can be really good ideas that are worth integrating into other boats."

Maritimo sales have grown by 20 per cent in the past year thanks to improvements in the global economy, the lower Australian dollar and the popularity of the new M65, says Greg Haines, sales and marketing manager. Forced to put off some 50 employees during the downturn, Maritimo has grown to 140 employees across composites, timber and leather upholstery.

For more examples of how Australian boat builders are growing their markets turn to pages 8 and 10.

Riviera is adding a fifth production line and recruiting composite technicians to meet growing global demand for their luxury motoryachts.

Composites enter the realm of the 'tinny'

Super-light and super-fast infused fiberglass and foam small boats are making inroads into the recreational fishing market, traditionally the realm of aluminium.

John Hall, Managing Director at Enlightened Boating in Caboulture, Queensland, identified a market for a range of boats that were light enough for the rooftop of a smaller car or van.

Using a state-of-the-art vacuum infusion process that gives an excellent core finish that minimises the use of resin and therefore weight, John and his team manufacture a range of EzyTopper boats for car roof-top transport. More recently they have expanded into a range for keen fishermen, the CrossXCountry.

"The advantages of these boats over tinnies is weight and strength. You need less horsepower to drive these boats faster, they are easy to get on and off the roof of your vehicle, improve fuel consumption and we are getting reports from customers saying their vehicle is cooler with the Ezytopper on their roof," says Mr Hall.

Weighing between 40 and 50kg, the Ezytopper is finding a niche market in the growing 'grey-nomad' community while the ultra-quiet CrossXCountry targets the sport fishing and family markets. Each boat is custom fitted to the client's needs.

While more expensive than the aluminium equivalent, customers are prepared to pay for the advantages and the finish, says Mr Hall. "We have grown from an average of 20 orders on the books six months ago to 30, and that is all by word-of-mouth. We have customers in their 80s and one who is 97 years old, and we have very serious sport fishermen," says Mr Hall.

The first of a new model under construction using state-of-the-art resin infusion. Image courtesy of Enlightened client Ken Brown, founder of Coastwatch.

"There is about 270kg difference between a 4.3m CrossXCountry and a tinny of the same size, so you are starting with the equivalent of three people less. And if you need to repair one of these boats, all you need is a surfboard repair kit."

Enlightened Boats' closed mould infusion process uses a DIAB core with a very fine finish to achieve the light weight and strength. "An added bonus of the sandwich construction is these boats are very buoyant, they are unsinkable," says Mr Hall pictured below demonstrating this with friends.

More information: www.facebook.com/EnlightenedBoating

Mission strengthens ties with German composites industry

At the invitation of federal Finance Minister, Senator Mathias Cormann, Composites Australia participated in a business mission to Berlin seeking to enhance economic engagement and boost trade and investment between Australia and Germany.

Composites Australia Board member Ms Leona Reif, a Director of Fibreglass Design Panels, represented Composites Australia on the advanced materials stream of the business mission, with 10 other participants from research, education and manufacturing, including Mr Jake Dingle, CEO of Carbon Revolution in Geelong and Jeff Swingler, chairman of Advanced Materials Solutions in Queensland.

The mission provided the opportunity to strengthen links with prominent members of the German composites industry, including executive members of Composites Germany, providing an insight into manufacturing trends, market challenges and significant government investment in education, research and development.

The advanced materials group met with major German manufacturers who are increasing their focus on advanced composite components to achieve environmental and fuel economy targets, including Airbus and CFK-Valley e.V in Stade, the Hamburg Aviation Cluster, Volkwagen, Rolls Royce and ADS Protection GmbH.

The Fraunhofer Institute of Manufacturing and Advanced Materials provided a briefing on current and future trends in advanced materials across Germany's key industries.

Strengthening Australia-German linkages: Composites Australia board member Leona Reif with Minister Cormann in Berlin.

In his address to the Konrad Adenauer Foundation in Berlin, marking the establishment of the Australia-Germany Advisory Group, Senator Cormann said: "Whether it is through people-to-people links or the capacity to take advantage of global value chains, there are really no limits to the Australian-German relationship."

Composites top traditional aluminium to deliver high performance pilot boat

Seeking to break into the pilot boat market, Western Australian boat designer and builder John Fitzhardinge saw the opportunity to build a boat that would stand-out in the market by combining the tradition aluminium hull and deck with a super light and super strong demountable wheelhouse.

Co-founder of Southerly Designs and owner of Dongara Marine, Mr Fitzhardinge says the feedback he is getting from Freemantle Pilots using the innovative 18.5m Berkeley vessel vindicates his novel solution.

The project represents a significant investment by the Port Denison commercial and leisure boat builder, in terms of breaking into new markets.

"There are a lot of ageing pilot boats out there and we saw the opportunity to design and build something special that would be competitive in the market," says Mr Fitzhardinge.

Southerly Designs set out to design a vessel that would outperform traditional pilot boats in the areas of fuel economy, speed, comfort and safety. The design went to GURIT for engineering design support and compliance with the Lloyds Register Service Craft Rule and National Standard for Commercial Vessels Code.

To maximise strength and weight savings, reduce noise and achieve a quality finish, Dongara use a resin infusion process for the composite boat building projects. They partnered with GURIT for structural cores, e-glass and Carbon Unidirectionals.

Designed and built to sit low on the hull, to maximise stability and fuel economy, fixing points and lifting points are integrated into the superstructure, enabling efficient removal and replacement of the wheelhouse structure providing excellent engine access for maintenance.

Other design features include fully integrated internal fittings and furnishings, increased visibility by minimising mullion sections on the wheelhouse windows, which are designed to achieve a modern industrial look, plus excellent sound dampening through the thick-cored floor that required no framing and could therefore sit low on the hull.

John Fitzhardinge, managing director Dongara Marine - investing in a new concept vessel to expand markets. Images: Southerly Designs

Martin Hannon, Gurit Design Engineer said: "The choice of composites over aluminium for the super structure has reduced overall weight, minimised clearances and offers better sound and thermal insulation due to the high performance properties of the sandwich core panel". Dongara Marine manager Rohan Warr said: "John wanted to build a concept boat and get it out there on trial." The Berkeley is currently on lease to Freemantle Pilots.

"We are getting really positive feedback especially in terms of the fuel efficiency, handling and performance of the Berkeley and our fender system." says Mr Warr.

Using the lessons learned from the Berkeley, Dongara Marine is currently building a composite wheelhouse for what will be the largest crayfishing vessel in the region.

The Berkeley in action on its launch off the Western Australian coast in May.

Advanced Composites Innovation Conference

April 12 to 14
Pullman Melbourne on the Park | 2016

Planning is well underway for the 2016 Advanced Composites Innovation Conference to be held in Melbourne on 13 and 14 April.

In its 13th year, this annual conference hosted by Composites Australia, with the support of ACCS and SAMPE-Australia, will provide a valuable forum for the sharing of industry and scientific knowledge. This year the focus will be on new and emerging developments in composites technologies, opportunities for new applications and markets, as well as sessions to advance business management and marketing.

The conference will be held at the five-star Pullman Melbourne on the Park, set opposite beautiful parklands on the fringe of the Melbourne CBD.

Keynote speaker Dr Lesley J. Cohen, Senior Vice President, New Business Development & Strategic Technology with HITCO, will provide an insight into the company's journey in the past seven years from a 100% build-to-print hand lay-up production company to a fully automated ATL, AFP, Drape forming ability to make more than 10,000 primary structure beams, stringers and wing skin structures along with complex hand lay-up hardware.

Call For Papers

Abstracts are invited for papers under, but not limited to the theme 'The scale of composites and advanced fibre/resin systems', through:

- New and emerging composite technologies
- New and emerging composite fibres, resins and systems
- Innovative solutions to design and engineering challenges
- Novel and new technical applications and processes
- Performance analysis and standards
- Support for industry.

"This year's program will see a strong industry stream exploring market and product opportunities, new technologies and business and financial management," says Kerryn Caulfield, CEO of Composites Australia.

By popular demand, highly respected engineering consultant and educator, Dr Rik Heslehurst, will again run a pre-conference technology workshop. This year the topic is Understanding, Developing and Predicting the Unique Capabilities of Composites. The half-day workshop will be held from 12.30pm on Tuesday, 12 April 2016 at the conference venue.

Refer to the conference website for the latest information on speakers and the timeline and process for the online submission of abstracts: www.compositesconference.com

Manufacturing in a small economy

Celebrating 40 years since starting Penguin Composites, John van der Woude says manufacturing in a small local economy presents unique challenges.

Recently installed for a scientific team, these Igloo Satellite Cabins blend into the Greenland landscape.

From the most remote lands on earth, to busy international airports worldwide; from the depths of Australian underground mines to Google's modern Zurich offices, Penguin Composites products are making an impact. Keeping the business sustainable by building a large portfolio of significant achievements has been an ongoing challenge for CEO John van der Woude, who started Penguin Composites in northern Tasmania in 1975, manufacturing kayaks.

"Our business originally involved the surf industry. We separated the retail business from manufacturing in 1990 but it has been the retail business that has provided the capital to continually expand the composite business and the properties Penguin Composites use," says Mr van der Woude.

"We quickly realised we needed to diversify into a broad base both for the opportunity to grow and to be sustainable in a small local economy."

Mr van der Woude's astute business growth strategy is based on building strong relationships through networking, marketing and proactively approaching opportunities; backed by a reputation for quality, engineering and design ingenuity and excellent customer service.

This focus, combined with hard work, has grown the company portfolio to now include two lines of camper trailers; the Igloo Satellite Cabins manufactured under license from Icewall One; chairlift components and walkways in many airports worldwide; dash panels and heat-shields on underground mining machinery; sewage vessels for Sydney Water and structural projects, such as a new roof for a heritage restoration project on Launceston's historic Albert Hall convention centre.

Founding director John van der Woude.

The new roof required a textured matt finish as close to the original as possible, which traditional roofing materials could not fulfil. Penguin Composites engineer Piers Findlay sourced the original architect's drawings in order to develop templates for the CNC cut moulds for the 40 roofing panels with an inbuilt lip-and-cup watertight joining system.

This year marked the 200th Igloo Cabin to come out

of production, one of two destined for Macquarie Island to provide refuge for field research teams.

Originally designed and manufactured by Malcolm Wallhead in 1982, the insulated, highly durable prefabricated cabins are in use in 19 countries and the number is growing. Recent orders fulfilled by Penguin included two destined for Svalbard, north of Norway, for an eco-tourism resort; four were manufactured in grey to fit into the barren Greenland base for a scientific research team. The units are popular with the Australian Antarctic Division, who affectionately call their red cabins 'apples' given their shape, colour and the fact they come from Tasmania, the Apple Isle.

With a workforce today of more than 30, including the specialist composites experience of engineer Piers Findlay, the company's capabilities include design and engineering of moulds and plugs, fibreglass and composite component manufacturing and low volume specialised composite projects in Light RTM (closed moulding), filament winding, panel manufacturing and CNC machining.

Summing up his 40 years in manufacturing in Tasmania Mr van der Woude says: "There have been many challenging times. Continual reinvestment, perseverance and a reliable, motivated manager (David Mercer) have been the key to our success."

True to its heritage – the new roof on Launceston's Albert Hall convention centre required a textured matt finish as close to the original as possible.

Composite Sandwich Structure Design Requirements

Composite Engineer's Viewpoint
By Rik Heslehurst PhD, MEng, BEng (Aero) FIEAust, FRAeS, CPEng

Part 5 – Composite Skin and Core Properties

This article discusses the properties of both the composite skins and core materials in terms of their importance and what is necessary in undertaking design stress analysis, and concludes with a short statement on adhesives used in sandwich panel construction.

Composite skin properties

The mechanical properties on composite material skins will differ with the different types of fibres, resins, fibre form (unidirectional versus cloth), the fibre-to-resin weight or volume ratio (or the fibre volume ratio) and, to a lesser degree, the laminate ply stack configuration. Assuming the fibre/resin selection has already been determined and the individual ply design fibre volume ratio achieved, then the basic ply properties of a composite material can be obtained from ply property tables. (See below.)

Material	V_f	E_x GPa	E_y GPa	u_x	E_s GPa
Graphite / Epoxy	0.70	181	10.3	0.28	7.17
Boron / Epoxy	0.50	204	18.5	0.23	5.59
Glass / Epoxy	0.45	38.6	8.27	0.26	4.14
Aramid / Epoxy	0.60	76	5.5	0.34	2.30

Material	V_f	Longitudinal Tension *X*	Longitudinal Compression *X'*	Transverse Tension *Y*	Transverse Compression *Y'*	Shear S
Graphite / Epoxy	0.70	1500	1500	40	246	68
Boron / Epoxy	0.50	1260	2500	61	202	67
Glass / Epoxy	0.45	1062	610	31	118	72
Aramid / Epoxy	0.60	1400	235	12	53	34

For a given fibre volume ratio the skin properties required for sandwich structure design and analysis are:

a. The in-plane longitudinal and transverseaxial Young's modulus (E_1 and E_2).
b. The in-plane shear modulus (G_{12}).
c. The in-plane major and minor Poisson's ratio (υ_{12} and υ_{21}).
d. The in-plane longitudinal, transverse and shear strengths (ultimate and first ply failure) (σ_1, σ_2, and τ_{12})
e. Through-the-thickness tensile, compression and shear strengths (σ_{z_T}, σ_{z_C}, τ_{13} and τ_{23}) for out-of-plane loading cases.

The skin engineering properties are determined through classical laminate plate analysis. If the laminate is made from the same materials (not a hybrid) and has an orthotropic lay-up (balanced and symmetric), then a set of simple expressions can be used to estimate the composite laminate skin properties. The Hart-Smith simplified method ('The Ten-Percent Rule for Preliminary Sizing of Fibrous Composite Structures', presented to 51st SAWE International Conference, Hartford, Connecticut, 18-20 May, 1992) for estimating the composite skin in-plane properties is very useful in designing sandwich structures.

Core properties

There are three fundamental types of core materials: foam, balsa and honeycomb. A comparative listing of typical core properties of common core materials is shown below. Note that these properties are for the same core density. (See below.)

Most honeycomb cores are orthotropic and we should identify the longitudinal (ribbon) direction properties and the transverse properties for thorough stress analysis and design purposes.

Adhesive properties (skin-to-core bonding)

Adhesives are primarily used in the construction of the sandwich structure to bond the core to the skins.

		TTT Compression		Transverse Shear	
Material	Density gcc	Strength MPa	Modulus MPa	Strength MPa	Modulus MPa
Aluminium Honeycomb	0.050	2.07	517	1.45	310
Nomex Honeycomb	0.048	2.24	138	1.21	41
Fibreglass Honeycomb	0.048	2.83	158	1.34	131
Rohacell Foam	0.050	0.88	69	0.79	21
Klegecell Foam	0.048	0.48	18	0.35	7.5
Rigicell Foam	0.048	0.55	14	0.48	17
Divinycell Foam	0.050	0.69	70	0.50	17

Adhesives are also used in connecting sandwich panels and repair of sandwich panels.

Detailed shear stress/strain behaviour must be obtained from tests or the adhesive vendor. Other adhesives used in sandwich panel construction include core splicing (foaming) adhesives that bond core pieces together.

All articles published in Engineer's Viewpoint are available on the Composites Australia website (www.compositesaustralia.com.au/industry). Rik welcomes questions, comments and your point of view by email to rikheslehurst@gmail.com

Resin cure monitoring by means of dielectric analysis (DEA)

By Andrew Gillen, NETZSCH Australia Pty Ltd

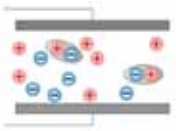
When working with thermosetting resins, detailed knowledge of the reactivity at every step of the process is fundamental to achieve fully-cured composite parts with a minimum cycle time. Therefore, analytical methods are used during the entire development process from resin formulation to composite processing, to final composite analysis. In addition to mechanical properties, thermal analysis methods also provide a comprehensive insight into thermoset resins and composites to understand the curing behaviour and the achievable properties. Differential scanning calorimetry (DSC) and dielectric analysis (DEA, also known as Dielectric Thermal Analysis (DETA) are well-established methods for investigating cross-linking behaviour. Dynamic mechanical analysis (DMA), thermomechanical analysis (TMA), thermogravimetric analysis (TGA) and laser/light flash analysis (LFA) reveal further information about the properties of a composite material.

Dielectric analysis (DEA) technology is already used in a wide faield of applications – from cure monitoring of resin formulations in research laboratories to moulding process control in composite manufacturing. DEA provides an on-line insight into the state of cross-linking by detecting the change in dielectric properties of a thermosetting resin. To this end, the uncured resin must be in contact with a dielectric sensor consisting of two electrodes. A sinusoidal electrical voltage (excitation) is applied to the electrodes and the resulting current and corresponding phase shift are measured (see Fig. 1). The response signal correlates with the ion mobility (also known as ion conductivity) of the resin and the alignment of dipoles. As the curing reaction progresses, the sample material becomes increasingly viscous and the mobility of charge carriers decreases. Since ion viscosity, just like shear viscosity, changes as a function of the degree of curing, DEA is the ideal tool for in-situ monitoring of the cross-linking progress of thermosetting resins.

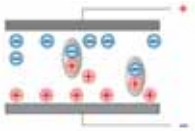
Further, DEA describes the entire sequence of curing behavior from 0% to 100% in one measurement. In contrast, rheometry can only be applied before vitrification of the resin and not to the final end of curing. DEA does not require a defined sample geometry, only a thin coating on the sensor. As disposable sensors can be placed at different thicknesses across a moulded part, DEA yields spatially dispersed information about the surface or the bulk of the resin (Z-information) and, when multiple sensors are used, it monitors the resin flow front (X-Y information) during infusion processes.

More information: andrew.gillen@netzsch.com
www.netzsch.com/n69586

Behavior of ions and dipoles inside an external electrical field



Without external field



With external field

Specialist composite solutions deliver exceptional products

The star of the 2015 Brisbane Truck Show was the Navistar ProStar and, while truckies honed in on what's under the bonnet, they could not take their eyes off the sleeper box.

Inside the Navistar ProStar slide-out sleeper box

The unique Australian-designed electrically operated slide-out sleeper cab is the result of extensive product design and development by Queensland composite specialist Marky Industries.

Founder and CEO Martin Nikolas is thrilled with the contribution his team made to the award-winning rig.

"We worked closely with Navistar throughout the design and development stages to ensure we met every detail of their requirements," says Mr Nikolas.

"Having 37 years experience manufacturing for clients such as Mack, Volvo, Iveco, Ford, Western Star and Navistar branded trucks, gives us some knowledge of the industry and where we can leverage specialist composite materials to cater for clients' performance, engineering and aesthetic needs.

Winning partnership - Martin and Krystyna Nikolas with the Navistar ProStar truck, winner of the 2015 "Truck of the Show" at the Brisbane Truck Show.

The spacious sleeper is fitted with built-in seats, desk, fridge, TV, microwave and even a coffee-making machine and reflects Marky Industries' extensive knowledge of the Australian and international trucking industry gained over 37 years of manufacturing.

Utilising the closed moulding process at the state-of-the-art facility in the Crestmead Industrial Estate, the company manufactures small parts like dash board components through to larger applications, such as bonnets and fully fitted sleeper cabs for client truck production lines.

"We pride ourselves on our manufacturing expertise, the well ventilated, dust free environment of our plant and our quality assurance processes," Mr Nikolas says. This attention to excellence earned Marky Industries Q1 status with the Ford Motor Company.

"We were the sole supplier of the composite parts prior to the Ford Truck closure in Australia and the accreditation allowed us to become more competitive within the international market," says Mr Nikolas.

To further improve the company's overall standard to be a world-wide supplier of composites products, Martin and his wife Krystyna, the company financial

S.R. Smith Bulkhead with optional dive platforms for Olympic pool applications. Image courtesy S.R. Smith

controller, undertook the Quality Management System compliance process, receiving AS/NZS ISO 9001:2008 certification for products and services.

Trucks are just one market served by this diverse composites specialist, who also has extensive experience manufacturing products for the mining, transport, construction, chemical, defence, recreation and building industries.

Over the past ten years Marky Industries has built in excess of 4000 parts for trains in the Perth Urban Rail System and components vary from cosmetic internal panels to train driver dashboards and whole cab fronts for Queensland Rail projects. All train components are made of fire retardant resins and specialised composite materials to ensure compliance with ballistic and high impact requirements.

Since 1991, Marky Industries has been a major provider of composite parts for mobile, elevated working platforms.

"Working with our clients we were able to provide unique solutions that satisfy their functional and safety requirements and the strict safety requirements of the electrical industry. It required specialised materials and manufacturing procedures and electrical testing along the way to achieve the weight, strength and safety performance that make this an exceptional product in its market."

"That's our goal! Whether we are making 200,000 litre tanks or truck components, we want to give our clients an exceptional product," says Mr Nikolas.

Redmond Gary Elevated Work Platform.

Composites tread lightly in national parks

Australia's national parks are discovering the benefits composite materials offer in helping protect sensitive environments while reducing maintenance costs.

Above: Jibbon Beach Lookout, Royal National Park, NSW (Image: Peter Tasesk NPWS).
Right: Tallebudgera Conservation Park boardwalk, Burleigh Heads, Queensland.

Queensland's Parks and Wildlife Service says it is turning to fibre composites for highly developed visitor facilities along the state's sensitive coast and isolated islands and is assessing the benefits of fibre composite use in high rainfall and/or high humidity environments to replace timber joists, stringers and bearers in some situations.

"Fibre Reinforced Plastic (FRP) is chosen for its light weight, chemical inertness, potential corrosion resistance and potential durability. Sometimes it's also chosen for specialist solutions – for example, its use in the Tallebudgera Conservation Park boardwalk (Burleigh Heads) allows more than 40% of light through the surface to meet standards for works on a fish habitat area," a QPWS spokesperson said.

The importance of light to marine habitat also led to FRP decking being chosen for the recently completed Wynnum Mangrove Boardwalk on Moreton Bay. The service has chosen to use FRP decking on the Springbrook Suspension Bridge in the Gold Coast hinterland and the Rex Creek Suspension Bridge in Daintree National Park, far north Queensland. Also in the Daintree, the Marrdja Boardwalk was built using recycled plastic decking with FRP posts, bearers and joists. The Service used the same combination of materials on the Lizard Island boardwalk.

In NSW, FRP is becoming more widely used in many national parks with high-visitation and demanding environmental conditions. "As FRP is a relatively new material, its longevity and asset life-cycle advantages is still being reviewed. However, to date, FRP has proven to have superior corrosion protection compared with steel; and the fire-resistant nature of the material is of interest to the National Parks and Wildlife Service," says a spokesperson.

"FRP is particularly suitable for wet areas where traditional materials have less durability, for example in the construction of boardwalks through wetlands."

So far the Service's most common use of FRP has been at coastal locations for boardwalk facilities and pedestrian bridges.

The recently completed viewing platform and walkway at Jibbon Beach in the Royal National Park uses FRP mesh extensively and there are plans to use FRP in future upgrades in national parks, especially around replacing steel boardwalks with FRP.

Events Schedule 2016

February

Monday 15
NSW

Automation of composites in manufacturing
This half-day site visit and networking event will provide a unique opportunity to view this newly opened research facility at the University of NSW.

March

Wednesday 16
Queensland

Industry Site visit with networking
This half day site visit at Marky Industries will provide a unique opportunity to hear about and see the operations of this state-of-the-art manufacturing facility in the Crestmead Industrial Estate.

April

Tuesday 12
Melbourne

Pre-conference technical workshop
A half day technical workshop with international composites engineer Dr Rik Heslehurst on the topic: *Understanding, Developing and Predicting the Unique Capabilities of Composites.*

Wednesday - Thursday 13-14
Melbourne

2016 Advanced Composites Innovation Conference
Hosted by Composites Australia this conference offers two days of knowledge exchange, networking and business development opportunities with a strong speaker line-up of global and national industry and research leaders.

May

Thursday 5
Queensland

Technology Workshop: Do I bond, bolt or weld my composite structures together?
A full day workshop with international composites engineering consultant and trainer Dr Rik Heslehurst.

June

Tuesday 7
NSW

Technology Forum - Advancing Bridge Rehabilitation Using Advanced Composites Technologies
A full-day forum to share relevant, experience-based knowledge about new and emerging initiatives in the field of bridge rehabilitation using advanced composites, including carbon fibre reinforced polymer (CFRP) materials.

August

Wednesday 10
Victoria

Technology Seminar: Developing composite solutions for facades and roofing
Details to be advised.

October

Wednesday 5
Queensland

Technology Seminar : Composites for Infrastructure
Details to be advised.

Wednesday 26
Victoria

Graphene – the future for high performance materials
This half day technology seminar will outline the value proposition for graphene and its potential for new, high performance polymers and composite materials.

November

Wednesday 23
Perth

Industry seminar and networking event
Details to be advised.

December

Thursday 8

End of year industry site visit and networking event
Details to be advised.

For full details and to register go to
www.compositesaustralia.com.au/events

Disclaimer: This schedule was current at time of going to print but is subject to change. Composites Australia is not liable for any loss or expenses incurred due to changes in the program.