MARKET VISION

for composite solutions

OCTOBER 2015

Solutions delivering more ... and less

EDITORIAL

OWENS CORNING COMPOSITE SOLUTIONS DELIVERING MORE … AND LESS

As consumers, we all know that a primary consideration when evaluating new products, materials and processes is the additive features and benefits they provide. In short, the value we place on new offerings is most often directly tied to what more they can do for us.

Among the most valuable attributes of composites is their unique ability to provide more – in the way of durability, strength, and design flexibility – while also providing less in terms of weight and cost. The capacity to provide customers more of what they desire and less of what they don't want is a key reason why composites are a favorable alternative to traditional materials like steel and aluminum in many applications.

It is also a major driver in the growth potential for our industry.

This issue of Market Vision features several stories that showcase how we are working with customers to deliver more – and less – in support of their needs:

- In the automotive market, Owens Corning leveraged its deep product and technical expertise to help Continental Structural Plastics (see page 3) develop a new generation of glass fiber reinforced polymers that provide higher strength and lower weight in certain exterior body panel and structural component applications.
- In the broader transportation sector, Owens Corning worked with Great Dane (see page 4) to improve the strength, stiffness, and impact resistance of composite liner panels for refrigerated trucks through the use of its Performax® SE4849 direct rovings.
- Owens Corning also worked with Golden Tsai Hsing (see page 6), to leverage its FRP composite application expertise and boron-free Advantex® E-CR glass fiber reinforcement to provide a host of benefits for conduits enabling new urban transportation systems in China.

As these and other stories illustrate, we've reached a turning point in the perception – and reality – of composite solutions as highly engineered materials that provide benefits throughout the product lifecycle, including recyclability.

We invite you to meet our team and learn more about these and other product benefits up close at CAMX 2015, which will take place from October 26-29 at the Dallas Convention Center in Texas. Owens Corning will be represented at Booth P85 and by a series of technical presentations delivered by experts from our composites team. We look forward to meeting with you and working together to explore the exciting opportunities for performance and growth in composites.

Sincerely,

Arnaud Genis
Group President, Owens Corning Composite Solutions Business

Space-age material for down-to-earth automotive solutions

Corvette car pictures © General Motors.

OEMs have to meet even stricter industry regulations for fuel economy and the lowering of CO_2 emissions which are pushing the design of sophisticated light-weighting metal-replacement alternatives, such as glass fiber reinforced polymers (GFRP), to new limits.

To further meet the light-weighting challenges facing automotive OEMs, Continental Structural Plastics (CSP), a world leader in diversified composite technologies and pioneer in reshaping the future of vehicle light-weighting, has introduced TCA® Ultra Lite™, a new generation of Tough Class-A (TCA) GFRP low density advanced composite material for exterior body panels and structural components. The first production use can be found on GM's 2016 Chevrolet Corvette Stingray Coupé model[1].

40 percent lighter

To help develop the new, innovative advanced composite material, CSP replaced calcium carbonate ($CaCO_3$) mineral filler with lower density glass microspheres together with Owens Corning's Advantex® ME1975, a new multi-end glass fiber roving specifically designed for use in SMC Class-A applications, particularly vertical walls.
Dr. Sanghamitra Sircar, Global Product Manager SMC at Owens Corning says,

"The unique formulation developed by CSP provides a 40 percent weight reduction when compared to standard SMC material, and depending on part design, can be as light as aluminum yet more cost-effective."

Owens Corning also provided support on a range of technical engineering design, surface chemistry and processing optimization modifications, she added.
The new material not only provides high mechanical properties, it is also e-coat oven-capable and provides a desirable superior Class-A surface finish that will not corrode, crack or scratch.

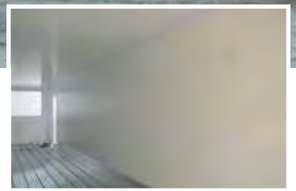
30 percent lower carbon footprint

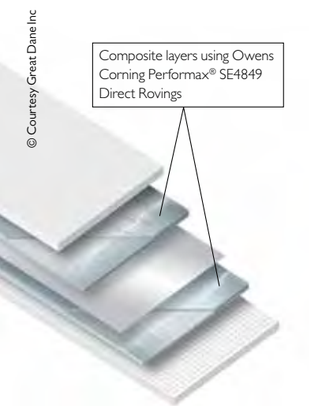
With regard to sustainability, a Life Cycle Assessment (LCA) study[2] comparing a TCA Ultra Lite constructed deck lid versus an aluminum counterpart, designed to the same load and structural requirements, reveals a 30 percent lower carbon footprint to manufacture the TCA Ultra Lite product. Even when the complete lifecycle is considered, new state-of-the-art composites will become the light-weighting choice for OEMs over aluminum or other metals as more engineers understand its strength, design flexibility, unique moldability and exceptional surface aesthetics.

[1] CSP press release July 21, 2015 (www.cspplastics.com/general-motors-lightens-the-corvette-with-continental-structural-plastics-tca-ultra-lite/)
[2] Continental Structural Plastics, Auburn Hills, MI 2015. Life Cycle Assessment (LCA) studies comparing a composite deck lid vs. aluminum and steel.
TCA® Ultra Lite™ is a registered trademark and trademark of Continental Structural Plastics respectively.

Contact:
composites@owenscorning.com
www.cspplastics.com

Composite liner panels help reefer trailers keep cool and cargo safe





ThermoGuard(TM) liner panels made with Performax® 4849 Direct Rovings are almost 300 percent more impact resistant than competing thermoset liner panels.

Refrigerated truck technology has considerably improved over time with reefer manufacturers developing more efficient and better insulated units which are lighter, stronger and more durable.

Reefer trailers[1] are used for the transport of perishable, temperature-sensitive cargo and maintaining optimum operating conditions inside the trailer is of utmost importance. Based in Chicago IL., Great Dane is an industry leading manufacturer of dry van, refrigerated and platform trailers. Their patented multi-layer ThermoGuard™ liner panel, used exclusively on Great Dane trailers, includes thermoplastic composite layers made using Owens Corning Performax® SE4849 Direct Rovings that provide strength, stiffness and impact resistance.

Thermally efficient and 300 percent more impact resistant

The strong, yet lightweight liner panel is superior to non-barrier liners in competing reefers since, by design it helps better maintain thermal efficiency of the trailer over its service life. A bonding scrim on the back side provides excellent adhesion to the polyurethane insulating foam.

"The composite layers seal and protect a patented metallic vapor barrier that greatly enhances resistance to permeable gasses significantly reducing 'out gassing' effects and resistance to water vapor that cause foam insulation to degrade over time" says David Grant, Marketing Director at Great Dane Trailers. The composite layers provide the panels' impact and puncture resistance needed to combat fork lift damage during loading/unloading and shifting cargo during transportation —thereby reducing damage to both trailer and consignment. In comprehensive tests, ThermoGuard™ made with Performax® 4849 Direct Rovings are significantly more impact resistant than competing thermoplastic liner panels, and almost 300 percent more impact resistant than competing thermoset liner panels.

Weight savings, bigger payloads, less fuel consumption

Used in the sidewalls, ceilings and subfloors of Great Dane reefers, ThermoGuard™ liner panels can also help prevent trailer weight gain caused by water vapor intrusion through the liner into the insulating foam—a process that can add 1000lbs or more to a semi-trailer's weight over time, leading to significant reductions in payload capacity. Combined with the significant cooling unit fuel savings the innovative panel allows in most types of refrigerated trailers, fleet operators can realize an average of 200 gallons per year in fuel savings during the life of the trailer.

Contact: composites@owenscorning.com www.greatdanetrailers.com

[1] Colloquial term for refrigerated trailer
™ ThermoGuard is a trademark of Great Dane Inc.

Composite flooring for lighter, stronger and more sustainable containers

Conventional shipping containers have floor panels made of bamboo, tropical hardwood or plywood. Container users have been seeking to cut their maintenance costs for these systems, which need to be replaced every three to five years.

A member of China International Marine Containers (Group) Ltd. (CIMC), located in Shenzhen in Guandong Province, CIMC ECO New Material Co Ltd[1]. is a world leading manufacturer of cargo, refrigerated and specialty containers, as well as modular building and flooring products. To improve the quality and durability of its container flooring they developed a glass-reinforced composite flooring panel system for use in its diversified portfolio of shipping containers. The system features innovative pultruded FRP structures made with Advantex® glass and PulStrand™ roving from Owens Corning and underscores CIMC's mission of supplying secure, tough and durable lightweight container solutions for the global logistics market.

Lasts six times longer than traditional materials

The components are pultruded and finished with a sprayed polyurea (SPUA) surface coating for protection against weathering, abrasion, chemical attack and water. Steven Zhao, General Manager of CIMC ECO New Material Co. Ltd said the advanced glass roving products from Owens Corning gave us exactly the property profile and processability we had been looking for. He went on to say the result is a high-performance flooring system with superior strength-to-weight ratio and significantly lower cost-of-ownership for their global customers.

"Compared to traditional wooden or plywood panels, our composite structures with Advantex® glass and PulStrand™ roving last up to six times longer, which makes them an ideal refurbishing solution," he concluded.

32 percent lighter yet offers extra payload

CIMC ECO's composite flooring panels are up to 32 percent lighter than conventional systems outperforming them in durability and payload while at the same time providing significant weight savings. The composite flooring panels using Owens Corning's Advantex® glass and PulStrand™ products are manufactured at CIMC ECO's plant in Nantong (Jiangsu Province). The system is designed for modularization and can be customized to various different container standards, including those of the 45' (13.7m) container and the U.S. cars and rail cargo transportation market.

[1] A joint venture between CIMC and Chinagrate, a specialist in fiberglass composite materials.
Data: Owens Corning China Composite Center and courtesy of CIMC ECO New Material Co. Ltd

Contact: composites@owenscorning.com
www.cimc.com/en/business/container

Steven.zhao@chinagrate.com

Pultruded power supply conduits for catenary-free tramway system

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© Golden Tsai Hsing Co. Ltd.

High temperatures and humidity, as well as frequent typhoons and heavy rains, encouraged the municipality of Zhuhai in Guangdong to specify a catenary-free power supply system for their new tram line.

As a more aesthetic, as well as robust solution compared to overhead catenary supply lines for public tramways, the authorities of Zhuhai City adopted ground-level TramWave® patented electro-magnetic power supply system, used under license from Ansaldo STS, Italy. Serving as a role model for street aesthetics and sustainability, the novel system had to be laid in conduits capable of resisting the detrimental effects of water, humidity, and heat and stress corrosion in the underground environment.

High protection and operational safety

The 3 to 5 meter length conduit components were developed and manufactured by Taiwan-based Golden Tsai Hsing Co. Ltd., using a pultrusion process with Advantex® E-CR glass rovings as reinforcement in both a matrix of polyurethane (PU) and unsaturated polyester resin (UPR).

Jay Liu, General Manager of Golden Tsai Hsing said that he was very pleased with the smooth progress of this project, where Owens Corning brought in their extensive expertise in FRP composite applications. The use of boron-free Advantex® E-CR glass fiber reinforcement, which provides excellent dimensional stability, mechanical strength, durability and superior corrosion resistance, enabled conduits displaying superior weatherability even in regions with more severe climate conditions.

"Working together with Owens Corning to optimize the resin and glass fiber reinforcement components helped us develop an innovative solution for the FRP conduits which provided the perfect solution for maximum protection and operational safety of the ground-level power supply system" Liu added.

Sustainable urban transport systems

The installation in Zhuhai City is the first commercialization of this innovative catenary-free public transport system in China. It is now being promoted by China Tramway Corporation for use in several other urban traffic projects across the country thereby transferring the benefits of this novel conduit design to a wide range of further ground-level tramways, electric bus lines and other sustainable urban transport systems in collaboration with conduit maker Golden Tsai Hsing and glass fiber supplier Owens Corning.

Contact: composites@owencorning.com Jay@gtifrp.com www.gtifrpcomposite.com

GFRP rebar: a revolutionary concrete game-changer helping reduce the effects of climate change

© Hughes Brothers Inc.

Pedestrian bridge, University of Miami campus August 2015, © Hughes Brothers Inc.

Across the U.S. in 2012, the Federal Highways Administration spent an average of 15 billion dollars rehabilitating over 5,200 bridges[1] spanning rivers and brine waterways. According to a recent study[2], even climate change may be affecting concrete's durability, with potential long-term consequences for familiar urban infrastructure.

The report reveals that eventually both carbon dioxide (CO_2) and chloride ions seep into concrete and promote the corrosion of steel reinforcing bars (rebar) triggered by increases in carbonation (which reduces the pH) and chlorides concentration that causes the depassivation of steel.

In addition, the concrete industry is one of the largest industrial consumers of fresh water[3], a precious resource in peril due to population growth and global warming[4]. Owens Corning, the University of Miami and other academic and industrial partners, are working together to demonstrate and deploy safe utilization of glass fiber reinforced (GFRP) rebar in concrete, which would not only help combat the effects of climate change, but could help conserve fresh water resources by using seawater and salt-contaminated aggregates. To do so, an alternative to steel rebar would have to be used. Typical GFRP rebar - made using vinyl-ester resin and Owens Corning's Advantex® E-CR glass - does not rust, nor corrode.

Impervious to saline corrosion

GFRP rebar is impervious to corrosion by saline solutions and associated chloride ions and therefore offers a viable, more sustainable non-corrosive concrete reinforcement solution when compared with epoxy-coated steel rebar.

Contact: composites@owenscorning.com

"If the chloride content threshold in cement, and consequently in concrete, could be relaxed for certain types of applications when using GFRP for reinforcement, there could be far reaching benefits for the concrete manufacturing industry both in terms of sustainability and efficiency" states Antonio Nanni, Professor and Chair, Department of Civil, Architectural and Environmental Engineering, University of Miami.

Technological progress helps improve infrastructure lifespan

Corrosion resistant GFRP rebar in concrete helps improve its durability and efficiency. If it becomes possible to produce concrete using seawater instead of freshwater for mixing and curing, concrete itself could become even more sustainable[5]. Consequently, these technological advances would enhance the sustainability of infrastructure and help extend their lifespan.

[1] www.fhwa.dot.gov/bridge/nbi/sd2012.cfm
[2] Source: http://www.coe.neu.edu/news/cee-prof-matthew-eckelman-featured-boston-globe October 14, 2014
[3] 'Reducing the Environmental Impact of Concrete' by P. Kumar Metha. Published in Concrete International, October 2001 (http://maquinamole.net/EcoSmartconcrete.com/docs/trmehta01.pdf)
[4] The Water Crisis: A Quest to Conserve Our Planet's Most Precious Resource http://www.studentpulse.com/articles/321/the-water-crisis-a-quest-to-conserve-our-planets-most-precious-resource
[5] Sustainable Concrete Without Chloride Limits (Federica Selicato, Mauro Moro, Luca Bertolini and Antonio Nanni)

An array of game-changing composite solutions at CAMX 2015

Market Vision, published by Owens Corning, coincides with major industry events in the U.S., Europe and Asia, providing thought-provoking content highlighting how composites are continually, and successfully, transforming our world.

Here at CAMX 2015, held at the Dallas Convention Center in Texas, Owens Corning (Booth P85) displays innovative game-changing products and customer success stories undeniably spearheading and driving composites market growth.

PulStrand™ 4100 roving helps add value

The global composites market for pultrusion continues to rise with even more demanding applications, and to help meet these needs, Owens Corning recently introduced its PulStrand™ 4100 best-in-class product. Having multi-resin compatibility, it allows excellent performance, processing, a wide range of tex for design flexibility (600-9600) and the excellent corrosion resistance of Advantex® E-CR glass. A video will showcase a proprietary modeling tool and how it can help pultruders create value through profile design improvement and enhanced processing.

Durable and sustainable solutions for automotive, transportation and infrastructure

Owens Corning will highlight next generation light-weighting material developed by **Continental Structural Plastics** for automotive exterior body panels and structural components; thermoplastic **ThermoGuard™** liner panels for **Great Dane** reefer trailers, which are thermally efficient and up to 300 percent more impact resistant than thermoset alternatives and, in collaboration with the **University of Miami**, the revolutionary use of GFRP rebar for game-changing concrete, helping reduce the effects of climate change on urban infrastructure.

Day-Time		Event	Presenter	Venue	Topic
Tue Oct. 27	2:00-2:45 PM	Education session	Gale Tedhams	D165	Leadership in Energy & Environmental Design (LEED) v4: Transformation through Transparency, Health & Achievement
Tue Oct. 27	2:00-2:45 PM	Tech. Paper	Kevin Spoo	D171	How Glass Reinforcements Choice Can Effect Bow In Pultruded Parts
Wed Oct. 28	8:00-8:45 AM	Featured session	Raina Dhruv	D222	LCA for Composites and its Impact on Sustainability
Wed Oct. 28	9:00-11:00 AM	Panel	Dave Hartman	D225	Recycling Composites Materials - Challenges and Solutions
Thu Oct. 29	3:00-3:45 PM	Education session	Dhruv Raina	D168	Vehicle Light weighting – a Greener, Composite Solution (for Class A body panels using SMC)

Owens Corning presentation agenda during CAMX 2015

Contact: composites@owenscorning.com

Owens Corning, October 2015

OWENS CORNING COMPOSITE MATERIALS, LLC
ONE OWENS CORNING PARKWAY
TOLEDO, OHIO, USA 43659

1-800-GET-PINK™
www.owenscorning.com

MARKET VISION FOR COMPOSITE SOLUTIONS
Published by Owens Corning Composite Materials, LLC.
E-mail feedback and suggestions to MarketVision@owenscorning.com.

Executive Editor: Teresa May

Managing Editor: Emmanuelle Mangenot