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About the Cover:
The façade of the KAFD World Trade Center in Riyadh, Saudi Arabia, includes more than 3,000 unique FRP panels made from a sandwich construction.
Photo Courtesy of BFG International
Growing the Pie

In the composites industry, we talk a lot about “growing the pie” as a critical goal of market development. As markets evolve and new opportunities open for composites, it is easier to grow if we work together to increase acceptance and use of our products.

One way businesses can expand into new markets is through mergers and acquisitions. For example, in January, Core Molding Technologies acquired Horizon Plastics International (HPI) – a leader in structural foam and web molding. Acquiring HPI allowed us to add to our portfolio of manufacturing capabilities and cross-promote our existing capabilities and products to customers. But before jumping into the acquisition, it was important for us to do our homework. That means staying updated on the latest market trends to remain ahead of the curve.

A number of the stories in this issue of Composites Manufacturing will help you do just that. In this issue’s lead feature story (page 10), you’ll read about some innovative applications, ranging from building facades to louvered wall systems. Architecture is a relatively new arena for our industry, but thanks to the work of ACMA’s Architectural Division, composite products have increasingly been accepted and used by architects to create amazing commercial and residential buildings. A number of these innovative products will be on display in the Composites Pavilion at the American Institute of Architects (AIA) annual show (June 21-23 in New York City).

Many of today’s architectural composite structures utilize epoxy resins. Epoxies have been around for decades, but recent innovations that make them increasingly customizable could open up a wide range of new opportunities. Check out our story on epoxy developments on page 16 to find out what’s going on in this dynamic market.

Stories like these are a testament to the great work industry professionals like you have done to display what’s possible with composites. They are also proof of what our industry can achieve when everyone plays an active role in market development. To learn more about how you can become an influencer in the industry and create opportunities to penetrate new markets, visit https://acmanet.org/composite-growth-initiative-overview.

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Continuous improvement programs tend to focus on internally identified opportunities and solutions. After the “low hanging fruit” is plucked, further opportunities are progressively more difficult to identify and solve. Benchmarking provides a way to look for new opportunities and better practices outside of the operation. Benchmarking is a 12-step process (see the box at right), essentially a plan-do-check-act cycle that involves the internal improvement team, as well as outside subject matter experts from suppliers, consultants and peer organizations.

In a focused effort to improve and sustain its Sheet Molding Compound (SMC) operations, Molded Fiber Glass (MFG) embarked on an endeavor in 2006 called Project Hawk to determine and implement industry best practices for compounding SMC with a goal of sustained improvement. MFG led the project and, in the spirit of open innovation, encouraged other companies to join in to benefit the composites industry as a whole.

Sheet molded composites are compression molded high-volume cosmetic and structural parts – mainly for automotive, truck, industrial and watercraft applications – where the SMC is a mixture of polymer resins, inert fillers, fiber reinforcement, initiators, pigments, stabilizers, release agents and thickeners. The manufacture of sheet molding compound is a continuous in-line process. The base components of liquid and solids (paste) are bulk mixed and continuously metered onto the surface of a carrier/barrier film, coating the film surface. One of the paste coated carrier films is then layered with chop fibers. The two carrier webs, paste and fiber are then brought together in a compaction section, where the sandwich-like layered components are kneaded into a homogenous compound sheet. The sheet can then be rolled or festooned into a container and stored in a controlled environment where maturation takes place, on its way to a specified viscosity.

Project Hawk had three phases – benchmarking, implementation and sustainment. We invited many compounders to join us, and several large ones agreed to share best practices with their peers. Including MFG, nine compounding facilities participated in the study.

We generated a list of 82 input items and several output variables related to product uniformity and final quality to the customer. (Input items refer to resources such as raw materials, energy and information that are put into a manufacturing plant to obtain the desired output.) Each compounding facility was rated on these items and variables throughout the benchmarking process. Target areas funneled into seven broad topics:
1. General mixing and compounding
2. Raw materials
3. Paste mixing
4. A/B metering
5. SMC machine
6. Final SMC compounding
7. Compounded SMC materials and maturation

In reviewing the benchmarking exercise, we noted that a few facilities had much less output variation than the general population. There was a wide range of capitalization in facilities, but this was not the primary correlator with low variation. The most important point that surfaced was that best practices in both paste production and SMC compounding were data driven and based on sound scientific principles.

We also saw a direct correlation of some controls with objectively superior output. With that information, MFG constructed a best practice protocol where the process flow starts at the point of receiving raw materials and ends with storage of the final product. We developed numerous detailed protocols, but here are examples of best practices in two areas – paste preparation and manufacturing SMC:

**Paste Preparation:**
1. Certificate of Acceptance (C of A) inspection of raw ingredients
2. Correct formula – Make sure correct revision level is in use
3. Make sure each formula is lot traceable with supplier lot information
4. Verify each formulation has correct ingredient quantities
5. Verify correct order of addition of ingredients is followed
6. Verify rate of addition of each ingredient is followed
7. Verify blending conditions are met for each formulation
8. Conduct quality control analysis on each paste batch (viscosity, temperature, paste density) per formula specifications

**The Benchmarking Process**
1. Select subject
2. Define the process
3. Identify potential partners
4. Identify data sources
5. Collect data and select partners
6. Determine the gap
7. Establish process differences
8. Target future performance
9. Communicate
10. Adjust goals
11. Implement
12. Review and recalibrate
Manufacturing SMC:
1. C of A inspection of glass rovings
2. Correct SMC machine set-up for each formula
3. Verify correct paste metering and thickener metering are set for each formula
4. Verify correct glass type per formula
5. Verify glass content – Make sure established method is in place that calculates/predicts glass content of SMC being produced
6. Verify edge seal equipment is working properly
7. Ensure mat weight samples are being taken for left, center, right sections of SMC
8. Ensure maturation room is operational temperature controlled
9. Conduct quality control testing on all produced SMC (gel, cure, molded density, shrinkage) per formulation specifications

At the end of the benchmarking process, the Project Hawk team made a report and presented to both MFG management and our partners.

To maintain best practices in SMC paste production and SMC compounding, an extensive audit plan was put in place that was ultimately absorbed into ISO/TS 16949 compliance audits for the automotive supply chain, as well as overall improvement of internal operations and quality. The plan helped maintain a data-driven, process-focused SMC compounding operation.

With the implementation of Project Hawk, which emphasized best practices and sustainability, many improvements have been made to both SMC paste production and SMC compounding at Molded Fiber Glass Companies. Just as importantly, the project highlights the value of collaboration among industry partners. All the participants were committed to developing collective best practices rather than narrowly focusing on their individual company interests, thereby advancing the industry as a whole.

The process for continuous improvement continues, and we can all be a part of it.

Kurt Butler is director of research for MFG Research. Email comments to kbutler@mfgresearch.com.

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Global sales of battery-powered electric vehicles (EVs) and plug-in hybrids increased 51 percent from 2016 to 2017, according to Macquarie Research. Startup Uniti Sweden is staking out its space in this burgeoning market as the manufacturer of a modern city car—known as the Uniti One—designed for “holistic sustainability” in both operation and production. Composite materials are an important part of that equation.

“We wanted to create a vehicle that made sense for electric vehicle technology, today’s consumer expectations, urban mobility patterns and the big environmental challenges we are facing as a society,” says Tim Unerman, composite manufacturing specialist at Uniti. “In other words, we are rethinking the car from the ground up. We designed the vehicle with the driver at its core, instead of just designing around the same mechanical properties of the combustion engine era. The result is a lightweight electric car that boasts an intuitive user experience on a platform that is highly scalable and emits a lot less carbon over its lifecycle.”

The Uniti One will have a range of up to 186 miles, be suitable for highway or city driving and have a top speed of 80 mph. To achieve this performance, the company chose lightweight CFRP for the main structural frame and bio-based composites for the interior.

Unerman says composites offered several advantages. Uniti One is classified by the European Union as a heavy quadricycle (L7e vehicle) so it must weigh less than 92 pounds (not including the battery weight). This requires the vehicle structure to be as lightweight and safe as possible. The Uniti design team determined that a carbon fiber-based system would offer the most effective crash structure.

Composite fibers will also be a better environmental choice in the long run, Unerman says. Carbon fiber is now typically produced from polyacrylonitrile (PAN) and petroleum pitch, but as technology advances it has the potential of being produced from more sustainable materials. It will be easier to incorporate such changes into production when they’re already using a composite, rather than changing the design from aluminum to composite materials.

There are manufacturing advantages as well. “We can manufacture [the vehicle] fully automated and very scalable, with a much better environmental impact,” notes Uniti founder and CEO Lewis Horne in a Uniti website video.

“Flexibility and speed to market are key requirements for Uniti,” Unerman adds. “On evaluating the options for suitable tooling for volume, composite tools could be procured within six to nine months and only require around 10 tools.” Both numbers would be higher for materials like aluminum.

The Uniti One EV started as an innovation project at Sweden’s Lund University. The company founders used crowdsourced funding to pay for development of a two-seat prototype model, which they introduced in December 2017. Production vehicles will go on sale in 2019, with four-seat models (for the European market) and five-seat vehicles (for the Indian market) available in the next phase.

Uniti Sweden is working through many design and production decisions as it prepares to bring its car to market. One is determining which carbon fiber composite formulation will provide optimum crash performance. “This is more challenging developing with composite structures as the engineering options are very varied and still developing,” Unerman notes.

Another challenge is ensuring there will be enough carbon fiber available to meet the anticipated demand for Uniti’s vehicles. The company recently signed a memorandum of understanding with U.S.-based Zoltek to guarantee that supply of carbon fiber and expects to confirm other supplier agreements soon.

Zoltek has been supplying carbon fiber for automotive brakes and clutches...
for more than 15 years and more recently for lightweight structural components for the GM Cadillac hood and Audi A8 rear seat wall. “Uniti realized that Zoltek would be the most logical choice for a carbon fiber partner as they scaled up,” says David Purcell, Zoltek’s executive vice president of composite intermediates and oxidized fiber. “A question that we often get about carbon fiber is if aluminum is struggling to keep up with global automotive supply, how will carbon composites respond? Zoltek’s business model addresses that question, as our ability to rapidly expand carbon fiber capacity is designed to address demand of 200,000 or 300,000 parts a year.”

Purcell says Zoltek is unique because it produces just one type of fiber. The company can tailor the sizing for both thermoset and thermoplastic applications, and it is capable of producing various fabrics, chopped fibers and pultruded profiles from it. But they are all variations on that one base commercial grade fiber.

Uniti is currently looking at a resin transfer molding (RTM) process with carbon fiber fabric for its composite car bodies, but that could change. In addition, it is evaluating various options for producing the bio-composite parts for the vehicle’s interior. “We are targeting manufacturing processes that have a high level of maturity,” explains Unerman. The company also is getting input from its suppliers on the design of manufacturing processes in order to minimize problems later on.

The company currently has more than 2,000 pre-orders for its vehicles from customers around the world. “We will deliver the first batch of cars to beta testers in 2019, a bigger batch to end customers in late 2019, successively followed by more cars in early 2020,” says Unerman. “We are aiming to ramp up production to 20,000-plus cars in 2020. Based on market demand, we will potentially scale up the production in the years after.”

Mary Lou Jay is a freelance writer based in Timonium, Md. Email comments to mljay@comcast.net
With summer right around the corner, boaters are eager to hit the water. Cigarette Racing Team, a Miami-based builder of high-performance boats, unveiled a 51.5-foot-long vessel at the Miami International Boat Show in February that’s sure to turn heads on the docks and in the water — assuming you can catch a glimpse as it races by at top speeds of 140 mph.

Cigarette Racing and Mercedes-AMG teamed up to build the 515 Project ONE Boat, which is inspired by the Mercedes-AMG Project ONE supercar. The sleek vessel has 30 percent more surface area than its predecessor, the 50-foot-long Marauder. However, the 515 weighs 5,000 pounds less than the Marauder, thanks to its all-composite construction.

The boat utilizes a combination of carbon fiber, Kevlar® and E-glass fiber reinforced materials.

“It’s a highly-engineered boat, with parts made of different materials for a variety of reasons,” says Chad Braver, who oversees product development and engineering for Cigarette Racing Team. “There’s a temptation today to do everything with carbon fiber because it’s cool. But we found that every material has its purpose. I call it the rational approach to design.”

The boat’s structure is designed for speed, as well as manageability in rough water. “Each material and construction methodology was selected based on a criteria of weight, strength, acoustics and safety,” according to the Cigarette 515 product information bulletin. Some of the primary composite components include the hull, deck, cockpit tub, bulkheads and cabin liner.

**The Hull** – Using a vacuum-bagged, sandwich construction, the hull is a hybrid of CFRP and GFRP. The outer structural laminate is made from quadaxial E-glass and vinyl ester resin. “We use E-glass for impact resistance, offering better safety when you’re navigating in shallow water,” says Braver. “It also helps with noise, vibration and harshness (NVH) properties, making the boat sound nicer when it runs through water.” The inner structural laminate utilizes stitched fabric carbon fiber to reduce weight and improve strength, and the core is balsa.

**The Deck** – It also uses a carbon fiber sandwich construction, however the core is made of polyvinyl chloride (PVC). “The sound properties on the deck are different, and we wanted to keep the deck light weight,” says Braver. “It’s the highest point
on the boat, so it has the most effect on dynamics.” CFRP provides high rigidity and light weight, providing 1.7 times more flexural rigidity in the 515 than the Marauder 50, according to the company.

**The Cockpit Tub** – Integrated into the deck, the cockpit tub is also made from CFRP, which helps reduce the total deck weight and lowers the center of mass of the 515. The cockpit area is tied into a stringer system, which creates smaller panel spans. This allows Cigarette Racing to reduce the core thickness and lighten the cockpit tub without affecting mechanical performance. In addition, it enhances the vessel’s acoustic properties.

**The Bulkheads** – The bulkheads in front of the longitudinal center of gravity are constructed of CFRP, while those close to the cockpit are made of quadaxial fiberglass for better NVH properties. “The idea is to take the weight savings where it makes the most difference — far forward — then near the cockpit use a material with better acoustic properties so you get a boat that sounds like a heavy luxury boat, yet performs like the agile, light one that it is,” says Braver. All the bulkheads are CNC cut for a perfect fit and machine laminated for higher resin-to-fiber ratio, which increases strength. The bulkheads are tabbed with a hybrid of Kevlar (for durability and toughness) and E-glass (to improve compressive strength).

**The Cabin Liner** – Constructed from CFRP, the cabin liner tub features integrated seat backs and storage. Integrating these components saves the weight of an additional substrate and avoids the use of adhesives and secondary parts. The carbon fiber weave is exposed on the seat backs for visual appeal, creating a modern aesthetic.

Prepreg exposed-weave carbon fiber with a honeycomb core is also used for the 515’s engine hatch and air intakes. The extremely high fiber-to-resin ratio allows for strong, light parts. For instance, the air intakes are more than 7 feet long and 14 inches wide, yet they weight only 4.4 pounds each.

“We really try to use the best material for the job in the right spot and then take care while building the boat,” says Braver. Cigarette Racing has received numerous orders for the 515. Each one is custom commissioned, with customers selecting design details. Most of the boats will take approximately 14 weeks to build, after which the eye-catching vessels are sure to make a splash upon launch.

Susan Keen Flynn is managing editor of Composites Manufacturing magazine. Email comments to sflynn@keenconcepts.net.

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Bill Kreysler, head of the architectural composite company Kreysler and Associates, has seen an encouraging trend in architects’ attitudes about composite materials in the past decade. “Ten years ago, we were going to architects and trying to explain what we did and why they should consider us. Architects thought of fiberglass as a cheap substitute for something that they wanted but couldn’t afford,” he says. “Today, that is changing fast. Nowadays composites are recognized in the building code as a legitimate building material, and they are being used more and more on projects as architects explore new ways of designing more complicated shapes.”

One example is the open-air BHP Billiton Pavilion for San Antonio River Foundations’ Confluence Park in Texas, designed by Andrew Kudless of Matsys design studio. The pavilion is the centerpiece of the 3.5-acre park, which overlooks the confluence of the San Antonio River and San Pedro Creek. The architect wanted to mill the forms for the pavilion’s walls out of foam using CNC and robots, then use those foam models to create GFRP forms for casting concrete. But the builder, unfamiliar with composite materials, considered fiberglass molds only after the bids for wood molds came in extremely high. Kreysler & Associates was able to produce the required molds at a significantly lower cost.

The molds for the 30-foot-high, poured concrete “petal” walls had to carry the tremendous weight of wet concrete. “The fiberglass had to be dimensionally stable and able to withstand 500 pounds per square foot of hydraulic pressure,” says Kreysler. “That took a lot of engineering of the material. It was thicker, had some stiffening ribs and included a rather elaborate steel support frame.” As they were reused, the fiberglass molds retained their initial shape. That was another advantage over wood molds, which absorb water and change shape as they’re reused.

Kreysler & Associates worked closely with Kudless and Lake|Flato Architects throughout the project. “Partnership early in a project is important, especially on something as unusual as this, so that the design is grounded in a feasible means of fabricating it,” says Joshua Zabel, vice president of business development at Kreysler and Associates and the lead on the project. “Early ideas about how to make the molds, how they might be transported, in how many pieces and how to assemble them was useful information that we provided as the project progressed.”
Using fiberglass molds enabled Kudless to achieve the curves and smooth finishes he wanted, producing the one-of-a-kind structure that the client had requested. “Doing something this radical, it’s amazing that it came in on budget and on time,” says Kudless. “It was more accurate than anyone thought it would be at the beginning, and it was only possible through using composites, the CNC router and the robots to mill the foam out first.”

**Complex Geometries**

While FRP can be used to make molds in architectural applications, it can also serve as the main material for some of the most stunning building exteriors in the world. Composite materials were featured in the eye-catching façade of the KAFD World Trade Center, the second-highest tower in the King Abdullah Financial District in Riyadh, Saudi Arabia.

Working with Permasteelisa Dubai, BFG International developed and manufactured 3,000-plus unique exterior panels spanning an area of more than 47,000 square yards. “The challenge was creating the large variations in geometry within the tight dimensional tolerances in a very short span of time,” says Mathew Sailesh, business development and project manager at BFG. “The safety aspects were critical, and the entire assembly was tested and approved to meet NFPA 285 and ASTM E84 fire safety norms as per the building code.”

The fiberglass panels are a composite sandwich construction with a self-extinguishing, polyester-based, fire-retardant and UV-resistant gelcoat polyester skin and a polyethylene terephthalate (PET) foam core from Armacell. The foam gives the panels, some almost 50 feet long, the required stiffness and light weight. “The long span PET foam cored panels are tailor-made to meet stringent high-speed wind loading criteria,” says Henri Chapelle, Armacell Benelux S.A.’s sales and marketing manager for PET foams.

“It was definitely an achievement that the panels were supplied on time and with the desired geometry, so that each panel aligned perfectly and was assembled on spot with ease,” Sailesh says. All of the panels delivered to the site were

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**Using composite materials, architects can create innovative building designs.**

*By Mary Lou Jay*

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Using composite materials, architects can create innovative building designs. To build the parabolic structures at Confluence Park, the shapes were first cut from foam using an automated CNC process. The fiberglass molds were derived from these foam shapes. 

Photo Credit: Kreysler & Associates
dimensionally perfect, he adds. BFG completed the façade package at the end of 2016.

**Optimizing Light and Heat**

In Columbus, Ohio, panels from composite manufacturer Kalwall have provided natural lighting without unwanted heat to a century-old warehouse that is the production facility for a local distillery. The renovation design for the building, from Jonathan Barnes Architecture and Design (JBAD), called for the removal of the middle third portion of Middle West Spirits’ one-story building and the construction of a 55-foot-tall structure in its place. But the polycarbonate material JBAD originally planned to use for the addition’s sidewalls was too expensive, so they approached Kalwall.

Kalwall manufactures structural composite sandwiches, bonding two specially-formulated translucent FRP faces to a grid core constructed of interlocking aluminum or composite I-beams. The panels contain an insulating layer that, along with the fiberglass façade, controls the amount of light that passes through and the solar heat gain.

Kalwall makes its own fiberglass and uses proprietary resins in the panel constructions, choosing the combinations carefully to ensure that customers get the desired effects. “We look at what properties they want in the panel. Is it color, is it light transmittance, is it certain fire properties?” says Amy Keller, principal and vice president of international sales. “We have an arsenal of 50 or 60 different types of fiberglass that we can make depending on what we need for that particular application.”

Kalwall worked with JBAD on the design, varying its panels to produce a unique look. They achieved a plank-like effect by incorporating thin, vertical offset lines through the panels. “On the south side of the building, we had the densest insulation that let the least amount of heat and light through, then we had these moments we broke the panel up with glass or different levels of insulation,” says Katy Viccellio, associate at JBAD. “It gave a kind of striping effect in the middle of the panel.”

There were other benefits to using the composite as well. “We worked with the architect to lay out the steel supports, saving a significant amount of money compared to their original layout,” says Keller. The Kalwall design also included many identical panels that made it easier for the contractor to install. The owner liked that the panels could be used as both exterior and interior surfaces – no drywall needed – and that they are easy to clean.

**Withstanding Weather**

Located on Galveston Island in Texas, the Sea Scout Base Galveston has to stand up to the Gulf Coast’s sultry weather and hurricane winds up to 150 mph. Architect Bob Randall of Resource Planning Architects designed a louvered wall system for the building’s exterior that allowed light and air into the external walkways and enabled the building occupants to enjoy views of the bay. Since the louvers were structural as well as decorative, Randall wanted to use material that would last better than aluminum. So he contacted Strongwell, a manufacturer of FRP.
FRP’s Flexibility a Fit for Furnishings

Architectural applications for composites aren’t limited to building exteriors. They extend into interior spaces and even furnishings. One example is the concierge desk for 1100 Millecento, a condominium building in the Brickell neighborhood of Miami. Italian automobile designer Pininfarina, responsible for the building’s interior design and furnishings, tapped Custom Composite Technologies of Maine to build the desk. It is an unusual shape – 161 inches long with one tapering, cantilevered side.

“Composite materials allowed Pininfarina to design without shape limitations,” says Steve Hassett, who runs Custom Composite Technologies with his wife Maureen. Starting with Pininfarina’s 3-D model, company workers cut the shape from urethane foam using a CNC machine, then integrated a plywood base so the desk could be bolted to the lobby’s concrete floor. The foam shape included a space for insertion of the plywood box that housed the drawer and door cabinetry required by the design. Temporary plywood spacers created room for two tempered glass shelves that were pocketed into the desk.

The Custom Composite crew laid up the foam base with Saertex unidirectional fiberglass. “The unidirectional fiberglass is positioned in a way that keeps the cantilevered section from draping down,” Hassett explains. “We had to essentially make a shell of composite that could have the compressional loads on the underside and the tensile loads on the topside.”

The form was then vacuum bagged with Derakane 510A40 resin, which was chosen because of its fire retardancy properties. The finish was a two-part PPG urethane paint. The entire laminate layer was just ¼-inch thick. The finished desk – stark white against a red wall – gave Pininfarina designers the desired look for the upscale lobby.

Custom Composite provides guidance to designers and innovative options for material use, installation options and how to put it all together, says Steve Hassett. “The designer has done their part, and the composites material and methods allow us to do our part,” he says. “They just have to say what their desired end product is, and we come up with how to do it – whether it’s a challenge on the fabrication or the installation. A lot of times it’s both.”

For example, when a major hotel chain renovated an old government building in Pittsburgh, they had Strongwell manufacture the FRP material for the rooftop deck structure. The owners used composite materials because they wanted their moisture resistance and their light weight, which enabled them to accommodate a greater number of people on the roof.

Moving Forward

Although the composites industry has to continue to educate architects and builders about the benefits of composite materials, many customers become converts once they’ve used them. “You have such a variety of opportunities to make your design, using PET foam cores in various densities and thicknesses, different kinds of fibers, different kinds of resins, different kinds of processes,” says Chapelle. “You can optimize it to obtain solutions for any project, which is not always the case with conventional materials.”

It doesn’t pay to use composite materials for a building designed for conventional materials, because that wouldn’t take advantage of composite materials’ unique properties, he adds. But architects who decide from the start to use composites can benefit from their light weight, which reduces the structural load and makes it possible to use lower-capacity cranes for installation. In addition, composite manufacturers can produce building materials in the factory at the same time as the concrete or steel work is taking place onsite, and they won’t be delayed by bad weather conditions.

Furthermore, composites allow architects to create innovative structures that push the boundaries of design. “With composites, architects can think a little more experimentally about form and the relationship between form and structure and fabrication,

composites and pultruded structures.

“He gave us a hand sketch of what he wanted it to look like and said, ‘Tell me what you can do in pultruded composites,’” says Stephen Browning, Strongwell structural engineer. The louvered walls that Strongwell developed consisted of 8-inch wide flange beams, 6-inch channels and 8-inch louveres. They met the wind load requirements and were lighter and more corrosion and UV-resistant than other materials.

To accommodate the 150-mph wind load, Strongwell placed glass reinforcement in strategic places. “The shape was a little bit thicker as well; it was ¾-inch, where we could have gotten it down to ¼-inch if the building was for some other area,” Browning adds. The company was able to manufacture the panels in lengths up to 30 feet since they were made of lightweight composite materials that workers could easily handle. That helped speed the louver installation.

Simple connections between the composite panels also made construction faster. “We used stainless steel self-drilling screws that required lab testing for pull-out strength,” says Browning. “The louveres were attached to composite framing using self-drilling screws, which was a first-time design and construction feature for us.” The white louvered panels are attractive and very low maintenance, which helped in the building’s pursuit of a LEED platinum rating.

Browning says there are still barriers to overcome in using composites for building applications, including the cost of the materials and their ability to meet some fire codes. But he says the industry is making progress in these areas all the time, and he’s getting more calls from architects about using Strongwell’s materials every year.
rather than being restricted to just the materials that historically we have worked with,” says Kudless. “It’s OK if the focus is on more unique, signature projects because that is what composites are really good at, where other materials are maybe not so good.”

Kreysler says he tells the architects and contractors he works with that if they can make something from plywood or sheet metal, they are probably better off making it with those materials. But if they can’t, they should look at composites.

“You don’t have to give up on the idea of something being a low, flowing curve or a complicated shape,” he says. “You don’t have to give up on your vision just because the contractor tells you that you can’t build it. You can build it! With composites, architects can get what they would like to have more readily than if they are forced to use more conventional material systems.”

Mary Lou Jay is a freelance writer based in Timonium, Md. Email comments to mljay@comcast.net.

BFG International manufactured more than 3,000 unique fiberglass panels for the façade of the World Trade Center in the King Abdullah Financial District in Saudi Arabia. Foam cores from Armacell gave the panels stiffness while keeping them light weight.

From June 21-23, 2018, in New York City, ACMA and its Architectural Division will host the fifth consecutive Composites Pavilion at the American Institute of Architects (AIA) show. The pavilion will highlight the latest composite architectural products from ACMA members and serve as a platform for architects to learn more about the technical side of designing with FRP. Visitors will also see the winning designs of ACMA’s annual Composites Challenge – a competition where teams of college architectural students develop a novel composite architectural/building component or assembly. Learn more at aia.com.
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Magnum Venus Products has been delivering ground-breaking innovation for over 70 years in adhesives and composites.
Epoxy matrix systems have been around for more than 75 years, with recent innovations moving away from off-the-shelf products to custom-made solutions. Advancements hinge on teamwork, such as an ongoing collaborative project between Dixie Chemical, which manufactures specialty chemicals, and four other industry partners. Together, they are developing an all-composite wall panel for damage-resistant modular buildings.

“The panel design can be tailored to withstand different levels of energy absorption, including shock waves from nearby explosions,” says Vinay Mishra, Ph.D., business development manager for the thermoset platform at Dixie Chemical. Key to the product is a new anhydride-cured epoxy resin system that is formulated for high strength and high glass transition temperatures (Tg) and uses a proprietary variation of the resin infusion process.

Dixie Chemical has assembled a team of experts to offer input, materials and production on everything from reinforcements to engineering and blast-resistant buildings. Those partners include Engineered Syntactic Systems, Core Composites, Clear Carbon & Components Inc. and Hunter Buildings LLC. The panels are currently undergoing various tests, and the team expects the first ones will be installed in prototype buildings late this year.

For demanding applications such as the wall panels, epoxy resins are often the clear choice. “End users are looking for higher and higher performance,” says Michael Watkins, senior technical advisor for epoxy thermosets at Dixie Chemical. “In the old days, polyesters and vinyl esters worked just fine. Now if people want higher performance, higher strength or higher temperature service, then they are starting to look at epoxies.”

A Proven Record

Epoxy resins have a proven record in a wide range of applications, from coatings and adhesives to composite parts and concrete repair. There are two basic kinds of epoxies: Ambient cure, which cure at room temperature, and heat cure, which require baking to cure. Both kinds can be used in composite applications, however heat cure epoxies are more commonly utilized.

Epoxies are used mainly in fabricating high-performance composites with superior mechanical properties, resistance to corrosive liquids and environments, exceptional electrical properties, good performance at elevated temperatures and good adhesion to a substrate. “The defining feature of epoxies is they are able to cure to a very high degree of cross-linking, which leads to all these superior properties,” says Mishra.

Other benefits of epoxies include their ease of processing and balance of thermomechanical properties following cure. They may include low viscosity liquids appropriate for processes like infusion and filament winding or higher viscosity semi-solids used in pre-impregnated composites and laminates, according to Jean Luc Guillaume, global wind and composites marketing director of Olin Corporation, a producer of epoxy materials. “Epoxy resins can deliver high glass transition temperatures after cure to meet the most demanding service requirements,” he says.

Because of these advantages, one of the leading users of epoxies is the aerospace industry. Airliners rely on epoxy resins for structural parts as well as interior equipment. Epoxies are also commonly used in automobiles, sporting goods equipment, pipes and storage tanks, roads and bridges, electronic circuit boards and high-voltage electrical insulation.
Another promising market for epoxy is wind energy. As wind blades get increasingly longer – growing from 60 meters to 100 meters in length – they need to be stiffened so they don’t buckle or collapse on themselves. Many customers are turning to specially-formulated epoxy resins for high-speed production of structural components for large wind turbine blades.

**Considering Curatives**

Any discussion of epoxies must include mention of curatives. “Unlike some other chemistries, epoxy resins as a nomenclature only refers to about half of the total resin system because epoxies need a curing agent,” says Mishra. “The second component – the curing agent – is actually a significant portion of the final cured composite resin when compared with polyester or vinyl ester resins.” The choice of curing agent, he adds, determines how the epoxy resin system will be cured, how it will behave and what kinds of applications it will be best suited for.

Historically, most epoxies have been made from bisphenol A (BPA) with common curing agents including aliphatic amines and aromatic amines. However, aromatic amines – an organic compound comprising an aromatic ring attached to an amine – have faced some scrutiny because they can be hazardous. “Epoxy resins are relatively safe by themselves. It’s the curing agent that can change the safety rating of the system,” says Mishra. “So more and more people are looking at other amines, hydrides and other curing agents with low volatile organic compounds (VOCs).”

Increased demand for enhanced performance in composites also is leading end users to consider new combinations of epoxies and curing agents, including anhydrides, dicyandiamide and imidazole. For instance, Dixie Chemical recently developed a proprietary line of pre-catalyzed curing agents for epoxy pultrusions that offer long pot life, fast cures and high \( T_g \). These anhydride curing agents, included in the company’s ECA 607 and NMA 407 products, open up opportunities for a variety of applications, including leaf springs, bridge pilings, cable stays and composite rebar.

“Epoxy anhydride systems are now rivaling the traditional line speeds of polyester and vinyl ester resin systems, thereby narrowing their traditional productivity gap while offering a non-styrene containing, higher performing system,” says Mishra. “Combined with the increased use of carbon fiber, such advancements are enabling the growth of advanced composite applications.”

**Catering to Customers**

Customer demand drives innovation within epoxy technology. A. Schulman is an international supplier of high-performance plastic compounds, composites and resins. The vast majority of the company’s thermoset products utilize polyester and vinyl ester resins. “We offer epoxies when specific applications demand that an epoxy be used, whether for aerospace or a hot-wet environment where an epoxy will hold up better than a polyester or vinyl,” says Tim Langschwager, product manager for A. Schulman’s sheet molding compound (SMC), thick molding compound (TMC) and Quantum Composites® product lines.

An automotive OEM approached the company several years ago to replace its vinyl ester SMC. “The objective was to create an epoxy compound that could exceed the performance of their current SMC, while offering lower VOCs and higher mechanical performance,” says Langschwager. “They had specific targets around thermal performance for glass transition temperatures, tensile strength, compressive strength, surface finish, room temperature stability, and flow and fill of the material.”

The company developed a product line that relies on several different epoxy resin systems – combined in different ratios to maximize performance — rather than a single, standard resin. The sheet molding compounds use standard BPA, bisphenol-F, multifunctional and novolac epoxies with a variety of amine, anhydride and boron trifluoride hardeners, reactive diluents and accelerators. Officially launched at CAMX 2017, the *LYTEX™ SF* series of sheet molding compounds includes three different resin systems for carbon fiber, glass fiber and continuous fibers.

Langschwager says it’s all about dialing in to customers’ specific needs. “If they are concerned about storage and need longer room temperature stability, out life and pot life, then you can modify the curative and additives. If they need a tougher system, there are a lot of epoxy reactive diluents to help viscosities and add toughness,” he says. “Epoxy suppliers today are more willing to work on a full solution as opposed to saying, ‘Here’s our resin. Figure out how to use it.’”

Olin’s approach to product development is similar. It introduced the LITESTONE™ portfolio of epoxy systems,
which has more than a dozen products with tailored processing and performance characteristics. LITESTONE 2130/2142, for example, is designed for the filament winding process. The low viscosity epoxy anhydride system has a minimum pot life of 12 hours, which allows for long working times – a key requirement for filament winding. “The unique aspect of the 2130/2142 system is the enhanced fracture toughness, which is achieved without any compromise to its temperature or mechanical properties,” says Guillaume. The system has been used in Type IV pressure vessels for compressed natural gas (CNG) storage.

Advancing Epoxies
“The increased demand on composite parts is making people look more closely at epoxies now as candidates, whereas in the past cost was such a big factor,” says Mishra. “As more people pay attention to epoxies as an option for higher performance properties, they are coming up with creative ways to use them.” For example, Mishra says in the past anhydride curing agents were not utilized for many infusion applications because the curing temperature wasn’t conducive to infusion processes. That has changed.

“Composites are increasingly replacing metal, so the epoxy industry has been advancing technology on the temperature performance of resins to meet strict service temperature requirements,” says Guillaume. Olin developed a high functionality novalac molecule called D.E.N.” 440, which enables high Tg after cure without sacrificing ease of processing. “Another major theme is toughening the damage tolerance and fatigue resistance of composite structures to improve their long-term reliability,” says Guillaume.

Of course, cost is nearly always a factor in material selection. “Epoxies tend to be more expensive than standard polyester resins, but in most cases they bridge the gap between specialty high-temperature resistant resins and polyesters,” says Guillaume.

Watkins adds that even if costs are higher pound-for-pound, epoxies may still be cost-competitive. “Sometimes since you have higher strength with an epoxy, you may be able to make a lighter part with less material than a polyester,” he says. “So although the material cost is higher, you are using less and that can offset some of the cost differential.”

Like most other areas in the composites industries, the key
to epoxies is educating customers and end users. “People often have pre-conceived notions of what an epoxy does and doesn’t do. We have to explain to potential partners that everything hinges on the particular resin, the particular curing agent and how they are combined,” says Mishra. “So re-educating people about epoxy resin systems is so important. Epoxies are a much broader class of resins than most people realize.”

Susan Keen Flynn is managing editor of Composites Manufacturing magazine. Email comments to sflynn@keenconcepts.net.

Join ACMA's High Performance Council

Want to help grow the market for epoxies and other high-performance materials? Join ACMA's High Performance Council (HPC). The council works to promote the benefits of high-performance composites in demanding applications to Congress, federal agencies, engineering students and end users. Members of the HPC also promote awareness and use of composites at conferences for various industries. For more information about joining, fill out an interest form at https://tinyurl.com/y88vbuoj.
When social media platforms like YouTube, Facebook, LinkedIn and Twitter became a part of our everyday lives, they also opened a world of new business opportunities. Although some critics insist that these platforms are productivity killers, others contend that social media is a critical component of any 21st century brand strategy if used correctly.

“I’m not talking about endless surfing on Facebook,” says Randall Craig, a management consultant and author of “Online PR and Social Media for Experts.” “I’m talking about basic organizational capacity so that people are able to understand what’s happening with their customers, with their competitors, with regulators, with suppliers, so that they can be closer to these other stakeholders and therefore do a better job.” To him, losing productivity to social media abuse is not a social media problem. It’s a management problem.

However, Craig has also seen his fair share of companies that feel pressured to rush mindlessly into the world of social media and end up with a disjointed approach. Just as composite manufacturers and engineers do not begin a construction project without a plan, social media managers should not simply post content without thinking about why they’re doing it and what their goals are.

**Getting Started**

According to Craig, many businesses struggle with a “chicken or the egg” dilemma regarding the best way to use social media: Should we generate interest in our business by using social media to drive “real world” activities, such as attracting visitors to a trade show booth? Or should we use those real-world activities as opportunities to build a larger social following, which in turn, will lead to greater interest? Craig says there is no wrong choice, but that businesses should have a concrete reason for whatever method they choose.

“It’s very easy to say, ‘I’m going to get on social media because...
it’s there,” says Craig. “What you do on social media must be integrated with your marketing and sales processes and strategy. Otherwise, you’re just wasting your time and your money.”

Another issue businesses frequently encounter is how to budget for their social media strategies. Craig says that while businesses do not need to possess an “all or nothing” mindset to social media, it can’t be an afterthought delegated to just one or two people. There needs to be a significant financial commitment to developing social media literacy at all levels of a company.

“You can’t suddenly say, ‘You know what? We’re going to get the receptionist to do a little bit of this in his or her spare time,’” says Craig. “Because otherwise, as soon as they get busy with their real responsibilities, [social media] will fall off.”

Peter Hedger Jr., director of marketing and communications at Magnum Venus Products (MVP), agrees, noting that MVP has found success dividing responsibilities for various social media platforms among its team. Hedger maximizes his department’s strengths by letting different people control different platforms where they have the most comfort and expertise. While other staff in his department handle Twitter and Facebook, he manages LinkedIn.

“A good strategy is utilizing everybody in the company to promote a similar message throughout all of the different social media outlets rather than trying to do that on my own,” says Hedger. As a result, MVP gets the most out of each platform without having staff spread too thin.

Another good strategy, he says, is to have a “promotional mix” of social and print media. A common misperception is that if a business starts using social media, there is no need for print media. Hedger says ignoring one particular medium could cause a company to lose the opportunity to reach its full advertising potential. MVP’s strategy is tailored to reach a wide range of potential customers who all consume content differently. For example, millennials might respond well to short videos, whereas older generations may respond better to print advertising. The key, he says, is to ensure message consistency across all platforms.

Making messages consistent does not mean using each platform the same way. According to Barry Myers, marketing manager at Strongwell, posts about community involvement resonate well on Facebook, whereas customers look to LinkedIn to see which companies are respected as experts in their industry.

Establishing Expertise

Hedger says that using social media to establish expertise is the best way to grow brand authority and influence. He notes, however, that there’s a difference between informing and educating that businesses should be cognizant of when creating their social media strategies.

“You can’t put the cart before the horse in the education track,” says Hedger. “You’ve got to establish [your company] as a renowned expert in the field. Once you get people locked into an education stream, you can begin to feed them information.”

For example, as a leader in pultrusion, Strongwell will often post their own in-house technical information about the pultrusion process and how it works. The company will also post external media that conveys its pultrusion expertise, such as the Public Broadcasting Service’s “Made in Virginia” video series, which featured an episode on Strongwell, its history and manufacturing innovation.

However, a company does not have to be featured on television to establish expertise and build prestige. One approach Strongwell takes is to promote case studies outlining successful applications of its products.

Last year, Strongwell published a case study about a pedestrian bridge it created over the Mountains to the Sea Trail in Boone, N.C., in 2016. Trail bridges are typically wooden and therefore susceptible to rotting and corrosion. However, Strongwell’s case study was not simply a side-by-side comparison of composites and wood. According to Myers, what really made the application stand out was that their products’ light weight allowed them to be prepackaged, helicoptered in, erected onsite and put together just as easily as a wooden bridge.

Since publishing that case study, Strongwell has received several phone calls from potential clients who are interested in building a similar bridge. Those type of calls, Myers says, can turn into business opportunities.

Another way to demonstrate expertise, according to Hedger, is to share and comment on relevant news stories that highlight what is possible with FRP. Sometimes, that means advocating for products and applications that do not come from your own company. Hedger says that sharing content that promotes the entire industry can help build relationships and establish a business as a thought leader.

“By doing that, you’re expanding the message,” says Hedger. That, in turn, increases a company’s ability to be seen as a reliable source for information on composite material solutions. “If the solution happens to be one of your products, great. If it’s not and you’re still helping [another] person out, then later on when they need a solution that is your product, they’re more likely to come back to you.”

However, Myers warns that won’t happen unless the content has a clear call to action. Businesses need to make sure they have a healthy balance of educational and actionable social media activity.

“You can spend so much time on social media and yet never accomplish anything,” Myers says. “Don’t make it all about education … like the student who goes to college for 15 years but has no job at the end.”

A Personal Touch

Another way to build relationships through social media is by showing your business’s personality. For example, Strongwell likes to use humor. Every Wednesday, the company posts a meme – a humorous image that is copied with slight variations and spread rapidly by Internet users – related to composites. One popular meme pays homage to a famous scene in “Indiana Jones and the Last Crusade” where the Grail Knight warns the protagonists to “choose wisely.” Strongwell edited the meme to say, “Choose your next building material wisely.”

According to Brian Leftwich, marketing and communications specialist at Mar-Bal Inc., showcasing the role a business plays in its local community is another way to add a personal touch to social media. Leftwich says Mar-Bal’s content doesn’t just cover the company’s products and capabilities; it also gives people an inside look at the staff who make the company what it is.

“We like to show our human side. We’re not always just about the bottom line. We’re not just trying to sell, sell, sell,” says Leftwich. The lighter side of social media content can
include anything from a post about a charity Mar-Bal supports to an employee’s work anniversary. Recently, a Mar-Bal employee who had been with the company for 18 years moved to Philadelphia, so the company dedicated several social media posts to acknowledging the employee’s commitment and hard work. Wishing him well publicly, Leftwich says, helps show that Mar-Bal isn’t just an FRP manufacturer – it’s a community of real people who genuinely care about each other.

Hedger adds that in addition to acknowledging current or outgoing employees, social media can also be a powerful tool for recruiting new talent. In an industry with a well-documented workforce dilemma, businesses should leverage social media to attract qualified candidates. “When we have an open position, we post it on our social media accounts,” he says. “And if [people] find that the stuff that you’ve been posting is relevant to them, or they resonate with it, then they’re more likely to go and apply.”

Myers agrees, adding that a critical component of Strongwell’s long-term business strategy is to post content that showcases how Strongwell supports students at all levels, from elementary school to graduate school. Due to Strongwell’s reputation for strong student engagement, the company now frequently receives requests directly from educators to have students tour its facility and learn about pultrusion.

Exposing students to composites manufacturing at a young age can help prepare them for the workforce. “But what that’s also doing is encouraging students who are looking for a career in manufacturing or a career in composites … to come look at Strongwell,” says Myers.

Untapped Opportunities

While the composites industry is starting to make greater strides in social media, there is still plenty of room for growth. Myers believes more companies should allow and encourage their customer-facing staff to be seen publicly on social media. That way, the team can be seen as more competent and capable.

Strongwell has several of its salespeople on LinkedIn who have been trained to generate content that could be interesting to a potential customer, such as case studies and new product
developments. The company’s president and CEO, David Oakley, is an active publisher as well and recently shared his thoughts on the evolution of workforce development in the composites industry.

Another relatively untapped element of social media strategy is live broadcasting. According to Leftwich, Facebook Live and Instagram Live present tremendous opportunities to make a company’s story more dynamic. He says events like the grand opening of Mar-Bal’s new facility in Painesville, Ohio, later this year could be a great starting point for Mar-Bal’s live broadcasts. Moving forward, he thinks live broadcasting could add significant value to a company’s trade show experience and that Mar-Bal may use it in on the show floor at a future event.

Craig says that one aspect of social media that most companies do not even consider is internal use on secure platforms. He believes that private social media has great potential as a tool for workplace collaboration, especially for companies that already tread cautiously when it comes to external communication. Craig believes the next step in workplace innovation is a transition from traditional training portals with “reams of reading” to live social conversations that can inspire new ideas.

“There’s so much opportunity in that area,” Craig says. “A funny thing happens when people learn to share more internally. They tend to share more and learn how to listen more effectively externally.”

One way businesses can start doing more with internal social media is through more interactive onboarding. For example, in sales, a company could task some veteran salespeople to record videos offering advice to new salespeople. After the video, the new employees can comment and create their own response videos. That way, Craig says, the business can get a sense of its complete knowledge bank in a way that encourages interaction with other people.

“Is there a big banner on top of that [video] that says ‘social media?’” says Craig. “No. This is about an HR department saying, ‘Hey, how do we bring people up to speed faster?’ But we’re using some of the concepts and ideas that we’ve learned in external social media and we’re bringing it inside.”

Evan Milberg is communications coordinator for ACMA. E-mail comments to emilberg@acmanet.org.
From pipelines and bridges to maritime and defense systems and beyond, corrosion is a looming menace that threatens assets in nearly every industry sector. In 2016, NACE International released its groundbreaking study, International Measures of Prevention, Application, and Economics of Corrosion Technologies (IMPACT), that analyzed corrosion management practices and estimated the global cost of corrosion at $2.5 trillion, which is equivalent to 3.4 percent of the global gross domestic product (2013).

The benchmarking segment of the study identified practices ranging from absence to full incorporation of corrosion management into an organization’s management system and practices. Even within a single organization, significant differences can exist and often depend on local culture and practices.

In response to the results of this study, the NACE International Institute designed a toolkit for corrosion management professionals seeking to advance their companies’ corrosion management performance. The result was IMPACT PLUS, a program designed to help management in any industry create a corrosion management system (CMS) and balance technical and business solutions by utilizing process classification frameworks, maturity models and benchmarking expertise.

“Soon after we released the IMPACT Study we began to hear from respondents and focus group participants that they needed tools to put the report’s findings into practice,” says Elaine Bowman, NACE past president and IMPACT PLUS project manager. “They couldn’t find any products to facilitate improved practices and asked us to develop a process that would help their companies manage, monitor and improve their corrosion management activities.”

Achieving the maximum benefit in reducing corrosion costs requires more than technology; it requires integrating corrosion decisions and practices within an organizational management system. Simply put, the corrosion practices need to be translated into the language of the broader organization. For significant gains, the organization as a whole must commit to ownership of the CMS and its processes. This means buy-in at all levels within an organization. IMPACT PLUS provides a framework for achieving that buy-in, helping companies realize higher levels of corrosion management performance.

You can access the IMPACT study online at http://impact.nace.org.
The Society for the Advancement of Material and Process Engineering (SAMPE®) is a global professional member society. SAMPE provides information on new materials and processing technology via conferences, exhibitions, technical forums, and publications. As the only technical society encompassing all fields of endeavor in materials and processes, SAMPE provides a unique and valuable network for scientists, engineers, and academicians.

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Taking Certification to the Next Level

Since it began in the late 1990s, ACMA’s Certified Composites Technician (CCT) program has been the gold standard for certification in the composites industry. The program allows composite manufacturers to elevate their standards, enhance production performance, recognize professional expertise and improve their employees’ knowledge of composites. Recently, ACMA expanded CCT to include a new program that allows professionals to become certified in “Advanced Composites” (AC). We sat down with Trevor Gundberg, a member of ACMA’s Education Committee and director of composites engineering at Vectorply Corporation, to learn more about the new program.

CM: Why did ACMA decide to create a new CCT program focused on high-performance composites manufacturing processes?

Gundberg: ACMA is expanding its reach to users of advanced composite materials and processes typically found in the aerospace and other high-performance industries. The reason for using these more detailed and intricate materials and processes is to produce structures as optimally as possible to achieve weight, performance and safety benefits. A composite technician working in these industries is required to have a certain skill and knowledge level before even being assigned to make production parts. High-level training is essential for this market to thrive.

Gundberg: “Advanced composites” isn’t so much about the fiber and resin material. It’s more about the level of engineering, quality and consistency required by the end use customer. For example, you can have an advanced composite E-glass/vinyl ester laminate made via prepreg with an autoclave cure, with that style of process producing parts with tight tolerances and high fiber content.

CM: What does “advanced composites” mean? It is meant to refer to just CFRP, or are there other composite materials, such as basalt and aramid, in the program’s purview?

Gundberg: ACMA members should enroll employees in this new program to broaden their knowledge base of what is required to work with and fabricate successfully with more advanced materials and processes. A highly-trained workforce opens up more opportunities for a company to branch out into different markets and have the confidence to produce the level of quality and consistency required for more demanding applications.

CM: CCT-AC is ACMA’s first certification program that requires demonstration of prerequisite knowledge prior to enrollment. Why did ACMA decide to structure this program differently?

Gundberg: Advanced composite fabrication can be very detailed and intricate. Therefore, you need a high level of skill and knowledge to successfully produce parts. The learning curve is steeper than it is for traditional industrial composite manufacturing processes such as hand lay-up or spray-up, so having background knowledge is critical for those looking to achieve certification.

CM: How can interested enrollees build their body of knowledge prior to participating in the CCT-AC program?

Gundberg: For more serious knowledge building, there are day- to week-long courses available from Abaris Training.
For years, a lack of design codes and standards has been a major barrier to increased adoption of composites in infrastructure. Shane Weyant, president and CEO of Creative Pultrusions, Inc., has called the standards gap our industry’s “threshold problem.”

Last year, ACMA took a major step to address that problem during a workshop at the National Institute of Standards and Technology (NIST) that laid the groundwork for a “roadmapping” document that outlines actions that industry, academia and Congress can take to help engineers and designers build more confidently with composites. Some of the needs identified in the report include aggregation, validation and dissemination of existing standards, development of advanced durability testing and performance modeling, increased education and training.

ACMA moved one step closer to overcoming these barriers on April 18 during a congressional hearing on how creating standards for composites can strengthen American infrastructure. The hearing focused on the benefits of composites and explored NIST’s unique ability to aggregate existing standards and design data for composites and validate them for broader dissemination and use.

During the hearing, Weyant, along with another ACMA member, Dr. Hota GangaRao, Wadsworth Distinguished Professor at Statler College of Engineering at West Virginia University, gave expert testimony that reinforced the need for FRP codes, standards and education. Now that the government understands both the benefits of composites and the need for standards, ACMA can work with Congress to pursue federal resources for a composites standards initiative.

For a complete recap of the hearing, visit http://compositesmanufacturingmagazine.com/category/columns/policy/.
**ACMA Upcoming Events**

ACMA is your key connection with the best and brightest in the industry – people who share your interests and drive for success. Don't miss these upcoming events:

**Global Composites Conference**
**June 27-28, 2018**
**Las Vegas, Nev.**
[http://globalcompositesconference.com](http://globalcompositesconference.com)

Global Composites will explore the industry from a worldwide perspective, looking at high growth areas such as the U.S., China, Brazil and the Middle East. The conference will examine the global supply chain with particular focus on carbon and glass fiber manufacture and resin production. It will also look at emerging technology trends from around the world and highlight global market information.

**Transportation and Defense Policy Fly-In**
**September 25-26, 2018**
**Washington, D.C.**

Join your fellow ACMA members in Washington, D.C., to advocate for the increased use of composites in aerospace, defense and transportation markets. Don't miss this key opportunity for your company to gain inside knowledge and to grow your business relationships with federal agencies. By attending, you gain important insights and potential leads in federally-influenced markets, as well as network directly with agency leadership and your industry peers.

**CAMX**
**October 15-18, 2018**
**Dallas, Texas**
[http://www.thecamx.org](http://www.thecamx.org)

Created by ACMA and SAMPE to connect and advance all aspects of the world's composites and advanced materials communities, CAMX is an all-encompassing event. Regardless of the application – transportation, aerospace, marine, wind energy, software, construction and infrastructure, medical, academics or sports and leisure – CAMX is the must-attend event for products, solutions, networking, and advanced industry thinking.

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For more information on becoming a member of ACMA, email membership@acmanet.org or call 703-525-0511.

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