



THERMOSET

THERMOSETTINGS

YOUR SOURCE FOR **THERMOSET COMPOSITE** TECHNOLOGY & EVENTS

March 2015



TOPCON 2015
Palm Springs, CA

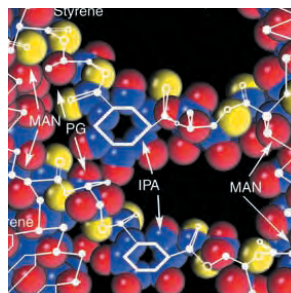
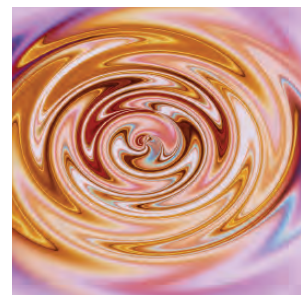


THERMOSETTINGS

brought to you by the SPE Theroset Division.

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Letter from the Editor

Dear Readers,

On behalf of the SPE Thermoset Division, I would like to thank the composites industry for their strong participation and support of the SPE Thermoset Topical Conference (TOPCON) in Palm Springs! A very special thanks to Mr. Alan Gardiner, President & CEO of Jushi Glass, who flew in to participate in the Leadership Panel Discussion and share some exciting developments on the horizon for **Jushi USA**.

Dates have not yet been set for the SPE Thermoset TOPCON 2016, but I can tell you that the group is bringing it to the midwest and rumor is that **Cleveland** is the top contender as the city. Watch your Inbox for further information!

Please remember that we welcome your press releases, company and product announcements and technical submissions. This publication is generated by the SPE Thermoset Division for educational and networking purposes, as well as a platform to share industry developments and announcements. We **welcome** new participants and advertisers. The following pages include some very exciting developments within the industry, some significant changes, and the movements of some key players.

Best Regards,

Shelane Nunnery



*Shelane Nunnery,
Editor of Thermosettings
& President of GV marketing & experiences*

2016 TOPCON RETURNS TO THE MIDWEST

CALL FOR PAPERS!



Deco-Plate Launches Line of Non-Melamine Decorated Plates

Deco-plate is the world's first company to launch a line of decorative plates with custom images, which are microwave-safe, dishwasher-safe, oven-safe and free of formaldehyde, which is present in melamine. Deco-Plate combines state-of-the-art digital imaging with a revolutionary new plastic resin technology to create the world's first on-demand customized dinnerware.

Deco-Plate's product is the result of years of research, and developed by leaders in the digital printing and thermoset resin industry. The material used to mold the products is approved for food contact by the U.S. FDA and by the European Union. All ink dyes used to decorate the products are the highest quality available, and all components used in the manufacturing process are 100% manufactured in the U.S.A. The final product decoration is also performed in the U.S.A.

"We are thrilled to be able to bring such a high quality product to consumers and businesses," commented Bill Rychel, Founder and CEO of Deco-Plate.com. "Our microwave-safe plates are an alternative to the melamine plastic-ware that currently dominates the plastic dinnerware market. The Thermosāf™ resin used in our products addresses the two biggest consumer complaints about melamine – no microwave use and the presence of harmful chemicals."

Having spent over 30 years in the digital printing and imaging business, Rychel and his team took over three years to develop and perfect this intricate 3D imaging process. The process doesn't print on the dinnerware surface, rather the image is infused into the actual material, producing crystal clear images and vivid, permanent colors.

Currently, full sized dinner plates and platters are offered, but other items such as salad plates, bowls, and placemats are in the works to add to the line.

One study which was published in *The Journal of the American*

Medical Association found that people who used hard plastic dishes had elevated levels of melamine in their urine, especially if they heated those dishes in the microwave or used them to serve acidic foods that contain items such as tomatoes, fruits, vinegar, or wine.

Rychel adds, "You may think you are eating a healthy meal at home, but take a look at what you are eating it off of. Not many people stop to think that the chemicals in their dinnerware could be harming them."



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Go to ashland.com/composites to start collaborating with the Ashland team.

Citadel, Quantum Composites to Exhibit at JEC Europe - *Quantum recognized as Rapid Composites' partner for 2015 Innovation Award*



BAY CITY, MI — March 3, 2015 — Quantum Composites, part of Citadel Plastics Holdings, Inc., is exhibiting at next week's JEC Europe Composites Show and Conference, scheduled for March 10 – 12, at Porte de Versailles in Paris. This year marks the 50th meeting of JEC Europe, considered the leading tradeshow and conference for the composites industry worldwide. The Citadel and Quantum Composites exhibit is booth C21, located in Pavilion 7.2.

Quantum Composites' customer Rapid Composites earned the JEC Europe 2015 Innovation Award in the UAV category for its rugged amphibious tri-copter/quad-configurable UAV drone. The drone features three of Quantum's carbon and glass fiber Advanced Molding Compounds®—AMC® 8590, AMC® 8593 and QC 8560.

"We wanted a product that could be man-portable with minimal parts for easy assembly and an unrivaled versatility; rugged enough to require no transit case; capable of carrying a 7 kg maximum payload; and that could perform amphibious take-off and landing as well as fly for more than 30 minutes," said Alan Taylor, president, Rapid Composites. "Quantum Composites and its engineered structural composites materials were instrumental in helping us to achieve our goals."

Quantum is named as Rapid Composites' partner and will feature one of these award-winning drones at its exhibit.



HUBER ENGINEERED MATERIALS

"We are honored to share in Rapid Composites' success," said Wisdom Dzotsi, vice president and general manager, Quantum Composites. "Citadel and Quantum welcome the chance to partner with our customers and deliver the customized solutions they need. Working with Alan and his team has proven to be one such partnership."

The JEC Innovation Awards ceremony to formally honor recipients will be held on Tuesday, March 10, at 5 pm, at the Paris Expo Porte de Versailles, hall 7.3, at the Agora. Exhibitors and visitors are invited to attend.

Mar-Bal Fact:
NAMED ONE OF AMERICA'S FASTEST GROWING PRIVATE COMPANIES
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For the second consecutive year Mar-Bal, Inc. was honored by Inc. magazine as one of the nation's fastest-growing private companies. The list represents the most comprehensive look at the most important segment of the economy — America's independent entrepreneurs. Mar-Bal, Inc. joins LivingSocial, Esible Arrangements, CDW and Lifelock, among other prominent brands featured this year.

We are so proud to be part of the Inc. 5000 list of 2014. Our world-class talent development process, commitment to integrity, to comprehensive one-on-one service for our customers, and ability to experience a three-year rapid growth rate will place us among an elite group of successful companies.

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INDUSTRY NEWS

At the recent SPE Thermoset TOPCON in Palm Springs, CA, there was much buzz in the air regarding 'change'. The industry has undergone a series of changes in recent months / years by way of various acquisitions and the noticeable migration of talent. With the recent Citadel Plastics acquisition of The Composites Group from Dallas, Texas-based Highlander Partners, L.P. (Citadel Plastics itself is held by equity firm HGGC, LLC), the number of BMC / SMC corporations doing business as private equity is making the privately owned and family business a more "rare breed".

Citadel Plastics has a long history of change itself. Formerly Bulk Molding Compounds, Inc. (BMCI), this privately owned 'industry character' sold to Wind Point Partners well after acquiring Cytec in the early 90's and, later, the troubled Rodgers Engineering Corporation in the mid 2000's (also family owned). BMCI sold to Wind Point in 2008 and has continued to expand ever since.

Additional BMC/SMC producing companies on the private equity side include Continental Structural Plastics (CSP) and Haysite, followed by the publicly traded Sumitomo Corporation and Interplastics.



On the other side of this spectrum lie industry leaders Mar-Bal, Incorporated, Industrial Dielectric Corporation, Inc. (IDI), and Plastics Engineering Corporation (PLENCO)...all individually or family owned businesses that continue to expand their global footprint. In addition to these companies is Cuyahoga Plastics and newcomer SMC Composites.

CHANGE is also evident in the world of suppliers. Owens Corning, once a fixture at the SPE Thermoset TOPCON (Thermosets consume hundreds of thousands of pounds of glass per year), was replaced in presence by Jushi Glass at this year's TOPCON. Alan Gardiner, President and COO (Jushi USA & Canada) participated in the exclusive Leadership Panel Discussion with Steven

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March 2015

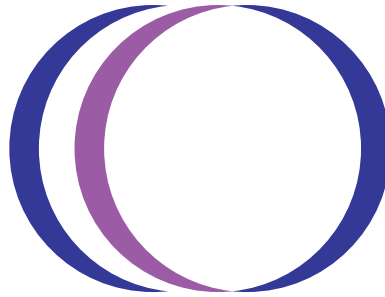
Industry News, continued

Balogh (VP, Mar-Bal, Inc) and Len Nunnery (EVP, Citadel Plastics, Inc). Discussions (moderated by Ron Poff, Director of Marketing & Brands, Mar-Bal) revealed that Jushi USA will be on target to open the doors of their first US based manufacturing facility in 2017 in the southern U.S.

Citadel Acquisition, continued

The TCG acquisition, which marks the second transaction completed by the team of HGGC, Charlesbank and Citadel in the last 12 months, expands Citadel's portfolio of industry-leading capabilities and builds the Company's market presence in attractive end markets such as energy, aerospace and healthcare.

"TCG strategically enhances Citadel's positioning in the market, strengthening the Company's ability to deliver customer solutions across a growing portfolio of product and material capabilities," said Gary Crittenden, HGGC Chairman, who also serves as Chairman of Citadel.



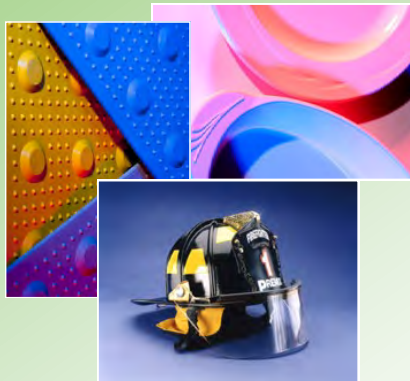
COMPOSITES ONE®

Citadel Plastics' Acquisition of The Composites Group

WEST CHICAGO, IL - Nov. 6, 2014 -Private equity firms HGGC and Charlesbank Capital Partners, with portfolio company Citadel Plastics Holdings, (AKA Citadel Plastics, Inc.), announced the completion of the acquisition of The Composites Group ("TCG"). The deal brings together Citadel, a leading global provider of thermoplastic and engineered composite compounds, with TCG, a top manufacturer of engineered composite compounds.



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Industry News, CONTINUED

"We are excited to bring the collective capabilities of Citadel and TCG to our global customer base, now spanning an even broader set of industries," added Brandon White, Managing Director of Charlesbank, who also serves on the Board of Citadel.

With this acquisition, Citadel has significantly expanded its business, with revenue increasing from approximately \$300 million to approximately \$525 million. Further, the

attractive mix of the acquired businesses, along with the operational excellence displayed by the Citadel team, allow for an increased earnings profile in addition to more avenues for revenue growth.



"Our partners and our team did a great job in recognizing the fit between Citadel and TCG," said Mike Huff, CEO of Citadel. "The shared organizational philosophies and the complementary capabilities and commercial approaches will allow us to quickly identify valuable ways to deliver solutions for our customers."

This will be the eighth plastics-related acquisition for Citadel since 2007 and the 39th overall acquisition since 2008 for HGGC, which has a controlling interest in Citadel.

This acquisition, along with the 2013 acquisition of Lucent Polymers, accelerates

the position of Citadel into a global leader of highly engineered thermoplastic and engineered composite compounds.

Owned by HGGC and Charlesbank Capital Partners, Citadel Plastics Holdings is headquartered in West Chicago, IL and has a global workforce spread across 20 plants in six countries. www.citadelplastics.com

Mar-Bal, Inc. Names Imbrogno to Leadership Position, Invests in Talent that will Drive Continued Innovation and Success

CHAGRIN FALLS, OH--(December 1, 2014) - Mar-Bal, Inc., a Chagrin Falls, Ohio-based leader in the thermoset composite industry and innovative solutions provider, has named a new Director of Materials Engineering, Marc Imbrogno. Mr. Imbrogno will be responsible for all facets of the materials engineering department. He will drive research, materials development, support

MAR-BAL IN THE NEWS _ CONTINUED

program launch implementations and inspire the long-range materials technology pipeline at Mar-Bal. The announcement was made by Scott Balogh, President and CEO of Mar-Bal, Inc. He will report to Balogh.



"We are very excited about Marc's arrival and I am very confident that his vast industry experience combined with his immense composites knowledge will drive a new culture of materials technology development for us at Mar-Bal," stated Scott Balogh. "This talent acquisition is consistent with our strategic plan to be the premier thermoset composites solution provider and will complement our continued growth and success."

Marc brings over twenty years of composite materials engineering experience at The Composites Group, Master Builders Technologies (now BASF) and Glastic Corporation. Most recently, Mr. Imbrogno was the Corporate Director of Market and Product Development at The Composites Group. Marc holds a Bachelor's Degree in Chemistry from the University of Akron. "I am very excited to join Mar-Bal in this role where I know that we can drive new materials technologies in existing markets and drive innovative opportunities in new markets as well," stated Marc Imbrogno. "I look forward to aligning these new material technologies with the other core competencies of Mar-Bal – the integrated model and solid industry reputation of engineering design, formulation, compounding, molding and finishing will only be stronger." Visit: www.mar-bal.com

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Announcing SMC Composites!!

MEXICO CITY - January 12, 2015 - A new SMC & BMC compounding company has started operations in North America. SMC Composites Inc. is headquartered in South Texas and boasts a a beautiful and modern production plant in Mexico City. "We are very pleased to announce the opening of SMC Composites", **said Director General Pablo Zahoul**. He added, "The SMC & BMC Compounding Industry needed a new player in Mexico and South America, and SMC Composites is filling that gap. SMC Composites has its own technology. more than 35 years of experience compounding and molding SMC and BMC in USA, Mexico, Brazil, Europe and China.

SMC COMPOSITES _ CONTINUED

We have developed formulas in a wide range of industries: electric & electronic, automotive, home appliances, sanitary, mining, oil & gas; HVAC, construction, transportation, subways and electric trains, etc." Mr. Zahoul had an extensive professional history at Citadel Plastics (formerly BMCI) and is joined by another former Citadel alum, Michael Loose.

Those seeking BMC and SMC formulations in Mexico and South America may contact SMC Composites (956) 246-4196 / Email: sales@smccomposites.com

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Introducing ZeMC², LLC

What is ZeMC²? - Thus far we have outperformed every molding compound we have come up against and have gained a reputation for **“DOING WHAT CAN’T BE DONE”**. Below is a partial listing of what we have available, BUT, **our forte is developing a product to fit your needs.**

Zeon Resin and ZeMC²BMC - The Relationship

The Zeon Resins are unique and can be modified into a myriad of forms from UV stability, very high Tg and long term heat aging to toughness and flexibility. All use peroxide as the crosslinking agent. The resins contain no styrene or VT and are oxygen inhibited. The way to keep them fresh is to leave the bag open and they must be stored in non-oxygen barrier containers. This unique property gives the BMC excellent shelf life and barrel life for injection. Injection barrel temperatures of 180° F have been used and this changes what is possible with injection molding. Heating of the stuffer may aid with feed and the resin will require a heated mixer. Our normal mixing temperature is 85°C.

Wear

Kevlar/Ceramic Filled

Carver Pump has been using a Kevlar and Ceramic filled BMC to mold wear rings and bushings for their industrial and military pumps for six years. In that time several have been returned for rebuild. Of those the only part of the pump that looked new were the parts molded from our BMC and the shaft under them. <http://www.pump-zone.com/topics/pumps/centrifugal-pumps/near-perfect-new-0512> The email below is an email received from Carver Pump on test results using the Kevlar/ceramic filled BMC molded parts.

Randy:

Carver Pump has been working with a potential new customer who is an OEM to sell them high pressure pumps (Carver Ring Section RS pump) for inclusion in their product. Each ring section in one of these pumps contains multiple wear rings and bushings made of Zeon ZTX 3033 HT molded and machined by R3 Composites. Carver Pump supplied one typical pump to this customer for their evaluation before placing orders. They ran this test pump through performance, endurance and accelerated usage test and returned it to Carver pump for inspection. The customer reported the pump ran beautifully no matter what they through at it. On inspection it appears they ran everything but the kitchen sink through the pump without problems or loss of performance. Metal parts and hose fittings were found lodged inside the pump along with other discarded floor debris. All of the rings and bushings appear to be in good shape with minimal dimensional change except for scars on the working surfaces where the foreign materials worked their way through the tight clearances on the pump during operation.

In addition we have completed machining of 9 impact test samples and have sent off to Stork Technimet for testing.

Aron Rutin

R3 Composites

563-264-0040

Carbon Fiber/Ceramic Filled

An unforeseen problem developed with the Kevlar/Ceramic filled parts in that the Kevlar was attacked by boiler cleaner. To fix this we substituted carbon fiber for the Kevlar and the parts have been on test at carver pump for over a year. I just received word that this test has been completed but they have decided to repeat part of the test using 350°F hot oil instead of room temp water. The disadvantage of the carbon fiber is galvanic corrosion in salt water but this is handled well with the Kevlar. The photo below is the part being tested. It is the backup seal for a Navy pump. It rides behind the

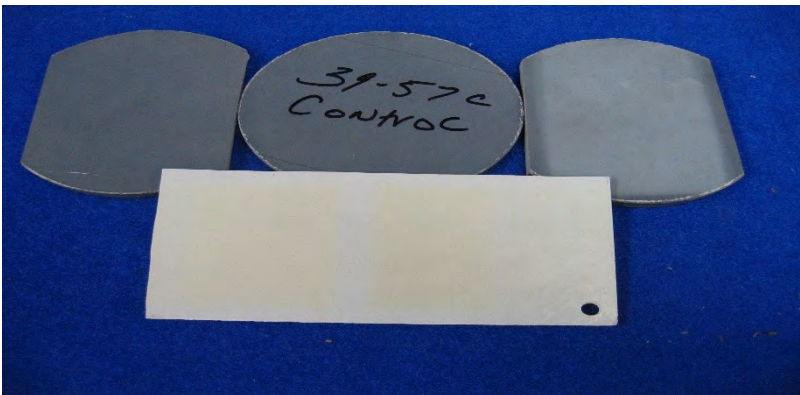
main seal and if the main fails and our backup fails lives are lost. This part reduces the outlet pressure to 30 PSI. Thus far we have passed all the test.



In conversations with DuPont, I was literally told I was not telling the truth about the adhesion we get between the Zeon resin and Kevlar. This is not solely the function of the resin but takes advantage of unique mixing techniques. Our adhesion is like epoxy to glass fibers.

UV Stability

While most of the Zeon resins have excellent UV stability one of the Zeon resins is UV transparent; therefore, the only UV inhibitors needed is to protect the binder on the glass. Our UV enviro test was stopped at 3500 hrs with no surface degradation on the ZeMC² BMC. This resin can be blended with a myriad of fillers for different out door properties. The pigment we chose faded in the accelerated side of the UV test but both samples had no surface degradation or yellowing. The square sample is the UV stable plaque from a competitor which exhibited both pitting and yellowing.



High Tg and Heat Exposure

Neat Zeon resins have extremely high Tg and with the unique fillers and mixing we have been able to raise the Tg of the Molded parts. We know this is against conventional wisdom but we have the data. Standard Tgs run in excess of 240°C and some are over 300°C. One BMC was put up against two competitors in an oven at a continuous 250°C. The test was remain at a steady 250°C and determine the number of hours until 18% weight loss was measured. The competitors failed at 400 hrs and 700 hrs respectively. The ZeMC² part was at 11% Weight Loss when the test was stopped at 4000 hrs. Some of this can be attributed to the lack of styrene or VT.

Through the Carver Pump custom molding we have one high temp BMC on test at Dispatch Oven in an aluminum replacement application. The requirements are 225°C continuous with excursions to 300° C while retaining V0. Word from Carver is we have passed the test. https://www.youtube.com/watch?v=njjHMZK_u38

Low Specific Gravity

We have developed several low specific Gravity (SpG) products. The Zeon resins are slightly higher in SpG at 1.20 as opposed to the 1.10 of most standard resins used in BMC but this is more than made up for by the its' ability to wet out filler. Our lowest SpG with glass is 1.20 but for lower SpG we produced Kevlar filled BMC with a 0.96 SpG and are fairly sure we can go lower. We are searching for chopped coconut fiber as initial test suggest it can be mixed in our process and possibly produce a BMC very low gravity BMC. Another advantage of our mixing is products such as Kevlar and natural fibers no longer absorb moisture after our processing.

Pressure Vessels - ZeMC² BMC was molded and tested at Thermosets, Inc., on a cover designed to withstand 600PSI, where we broke the test fixture without leaking through the part. The bolts holding the cover in place sheared. The main failure mode of all of the other BMC and SMC tested was water being forced through the porosity of the molded part. There are two reasons why the ZeMC² BMC succeeded where all others failed. First is the hermetic seal between the glass and the resin and the other is the shape, strength and hardness of the powder filler. No other BMC or SMC that I have molded has achieved this type of wet out we have proven we provide a BMC that will work as a pressure vessel. The micro photo below demonstrated why the ZeMC² works.



Conductive

There are two types of conductive molding compounds on the market, thermally and electrically conductive and thermally conductive but electrically insulating.

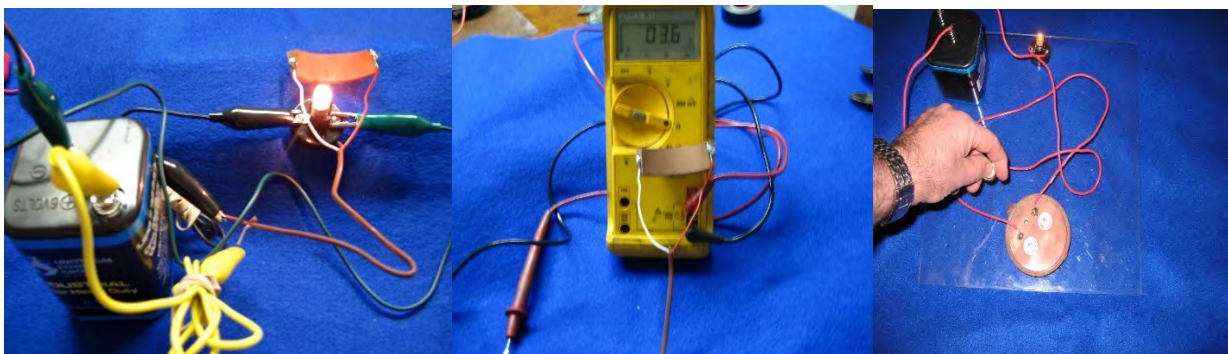
Electrically and Thermally Conductive

The photo below is of a copper filled molded part with a 6 volt battery powering a light bulb through the part. This part is 94% copper filled. The picture parts contain enough copper to solder the wires to them. We also produced an aluminum filled BMC, molded a part that was tested to be used as an iron skirt. It had holes drilled and cartridge heaters inside the molded part; then, subjected to 10,000 cycles to 350°F. We failed because we changed color, which had not been mentioned, but we passed the conductivity and heat test.

Thermally conductive – electrically insulating

Thermoplastic molding compounds are on the market at \$60.00 to \$80.00 per LB. <http://coolpolymers.com/>. I would suggest that we understand the price point and extreme advantage we offer this market with a high temperature thermoset; lower cost, faster cycle, higher T_g and use temperature. ZeMC² has achieved 5.5 Watts/m²K with no measurable electrical conductivity in our initial experiments. This is not a finished product. The fillers are in the neighborhood of \$50.00 to \$100.00 per LB. We have filler in house and we are working on this.

For a heat sink we would suggest starting with an aluminum powder and aluminum fiber filled part. The last fiber we bought was \$2.50 per LB and the powder was about \$7.00 per LB. The trick is a resin that aluminum will not kick over before it can be shipped and molded.



Soldered wires to the plastic parts with the electricity passing through the part having 3.6 ohms of resistance. Please enlarge the photos for better detail.