THERMOSETTING

November 2012

QUARTERLY NEWSLETTER ON **THERMOSET** TECHNOLOGY & EVENTS

www.spethermosets.org

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LETTER FROM THE DIVISION **CHAIR**

Len Nunnery
Division Chair

Dear Thermoset Division Members:

Now that 'election season' is behind us (and our Ohio and Michigan friends can answer their phones without fear once more...), it is time to begin to focus on the building of a 2013 plan. Your Thermoset Division Board of Directors have zeroed in on our 2013 Topical Conference being held in New Orleans, February 26-27. Needless to say, we are getting very excited about our annual meeting and celebration!!

As has become the Thermoset tradition, we have carefully reviewed several facilities in our city of choice and have located, what we believe to be, an outstanding value. The Roosevelt Hotel is a NOLA 'grande dame' that has undergone a recent $170M+ renovation. The result is a rare mix of meticulously reconditioned turn of the century decor incorporated with the contemporary amenities business people have come to expect/require. One full block off of the Quarter, you are in downtown NOLA, but not in 'the fray' (although 'the fray' is close by, if you desire). The location is ideal.

The content of our program will draw qualified decision makers to NOLA. It is our goal

continued

"THE COMPOSITES DIVISION IS A FORMIDABLE PARTNER"

Roosevelt Hotel, New Orleans

to always present new, innovative material to those who 'need to know'. Joining us in our effort to present diverse information to an inquisitive audience is the SPE Composites Division. Highly successful in their efforts

to grow membership and ACCE conference participation, the Composites Division is a formidable partner. In many ways sharing our thermosetting roots, Composites related papers will only compliment ours, building a more robust case for FR thermosets in structural, lightweight, heat resistant, etc. applications. We are still seeking presentations to include in this year's session. I invite you to forward your title and abstract to shelane@gvineme.com for consideration. With the inclusion of the Composites Division, we are expecting a record attendance. This is a great place to deliver your message and network. Join us and get the word out!!

Finally, in a first time effort, several of our key thermoset brands will come together to deliver an "Introduction to Thermosets and Thermoset Processing" seminar. This session will take place at the Roosevelt Hotel on February 25th (see www.spethermosets.org for a complete agenda), the day before the official conference kick off. Join the informative fun as competitors come together as a team to educate and discuss the manufacture, processing, design, tooling and performance associated with thermoset molding materials. Take advantage of this rare opportunity. Get your important questions answered by an objective alliance of material experts ($75/person, students enter free, welcome reception to follow).

Thanks to all who have read through this rather lengthy communication. As is probably evident from my letter, I am very much looking forward to this year's TopCon, visiting with my co-thermoset veterans, newbies and OEMs alike. For those of you who have been to past conferences, conscript others to come. Let them know that we deliver a high quality, value added event that is worth attending. For those of you who have not been to a Thermoset Topical Conference, this is a great year to give it a try! We are going to deliver a world class event.

Best to all as we move toward the Holiday Season!! See you in NOLA!!

Sincerely Yours,

Len Nunnery
Chair, SPE Thermoset Division
Vice President, Sales and Marketing
Bulk Molding Compounds, Incorporated

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NEAR PERFECT NEW CENTRIFUGAL PUMP WEAR RINGS AND BUSHINGS

New resin and Kevlar bulk molding compound adds strength to pump wear parts

Overcoming wear has vexed centrifugal pump manufacturers for years

For years, the pump industry has had problems with centrifugal pumps. The continual wear of rings and bushings has been an issue. Despite many efforts to improve life and quality of these products, none have measured up to expectations. Now new wear rings and bushings can be molded and machined from proprietary bulk molding compounds produced by a molding producer in Salisbury, N.C., that can improve these components.

Centrifugal pumps' high-speed shafts rotate the impellers. The impellers force liquid

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from a supply source through the pump to the user. The housing of the pump must remain stationary. The bushing guides and supports the high-speed/high-torque shaft at the interface between it and the stationary housing.

Until recently, the friction at this interface has caused either the shaft or the bushing to wear, and the pump became unbalanced and rapidly lost efficiency. Replacing either the shaft or the bushing because of this wear is the main problem and cost in keeping these pumps in operation.

Centrifugal Pump History

Overcoming wear has vexed centrifugal pump manufacturers for years. In early days both the pump shaft and bushings were made of cast iron. They were replaced with brass or bronze to increase the service life of the pump. However, seawater, boiler chemicals, unfriendly environmental conditions as well as other contaminants attacked these metals and caused pump failure.

Converting the shaft and housing to stainless steel solved the corrosion problem for these components, but the material did not work well as a bushing. Because of the relatively higher cost of the pump shaft and housing versus the cost of the bushing, manufacturers and the industry chose to make the shafts and housings of harder stainless steel and sacrifice the bushings to wear. Therefore, the service life of a centrifugal pump depends on, and is limited by, the life of the bushings that interface with the moving and the stationary parts of the pump.

Copper-based metal bushings, when used in conjunction with stainless steel, are a problem due to the higher relative coefficient of thermal expansion (CTE) of the copper-based materials. As the softer metal expands, the gap between the shaft and bushing widens, inducing vibration. When cool, the gap shrinks onto the shaft, and the wear increases.

molded and machined Kevlar-based wear rings

Non-metallic bushings, usually made of thermoplastics, have the necessary toughness but not the dimensional stability required for a pump bushing. All thermoplastic-based bushings, by definition, can be re-melted. As a result, as the temperature inside the pump rises, thermoplastics begin to melt and lose their dimensional stability. Adding glass fiber and other hard fillers in an attempt to achieve the needed dimensional stability causes excessive shaft wear because these materials are harder than the stainless steel that makes up the shaft.

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Other attempted nonmetallic solutions include:

- Impregnated graphite carbon—this material produces good wear characteristics, CTE and chemical resistance, but is extremely delicate and easily damaged during assembly. In addition, any foreign matter in the liquid damages the bushing when in operation.
- Glass filled Teflon (TFE) fluorocarbon—this material has excellent chemical resistance and wear resistance, but has 10 times the CTE of stainless. After several heating and cooling cycles the bushings simply "fall out." The bushings' stress relieves, and the force of the liquid pushes it out of the pump.
- Phenolic impregnated linen—being a thermoset plastic, this material has natural hardness and low CTE. The material meets all the requirements for a pump bushing, except that it is not naturally lubricious and wears quickly. Neither the linen filler nor the resin is sufficiently wear resistant.
- Wear-resistant, glass-filled bulk molding compound (BMC)—the glass and other fillers that provide hardness and wear resistance to the bushing will abrade the shaft.

The search for materials was started in 2008 to satisfy a wish list of pump wear components with wide reaching and ambitious targets. The goals were to develop material that can stand up to the centrifugal pump environment in all applications without wearing either the bushing or the shaft.

This component should:

- Be machined to a smooth surface so tight tolerances can be obtained around the pump shaft over a wide and changing temperature range to eliminate vibration
- Be tough and hard so that foreign material inadvertently carried in the liquid does not damage the bushing
- Provide excellent chemical resistance so that it is not attacked by what is purposely or inadvertently pumped with the liquid
- Be soft enough not to wear the shaft but tough enough to withstand press fit assembly
- Offer good adhesion between the resin and fibers so that the hold is stronger, therefore leaving a smooth and dimensionally accurate machined surface
- Have low water absorption so that it does not absorb liquids, which could cause expansion or contraction

Simply stated, the ideal bushing should be molded from a material that is tough, soft, hard, flexible, stiff, thermally-stable and easily-machined. It should not absorb liquids and must be cost effective.

The New Solution

The consulting-producer team had considerable experience with thermoset molding compounds. Thermoset's natural hardness and chemical resistance appeared desirable in a pump bushing. However, these compounds require fibers, usually glass, to give them strength and toughness. Glass is harder than the metal of the shaft and, as a result, causes shaft wear.

To overcome this problem, they used Kevlar to impart necessary strength to the molded part without the abrasive qualities of glass. Kevlar was not previously used because, in the words of a project engineer, "Nothing sticks to Kevlar." However, the molding producer had recently developed a resin that stuck to Teflon, so the consultant decided to try it with Kevlar.

Drawbacks of Kevlar

Without adhesion, the fiber reinforcement does not add much to the strength of the part. Without adhesion, when machining parts, the machined surface is fuzzy, therefore eliminating the possibility of holding tolerances.

When using any fiber-filled plastics to mold parts, two separate forces determine the strength of the molded part.

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The first is the strength of the fiber and the second is the adhesion of the plastic to the fiber.

The ideal condition is for the adhesive force between the plastic and the fiber to be greater than the strength of the fiber, or as great as it can be. When a good adhesive force is achieved, the part can be machined to a smooth surface without protruding (fuzzy) fibers.

The second major drawback of using Kevlar filled BMC as a bushing material is that Kevlar absorbs 7 percent moisture at ambient temperature. This causes problems with Kevlar "bullet proof" vests.

As the Kevlar absorbs moisture, the vest becomes less effective. A molded and machined part used inside a high-pressure pump that absorbs liquid will quickly become ineffective.

The New Resin Eliminates the Problems

The new resin, when used to manufacture a Kevlar filled BMC compound, solves both these problems. Molding a near-net shape part and machining to size produces a bushing that meets all the requirements listed in the section above.

In addition, it absorbs water at a rate about the same as a glass-filled epoxy, which is the bench mark for water absorption in a fiber-filled molded part. In other words, water absorption is not a problem.

Parts with the new BMC were molded, machined and assembled into a pump for testing. The molded part had a 5-inch outside diameter (OD) and 0.1-inch wall thickness. When quality control professionals checked the part, they found that the OD was 0.010 inch oversize, or 0.010 inch larger than the hole in the steel part into which it was to be pressed.

Rather than re-machining, the plastic part was positioned above the hole in the stainless steel pump housing, and the two parts were placed into a 20 ton press. Three steel plates were placed on top of the two parts to be assembled. As the press applied pressure, a crack like a gunshot was heard.

"Well, there goes your plastic part." an engineer commented. After disassembly the stack showed that one of the steel plates had cracked, leaving the molded part perfectly seated. That was a 0.010-inch compressive press fit.

Despite skepticism, pump bushings produced with Kevlar-based thermoset material meet all the requirements for pump wear parts: The near-perfect bushing's material is tough, soft, hard, flexible, stiff, thermally stable, easily machined, non-absorbent and cost effective.

Courtesy of Pumps & Systems , *May 2012*

Author Bio:

Randy Lewis of P.R. Lewis Consulting, LLC, in Lake Wylie, S.C. is an industrial engineer who has spent almost 40 years in every area of the plastics molding and compounding industry. He works with Zeon Technologies to invent new thermoset molding compounds for applications that "Can't be done," with wear resistance, chemical resistance, and high temperature being the focus. Lewis can be reached at lewispr@earthlink.net. *Special thanks to Mike Burnet, Zeon Technologies, Inc., for editing assistance.*

BMC TD4204 **ENCAPSULATES** HEV/EV POSITION SENSORS

Sumida Corporation has recently collaborated with Bulk Molding Compound's (BMCI) Hamburg Germany team to produce a new electric motor, rotor position sensor that is fully encapsulated by BMCI's low pressure molding compound, BMC TD4204. BMC TD4204 encapsulation provides a water-tight enclosure, that delivers long-term chemical resistance to a wide array of automotive fluids. Position sensors require a high degree of dimensional precision to enable recognition accuracy, while providing flexibility in motor design/ assembly placement. This eddy current based device is specifically designed to work with hybrid electric

synchronous motor propulsion systems and delivers key advantages in the associated/harsh environments.

BMC TD4204 offers an encapsulation solution for sensitive electronics and printed circuit boards (PCBs). The process causes no damage during injection or transfer over-molding while the material effectively fills small detail in the circuit board design. Molding directly over Sumida's proprietary PCB significantly reduces costs and cycle time by eliminating a traditional two step molding/potting process. BMC TD4204's ultra-low shrink performance prevents stress to the circuit board during post mold cooling. The material's unique CLTE and high resistance to moisture absorption ensure invariable seal & fit over an operational temperature range of -40 to 150°C. BMC TD4204 also successfully survives stringent vibration and temperature shock testing.

BMC TD4204 is a cost effective injection/transfer moldable encapsulate capable of yielding durable and dimensionally stable sealed housings for sensitive electronic devices that must function in automotive/electrical environments.

Story courtesy of Bulk Molding Compounds, Inc. www.bulkmolding.com Photo courtesy of Sumida, www.sumida.com.

I recently attended the SPE Automotive Topcon in Troy, Michigan. My job, as Membership Chair, was to try to encourage attendees to join SPE and the Thermoset Division.

It was a robust conference which was a pleasure to attend. Among the companies displaying their wares were many old friends and the opportunity to make new ones.

That's always a pleasure. Among the new friends were two young men who are recent hires of Dieffenbacher, a German company that sees the value in developing engineering employees by bringing them to key technical conferences. They are Trevor Frazier from the Alpharetta, Georgia office and Christian Fais of the Windsor, Ontario office.

I asked them if they were members of SPE and they said "No".

That gave me a chance to explain that networking was critical to their professional advancement and gave them appropriate examples from my past. I suggested that they join SPE and become active if they wished to achieve maximum acceptance by their peers. I also suggested that they join other professional organizations as befitted their developing interests. And yes, I gave them an SPE registration brochure.

My comments were received with enthusiasm, as they found an old timer who truly cared about their professional success.

Moral of this story: Wherever you are, contact young "wanna be" professionals. We have a lot to offer each other.

Jim Cunningham
SPE Thermoset Division
Membership Chair.

INDUSTRY BULLETIN BOARD

MAR-BAL ANNOUNCES LEADERSHIP APPOINTMENT

Mar-Bal, Inc. Announces Leadership Appointment - Chagrin Falls, Ohio-based thermoset composite industry and innovative solutions provider has named a new Director of Operations, Vince Profeta. In this newly created role Mr. Profeta will be responsible for all manufacturing, operations and plant support activities. He will also drive operational excellence and program launch implementations.

VINCE PROFETA

Vince brings over twenty years of Engineering And Program Management experience at Ferro Corporation, Premix, Inc. and Danaher Corporation. Most recently, Mr. Profeta was the North American Product Manager and also held a position of North American Sales Manager at Ferro Corporation within the plastics division. He holds a Bachelor's Degree in Mechanical Engineering from Cleveland State University

The SPE Thermoset Division welcomes industry related news, press releases and articles regarding new technology. Please forward any material you would like considered for inclusion in our newsletter to Grapevine Marketing & Experiences: shelane@gvineme.com.

BMCI ANNOUNCES MARKET DEVELOPMENT MANAGER

BMCI Announces Market Development Manager - West Chicago, Illinois-based thermoset composite manufacturer, Bulk Molding Compounds, Inc. (BMCI), welcomed Kristina Morgan to their Market Development Team as a Market Development Manager. In this function, her primary objection will be locating new market spaces for BMCI products to penetrate. Kristina was most recently with Ticona Polymers for nearly 9 years, specializing in marketing and sales, with a focus on developing consumer markets. Kristina holds a BA from John Carroll University in Cleveland and an MA from Bowling Green State University.

KRISTINA MORGAN

INDUSTRY BULLETIN BOARD

EMPLOYMENT OPPORTUNITIES

Regional Sales Manager for a leading custom molder of thermosets, thermoplastics and engineered composites. All U.S. territories are being considered for this position.

About the Position - We invite a highly motivated plastics professional who is interested in a long term career path to join our U.S. Sales Team. While technical skills are important, it is enthusiasm and personality that make for a successful career at this company. You will be responsible for the overall territorial sales and management within your assigned territory. As a sales leader, you will manage relationships with potential and existing customers, develop strategies and objectives to increase the sales of the company overall.

Desired Skills & Experience

•Bachelor's Degree

•2-3 years of sales experience in plastic or plastics molding industry

•Minimum two years management background

•Team oriented attitude with ability to work well independently

•Negotiation skills

•Ability to travel to all customer plants

•Fluent with Microsoft Word, Excel and Powerpoint

•Ability to understand the manufacturing processes and identify alternative solutions

Company offers a competitive compensation and benefits package and excellent opportunities for growth and advancement. Qualified individuals please send resume to: Plasteeka@gmail.com

MINUTES FROM 11/12/12 BOD TELECONFERENCE

Minutes:

- The meeting was brought to order at 4:10 EST.
- In attendance via conference call were Rick Faulk, Randy Lewis, Kevin Sweeney, Len Nunnery and Shelane Nunnery.
- Len Nunnery began the discussion by outlining Grapevine Marketing's (GVM) thermoset awareness campaign overview and proposal. Most complete in its scope, Len mentioned building a standard 'media foundation' before going into the field with the full compliment of GVM's recommendations. Included in the elements of this 'foundation' were:
    - Additional web content-specifically technical content:
        - Library with material composition, properties and procession techniques outlined
        - A reference section that includes application case studies.
        - A reference section that includes trouble shooting for processors.
        - A reference section for tooling and tooling tips.

**(Grapevine to format/facelift content submissions so there is a degree of uniformity on the site. Additional expansion of the site (for a 'library section') will require financial resource from the Division in addition to GVM's quotation. Investment in site expansion will be ~$4,000.

- Press release establishing our mission and goals:

continued

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MINUTES FROM 11/12/12 BOD TELECONFERENCE - *CONTINUED*

- A collaboration of industry leaders interested in promoting the applied uses and value proposition associated with our products and services using a multi-media approach (GVM to cover six press releases as a part of their retainer).
  •** Would like to have this work completed in time for the TopCon.

- Division literature/handout:
  - A trifold handout that further outlines our SPE mission, thermoset overview and end-use performance highlights.
  - Trifold to be sent out in a mass mailer to draw attention to the division/what we are doing and copies produced for use at collaborative trade shows and educational events.
  - Printing a postage costs will be approximately $6,000.
    •** Would like to have this work completed in time for the TopCon.

- Pop-up booth/commercial stand:
  - A commercial stand for 10' X 10' trade show space (unless the group would like something larger).
  - Space can be used as a backdrop at our conferences and educational events.
  - Pop-up graphics can be customized relative to the event theme.
  - Stand cost should be approximately $4,500 (with a single set of SPE Thermoset Division graphics).
    *•** Would like to have this work completed in time for the TopCon.*

- L. Nunnery cited specific trade show recommendations from the GVM proposal (for the Division to attend as a collaborative marketing team) including:
  - The Rubber Show
  - The Die Cast Show
  - Molding 2013

- L. Nunnery also reiterated the GVM concept of purchasing industry focused emailing lists for use in commercially specific spam campaigns. All spams linked back to the updated SPE web site.

- Finally, Rick Faulk introduced the concept of choosing a university per calendar quarter for the division to visit and deliver its 'Introduction to Thermosets Materials and Processing' session. The first university suggested was UW, Madison as the Division has an excellent relationship with Department Head and Prof. Timothy Osswald and believe he may be willing to work with us to establish a program kickoff date.

- The meeting was adjourned at 4:40PM EST. The Division is scheduled to meet again at 4:00 PM EST on Monday, November 19th.