

## **PolymerPlace Notes**

*A plastics technology newsletter*

By Margaret Baumann, G.H. Associates

**Volume 3**

**September 2002**

**800.207.7659**

### **Featured Story --**

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- ❖ Bio-renewable and energy saving technologies

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- ❖ Tough, light, and long-lasting carbon fiber is now being used in a new generation of orthotic shoe inserts Optical Media

#### **Business Machines and Telecommunications**

- ❖ Manufacturers are gaining interest in a thermoformed thin film shield that protects against electromagnetic interference and limits radiation emissions.

### **Polymer Material Developments**

- ❖ Greene, Tweed & Co., manufacturer of specialty seals and high precision engineered plastic components, has specified Victrex® PEEK-HT™ high temperature polymer for its 8-pin SealConnect® connector
- ❖ Ticona, the technical polymers business of Celanese AG, has created a new, impact-modified polyphenylene sulfide, Fortron® PPS SKX-382, with unusual ductility and flexibility.

### **Process Developments**

- ❖ Bayer Corp. has developed new technology that infuses the surface of thermoplastic parts with color

### **What's new at Polymerplace**

One thing is certain. The manufacturing sector is undergoing a major shift that has been accelerated by the recession and the woes of the U.S. stock market. More and more manufacturing is moving out of North America and Europe to the Far East and South America. Those who have survived through this protracted period need to work smarter and more collaboratively. We continue to offer our newsletter as a snapshot of product/ technologies that we believe are forward-thinking in the plastics materials, processing and design interface. In a small way perhaps we can contribute an idea or insight that might be of help to you. Polymerplace.com also offers a "post a technical question" through our website, [www.polymerplace.com](http://www.polymerplace.com). We have responded to all the questions we have received and hopefully have been of some help to those who have taken the time to e-mail us. In responding

to these questions we have often referred the individual to a supplier of a product or service in the Plastics industry.

Put us on your e-mail list when you want the product development community to know more about your product or service...send to mbaumann@polymerplace.com.

## **Management -- Plastics Encounter in Indianapolis**

We recently attended the Plastics Encounter in Indianapolis. The first day was a program on **Management in the Plastics Industry** and was co-sponsored by the Mid-America Plastics Partners. The design day program was co-sponsored with the IDSA (Industrial Designers Society of America) and Product Design and Development Division of the Society of Plastics Engineers. Products were on display that were recipients of the Structural Plastics Division of the Society of Plastics Engineers and the Design Excellence awards from IDSA.

Scott Murray, managing director of Madison Capital Partners gave an interesting presentation on the importance of lean manufacturing and managing cash flow. Madison Capital Partners is an investment banking firm that has been making acquisitions in the industrial machines and equipment segment of the plastics industry. Among their acquisitions in plastics: tubing and gasket manufacturer, Holm Industries, thermoforming machine maker Brown Machine LLC, plastic equipment re-manufacturer, Epcos and auxiliary and test equipment manufacturer, Dynisco LLC.

His key point was that managing cash flow has a greater impact on a company's ability to stay profitable than focusing on net income. Each dollar of debt reduction translates into a dollar of increased equity.

Actively managing cash flow provides cash for growth - new equipment, employees and lowers cycle time.

The following areas are those that Madison Capital Partners monitors all of the time:

- ✓ Receiving of material
- ✓ Lean manufacturing of the product
- ✓ Collecting Receivables
- ✓ Inventory and work in process
- ✓ Paying suppliers

The Design Day program had some very good presentations and panel discussions. We attended those headed up by principal Product designers from Appliance, Automotive and Consumer Electronics.

The keynote speaker, Lou Lenzi of Thomson Multimedia, openly shared a very insightful presentation on how Thomson built their worldwide base for consumer electronics products and electronic media. Thomson has been aggressive in their global presence having acquired the RCA and GE branded electronics businesses. Since Lou had been Thomson's VP of Design, his key message was that you can globally design but not design globally. To address this conclusion, Thomson has developed centers of excellence rather than centralized design. These groups have global responsibility but in a specific area of competency.

- ❖ Indianapolis- Digital Satellite, HDTV
- ❖ Paris- Life style, Personal products
- ❖ Hong Kong- Audio, communication products

Thomson depends heavily on retail distribution: Wal-Mart, Auchan (Japan), Media Markt (Germany), Best Buy, Meyer.

The global market has not created a common culture or consumer behavior - and there lies the opportunity. His key message was focus on innovation- this delivers true competitive advantage requiring a new thought process. Don't fall into common traps.

**Trap#1**- Providing solutions that some cultures don't want

**Trap#2**-Competing simply on mechanical skill or common practice leads to a price war that is that is difficult to win

Takeaway:

- ❖ Avoid Traps
- ❖ Innovate
- ❖ Take the offensive

## **Bio-renewable and energy saving technologies**

When the chairman of Ford Motor Co., Bill Ford decided to rebuild the company's historic River Rouge complex outside Detroit, destroyed by an explosion in 1999, he decided to make the new plant as environmentally friendly as possible. The result, which is scheduled to open next year, will be the greenest car factory ever. Thirty-five skylights will illuminate the 2.1 million-sq.-ft. area to save money on lighting. Sedum, an ivy-like plant, will cover the roof and help insulate the building while absorbing storm water, providing a natural habitat-- and saving the company an estimated \$35 million in construction costs and much more from lower energy use.

As public concern about the environment grows, there is an increasing acceptance in executive suites that industrial reform can be good for the environment and good for profits. Efficient use of energy and materials and a reduction in waste can help the bottom line. Everything that is recycled reduces the expense of buying raw materials.

The following are examples of this initiative in the materials and plastics industries:

BASF Corp.'s carpet- fiber unit has developed a recyclable nylon that makes it possible to reconstitute old carpets into new.

Swiss semiconductor maker ST Microelectronics has saved more than \$60 million by cutting its energy usage and more than \$20 million by reducing water consumption below baselines set in 1994. The company's leadership issued environmental goals and empowered its divisions to become creative. The responses included using solar power and finding ways to recycle water.

Cargill Dow, a joint venture by the agricultural giant (Cargill) and the chemical company (Dow), is manufacturing biodegradable and recyclable plastics from corn sugars. As we have written in our newsletter before, the company already makes environmentally friendly packaging for Sony products and pillow stuffing for Pacific Coast Feather. Cargill Dow opened a \$300 million facility in Blair, Neb., last year that makes material for packaging film and textile fiber.

G.I.Plastek, custom molders of diverse plastic products, has announced that a feedstock resin developed using soybeans is now being molded to produce John Deere Harvester Combine Access Door. G.I.Plastek, in cooperation with John Deere and Bayer Corporation, is molding the John Deere Harvester Combine Access Door weighing 35 lbs. and 52" x 28". 14 lbs. of soybeans are consumed per each Access Door. There are 60 lbs in a bushel of soybeans. The parts are reaction injection-molded At GI Plastek's Newburyport, MA facility and replace components previously molded with a Baydur® RIM system derived from standard petrochemical sources. The new composite is extremely strong, but weighs 25 percent less than steel.

Branded as HarvestForm™ by John Deere, the entire line of John Deere Harvester Works combines, beginning with the 2002 model year, will feature the new composite in body panels.

The University of Delaware, Iowa, Missouri, Indiana, Michigan and Pittsburgh State University in Kansas are currently researching ways to make plastics from bio-based materials and are focusing on making plastics from soybean oil. The United Soybean Board (USB) has identified urethane foams, urethane binders and agricultural film as three market segments offering the best opportunity for soy plastics. Markets include insulation for buildings, appliances, industrial tanks and pipes.

For more information on Case Magnum contact Rick Lonardo: GI Plastek Telephone: 978-462-9006, email: [rleonardo@giplastek.com](mailto:rleonardo@giplastek.com) or world wide web: [www.giplastek.com](http://www.giplastek.com).

Polymerplace believes that with the cooperation of industry there will be many applications for bio-renewable and energy saving technologies in the near future. Taking all things into consideration, it is the sensible thing to do...

*At the end of the newsletter we have listed some books that discuss how companies can be environmentally conscious as well as develop a business model that can make their company more profitable.*

## **Polymer End Markets**

### **Medical**

Orthotics are designed to correct and treat many ailments of the foot and lower limb, including heel pain, knee problems, and shin splints. Prescription orthotics are traditionally made from various density plastics and closed cell foams, and they offer a cost effective and durable solution to most problems.

Tough, light, and long-lasting carbon fiber is now being used in a new generation of orthotic shoe inserts, with real advantages for athletes, especially those where size and weight are critical. An acrylic and carbon fiber composite is providing orthotics that are super-light, strong and thin. The carbon fiber orthotics will be of particular use to athletes, including cyclists who require efficient transfer of power with minimum size and weight, and because they are about one third the weight and much thinner they will also be more suitable for use in men's and women's fashion shoes.

The orthotics are created from molds taken of the individual's foot, and modified to provide the corrective support where needed. The carbon fiber composite provides greater control, as well as being extremely durable.

### **Business Machines and Telecommunications**

Manufacturers are gaining interest in a thermoformed thin film shield that protects against electromagnetic interference and limits radiation emissions.

Shielding For Electronics Inc. of Sunnyvale CA forms the shields into a variety of shapes to protect devices from EMI and radio-frequency interference. A division of the company applies aluminum vacuum metallization on one or both sides of a thin, thermoformed film of polycarbonate, PVC or glycol-modified PET. The product approach is called Form/Met. Patent applications are pending.

This approach can eliminate the need for in-house or contract part painting or plating. Shielding for Electronics believes that the approach can work in about 95 % of EMI/RFI applications. . Optional applications include conformal shields inside a plastic housing or over a printed circuit board.

Form/Met can potentially eliminate gaskets and is more consistent than spray paint. Currently four cell phone manufacturers and one contract manufacturer, Flextronics, is looking at Form/Met. It shifts the responsibility for EMI solutions to circuit-board designers upfront, rather than mechanical engineers in later development stages which could save both time and money.

Shielding for Electronics acquired the original patent and Vacuum Plating in Mauston Wisconsin in May 2000 and created separate business units for decorative metallization services and EMI shielding. The Sunnyvale site has design capabilities, prototype laboratories for tooling, thermoforming and testing

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## Polymer Material Developments

Greene, Tweed & Co., manufacturer of specialty seals and high precision engineered plastic components, has specified Victrex® PEEK-HT™ high temperature polymer for its 8-pin SealConnect® connector. Specifically developed for use in oilfield exploration and production, the connectors are designed to withstand prolonged exposure to an applied pressure of 138 MPa at 204°C. Short-term exposure to pressures of 172 MPa at 260°C is also possible.

Fully tested and proven in down hole and sub sea environments, PEEK- HT™ polymer was selected as it provides long-term product reliability following exposure to these extremes of temperature and pressure, combined with cost-effective, high precision reproducibility.

While offering all of the high performance characteristics of natural Victrex® PEEK™ polymer, PEEK-HT™ polymer has been specifically developed to provide superior high temperature performance. With a glass transition temperature of 157°C and a melting temperature of 374°C, it retains mechanical and physical properties at temperatures that are up to 30°C higher than traditional PEEK™ polymer. It also delivers up to three times the wear resistance, substantially higher tensile strength and flexural modulus at 250°C and long-term creep and fatigue resistance over a wide temperature range.

The SealConnect connector is designed to operate within a very tight space. Compared with conventional hermetic connectors, which use glass, ceramic and metal parts, this state-of-the-art connector features a single PEEK-HT™ polymer component which is injection molded and machined to meet precise tolerances. This manufacturing process has eliminated product failure caused by traditional assembly and secondary operations and provides cost-effective opportunities for design modification, tooling and prototyping.

For more information on Victrex PEEK go to [www.Victrex.com](http://www.Victrex.com).

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Ticona, the technical polymers business of Celanese AG, has created a new, impact-modified polyphenylene sulfide, Fortron® PPS SKX-382, with unusual ductility and flexibility. It has high melt strength, so it can be extruded or blow molded as a monolayer or as a part of multilayer structures, operations not typically associated with this polymer.

Fortron PPS SKX-382 has excellent adhesion to nylons and polyolefins. It also has a tensile elongation at break of 25 percent and a flexural modulus of 2,140 MPa compared to about 3 percent and 3,750 MPa for unfilled PPS, respectively. Its notched Izod impact strength is 40 kJ/m<sup>2</sup> versus 3.5 kJ/m<sup>2</sup> for unfilled Fortron PPS.

The new Fortron PPS is the first of a family of grades with a new, proprietary impact modifier. The unfilled material is a good candidate for use in tubing, piping, and film where high-temperature resistance, impact strength and flexibility are essential. Compounding Fortron PPS SKX-382 with glass fiber increases its modulus and melting point, so it can be selected for use in molded shapes such as bearings, auto fuel rails and couplings, and other components where impact is a factor.

The new grade retains much of the traditional benefits of Fortron® PPS, including high chemical resistance and low fuel permeation. A 5-mil film of Fortron PPS SKX-382, for example, has a gasoline (CE10) permeability rate of 0.121 g mm/m<sup>2</sup>/day, which is far less than that of nylon, polyketone, and other resins often used with gasoline and other fuels.

For information contact: Ed Hallahan-Ticona- Phone:-908-598-4209 or E-mail:

[Ed.Hallahan@ticona.com](mailto:Ed.Hallahan@ticona.com).

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## Processing Advances

Bayer Corp. has developed new technology that infuses the surface of thermoplastic parts with color. Called Aura, this patent-pending process represents a big departure from traditional molded-in color and could change the economics of coloring short-run, made-to-order, and

mass-customized products. The process starts with a clear or white part and the color is added downstream of the molding press.

Aura's infusion process takes place in a heat bath containing an aqueous dispersion of dye and a proprietary, polymer compatible surfactant. The heat opens up the polymer matrix, allowing the surfactant to transport the color into the plastic. Depending on the type of plastic and the process conditions, Aura colors penetrate up to 10 mils deep. Parts stay submerged for anywhere for up to five minutes with the time in the bath, the processing temperature, and the type of thermoplastic plastic determining the final hue.

Bayer researchers have successfully applied the new process to the company's core engineering plastics, including PC, PC/ABS, nylon, and TPU and for parts as small as screws and as big as 4x8-ft sheets.

The properties of the Aura part are essentially the same as the white or clear part. This is because the colorant remains close to the surface and makes up a minor portion of the surface compared to the much larger polymer molecules. Aura parts actually absorb the color thus the dimensions of the part don't change as they could with a thick coating.

Parts colored by the Aura process can achieve a variety of aesthetic looks --including light diffused and opaque-that closely mirror what's available with traditional molded-in color.

Aura-colored components can be easily color-matched to existing products. The process will also allow adding a splash of color to existing products without having to modify the tooling or molding machines. The process can also create a two-tone effect by selectively etching away some of the applied color. And it can be used as part of process to create hidden graphics that become visible only when the part is back-lighted.

Aura could reduce the cost of color dramatically by eliminating those costs associated with inventory and frequent molding machine changeovers. These in-process costs typically stand out at low production volumes.

Likely applications for Aura span a range of components in which short life cycles or a desire to mass customize will keep production volumes of any given color relatively low --even though total production volumes could be in the thousands. Bayer suggests that consumer electronics, housewares, electronics, and automotive interiors as good candidates for Aura.

It may also see use in cosmetic prototyping. Designers can dip a part to create a new look and the process is also reversible. Parts that have gotten too dark can be lightened with a second trip to the bath.

Parts that have high production volumes and unchanging color needs would be more economically served by pre-compounded resins. Aura cannot yet impart metameric or metallic effects-though the latter can still be accomplished by compounding the metal flakes in the base resin. The Aura process also currently does not have FDA approval for food contact uses.

Bayer researchers claim that they are working on Aura to do more than color parts in the future. For example they would like to add functional attributes to plastic parts citing scratch resistance as a likely candidate.

For more information send an e-mail to [fantasia@bayer.com](mailto:fantasia@bayer.com).

## **Recommended Reading:**

*Cradle to Cradle*- William McDonough and Michael Braungart- discusses a world without waste, a world in which all materials are recycled.

*Natural Capitalism*, Peter Hawken (founder of gardening supplier Smith and Hawken), Amory Lovins and L. Hunter Lovins- makes a strong case that natural resources should be valued a part of our capital base as factories and machines.

*Biomimicry*, Janine Benyus- encourages companies to look to nature for possible design techniques.

*The New Economy of Nature*-Gretchen C. Daily and Katherine Ellison- tells the stories of innovators trying to “make conservation profitable.

Note: Connect to Amazon.com through [www.Polymerplace.com](http://www.Polymerplace.com) to order these books.

**References:** The stories in *PolymerPlace Notes* come from a variety of sources including Company Press Releases, Interviews, and trade publications, e.g. *Plastics News* and newswires.

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September 2002