

RE:Invent



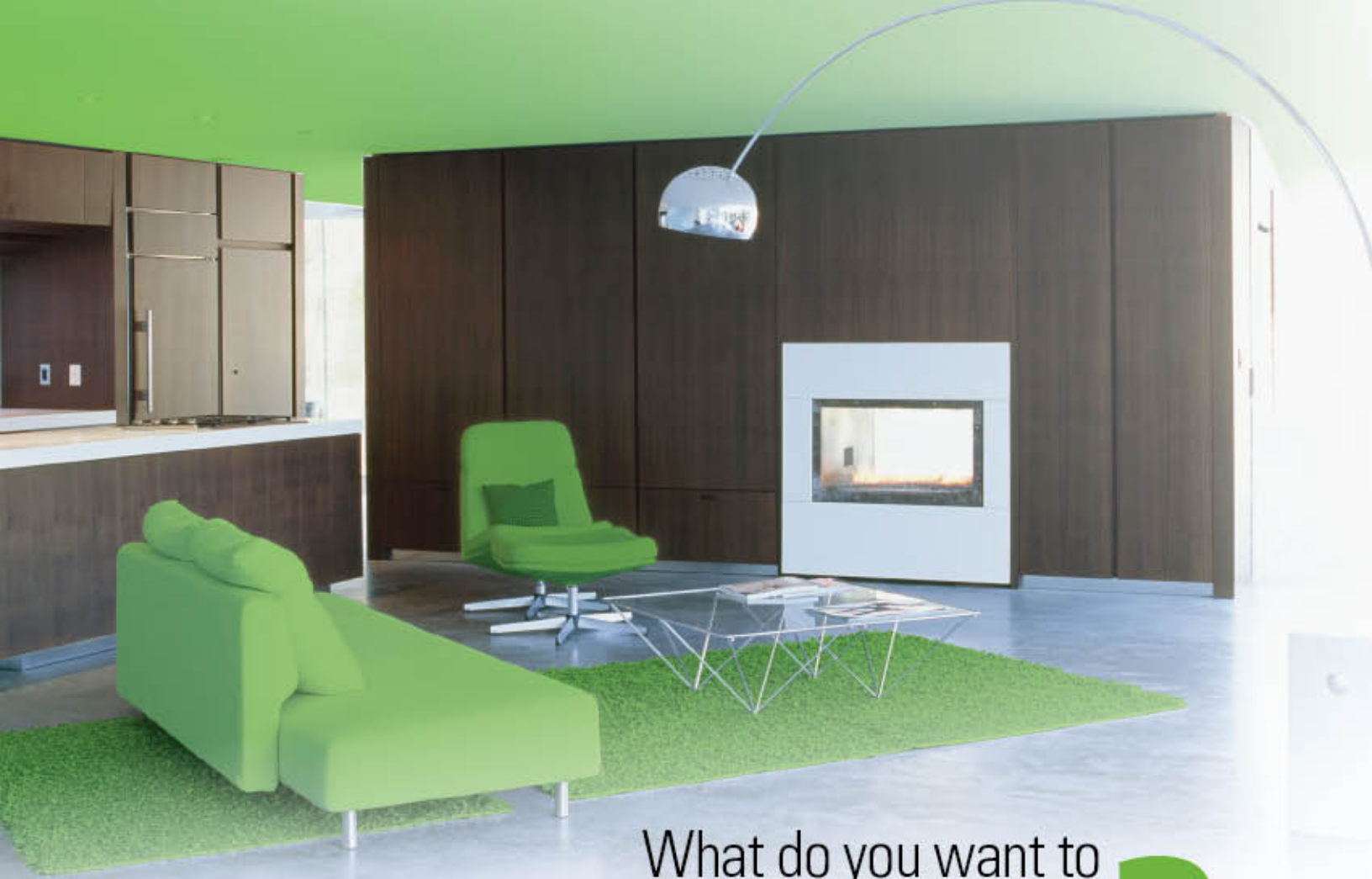
2010 Issue

Trusted Products. Meaningful Solutions.



Featured stories include:

- Impact of stimulus packages on polyurethanes
- Onsite coating formulation for offshore oil industry
- Innovative mattress core
- New "green" wall décor for kids



What do you want to **green?**

Dow RENUVA™ Renewable Resource Technology enables you to make a wide range of products that contain among the highest levels of renewable content available in the market today – without sacrificing performance.

Dow has brought performance to green! We work with product manufacturers to custom-design key performance attributes into our RENUVA products so consumers can buy green products that are just as good or even better than their conventional counterparts. That can mean “greener” sofas and mattresses with improved support, paints, coatings and adhesives with improved water resistance, and carpet backings that last longer – and that’s just the start.

So what do you want to “green”? Please contact us. We’d like to discuss designing a solution just for you.

www.dowrenuva.com



Technology. Science. Markets. Solutions.



Welcome to the third issue of *RE:Invent* – a magazine about market-driven invention and innovation for the polyurethanes industry from Dow. During these challenging times, invention and innovation have never been more important

as new and better solutions will be critical to ensuring a sustained economic recovery.

Today, Dow's more than 65 years of expertise in polyurethane chemistry is helping our customers deliver value in some of the most critical areas of rebuilding the world's economies – areas such as strengthening infrastructure, improving energy efficiency and developing new sustainability solutions. This issue highlights many of these stories.

Together with our customers, Dow is helping make a difference in people's lives around the world. Our products improve the energy efficiency and fire performance of insulation materials for buildings so families are both comfortable and safe. We are at work on municipal water systems, urban center parking garages and pipelines to help deliver oil reserves from far beneath the ocean's surface so communities have the resources they need to thrive. We provide materials to architects and roofing contractors to create 'green' roofs that help reduce the carbon footprint of buildings. And, we're helping meet consumers' demands for products made with more renewable content.

I would like to thank the many customers who contributed to this issue of *RE:Invent*. In the end, our success is built on our customers' success. It is the true driver for invention and innovation at Dow.

We hope you enjoy this issue of *RE:Invent*, and we look forward to working with you.

Sincerely,

Pat Dawson
President
Dow Polyurethanes

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Dow Polyurethanes and Dow Formulated Systems are business units of The Dow Chemical Company ("Dow"). Dow Isocyanates, Dow Polyols and Dow PO/PG are business divisions within Dow Polyurethanes. Dow Hyperlast is a division within Dow Formulated Systems.

Stimulus Plans Create Sustainability Opportunities for Polyurethane Products

Businesses offering polyurethane-based products are positioned to benefit from government stimulus plans currently being implemented in various countries around the globe. While most of the money won't make its way into the polyurethanes industry directly, the push to boost the economies of many countries around the world through improving energy efficiency in our homes and commercial buildings as well as to provide critical repairs to infrastructure like roads, bridges, and water pipelines should increase demand for polyurethane (PU) products.

The chemical industry has long been a provider of products and innovations that can help to increase energy efficiency, protect and extend the operational life of infrastructure, and help to reduce greenhouse gas emissions. In fact, a new McKinsey & Co. study has found that use of chemical products saves an average of three units of CO₂ emissions for every unit of CO₂ emitted in the chemistry life cycle. This is according to the American Chemistry Council (ACC), which cited the study in a statement before the U.S. House Committee on Energy and Commerce Subcommittee on Energy and Environment in June.

As a business, Dow will continue to help society by creating solutions that can help our customers to stay competitive and add value to their product or systems offerings. It's a 'win-win'!

"Any stimulus plan that encourages an economic recovery that has a positive impact both financially and environmentally makes sense – both in the near-term and for society's long-term gain," said **Pat Dawson, president of Dow Polyurethanes**. "Investment in energy-efficient technologies, as well as public projects that extend the useful life of our nation's roads, sewers and bridges, can help create thousands of new jobs and billions of dollars in economic activity. It also can help nations reduce their dependence on oil while potentially reducing greenhouse gas emissions. However, if these intervention plans do not ultimately benefit businesses, they will not have a long-term impact on our economies, society and its people."

"Today, our customers utilize many different Dow Polyurethanes products and solutions to help address diverse challenges in local communities," continued Dawson. "For example, HYPERKOTE™

500 concrete and waterproofing and protection systems, a Dow Hyperlast product, is used to protect and reinforce water and wastewater service reservoirs and helps to keep water clean and free of contamination. And, appliance manufacturers use our polyols and formulated polyurethane systems to create foams that deliver low-k factor performance, reducing energy use in refrigerators and water heaters. As the world continues to look for better ways to protect our precious resources, demand for products made from polyurethanes will continue to grow."

Who's Spending – And On What? Energy Efficiency & Infrastructure

Across the world, governments are using stimulus funds to encourage more efficient use of energy and factors that reduce the effects of global climate change. Sustainable energy investments account for an estimated \$183 billion of government fiscal stimulus funds to date, according to a report by the United Nations Environment Programme, released in June.

Spending on infrastructure such as roads, bridges, hospitals and schools is another way that governments globally are directing stimulus money to improve the economy. According to a survey by the International Monetary Fund, about three-quarters of the G-20 countries have announced plans to increase spending on infrastructure, largely on transportation networks – either in the form of direct central government spending, or through capital transfers to local authorities. Among these countries are the U.S., China, Canada, France, Germany, Korea and Saudi Arabia. (See chart on page 5 for details.)

"As issues like climate change move through the legislative process, energy efficiency will become the low-cost option to help reduce energy costs and greenhouse gas emissions," said **Peter Molinaro, vice president, U.S. Federal and State Government Affairs for Dow**. "Government stimulus spending also shows, from a policy perspective, that efforts to promote the efficient use of fossil fuels and products made from renewable raw material – like those used in Dow Polyurethanes' RENUVA™ Renewable Resource Technology – are here to stay. It signals long and sustained growth in this arena from which the polyurethanes industry and our customers can benefit."

The spending on energy-efficient technology is also designed to be a quick path to job creation. In fact, the think-tank World Resources Institute has said that every \$1 billion spent now on energy efficiency and renewable energy technology would generate 30,100 jobs in the U.S. and save the country's economy \$450 million a year.

"Governmental funding and support for energy efficiency has immediate and long-lasting economic benefits, but can also help improve the world's environment," continued Dawson. "As a business, we will continue to help society by creating solutions that can help our customers to stay competitive and add value to their product or systems offerings. It's a 'win-win'!"

Below is a chart detailing how various nations have included investments in energy and infrastructure in their stimulus packages, according to publically available information, as of July 1, 2009. Unless otherwise indicated, dollar amounts are in United States dollars (USD).

Nation	Stimulus Package Highlight
United States	Of the \$787 billion stimulus package, \$44 billion is targeted for investments in energy, particularly renewables. The stimulus plan allocates \$6.3 billion to state and local governments to make investments in energy efficiency, \$4.5 billion for federal buildings to increase their energy efficiency, \$6 billion in renewable energy power generation loans, and \$11 billion for the modernization of the U.S. electric power grid. In addition, it targets about \$20 billion for tax breaks. About \$80.9 billion is slated for transportation and infrastructure.
China	China's vast \$586 billion stimulus plan covers 10 areas, including areas such as housing construction, rural infrastructure, water and electricity supplies, transport infrastructure, technological innovation and the environment. A February analysis by HSBC Global Research in Hong Kong projects that nearly 40 percent of China's stimulus plan is going toward public investment in renewable energy, low-carbon vehicles, high-speed rail, an advanced electric grid, efficiency improvements, and other water-treatment and pollution controls. This stimulus is on top of historic levels of government spending and private investment in renewable technology, energy efficiency and low-carbon growth all across China.
Canada	The government's Economic Action Plan aims to provide approximately C\$30 billion (~USD\$24.1 billion). Under the proposal, almost C\$12 billion would be used to build and repair infrastructure, and C\$7.8 billion would be used to stimulate housing construction.
France	One-fifth of the €26.5 billion (~USD\$34 billion) is to target energy-efficient or low-carbon technologies, including earmarks for energy infrastructures. Public investment will also fund transportation infrastructure, higher education, research and improvement of state-owned properties.
Germany	Germany is spending €50 billion (~USD\$67 billion) over the next two years to mitigate the economic downturn – of which €17 billion (~USD\$24 billion) is to be spent on roads, schools, hospitals and other infrastructure, mainly through local authorities. Thirteen percent of Germany's economic plan is to be targeted toward low-carbon technologies. For example, the government plans to pump €3 billion (~USD\$3.8 billion) into a program aimed at making buildings more energy efficient. Germans also will be able to claim tax breaks for making their homes more environmentally friendly and for trading in inefficient vehicles.
Australia	Australia approved a \$42 billion (~USD\$26.5 billion) stimulus package, including money to insulate the ceilings of 2.7 million homes and build infrastructure. The measures are expected to reduce greenhouse gas emissions by 2020, an amount equal to taking more than 1 million cars off the road.
South Korea	South Korea plans to invest \$38 billion in green projects in the next four years to create almost a million new jobs. Increasing energy efficiency and developing renewable energy resources are two of the sectors.
Japan	In its third stimulus package since October, Tokyo announced ¥15.4 trillion (~USD\$154 billion) in subsidies and tax breaks in April. The plan would bring total Japanese stimulus spending to ¥27 trillion. Much of the package is to foster environmentally friendly technologies – including energy efficiency materials for buildings and homes and solar energy. Consumers will receive tax breaks for purchases of "green" cars, as well as subsidies of 5 percent on energy-efficient televisions and other appliances.
Brazil	Brazil's \$270.3 billion multiyear investment program, which increased by \$59.46 billion in February, includes industrial tax breaks for autos, allowing auto dealers to reduce prices that attracted customers. Eighty-five percent of new car sales in Brazil are flex-fuel cars, which can run on 100 percent ethanol.

For up-to-date details on the U.S. stimulus plan, go to www.recovery.gov. For more about financial stimulus plans in selected countries globally, go to the U.S. Library of Congress's roundup at www.loc.gov/law/help/financial_stimulus_plan.php.

How Could You Benefit?

The ACC estimates that for every \$1,000 spent on nonresidential construction and infrastructure projects, like roads or bridges, about \$160 to \$230 makes its way to the chemical industry.

That number rises when home construction, an area in which stimulus dollars are targeted to improve energy efficiency, is included. In fact, the chemical industry products make up about \$17,000 of each house built, according to the ACC, and the housing industry is a primary end user of polyurethanes.

Here is an overview, by market segment, of opportunities in energy efficiency:

- **Thermal insulation and rigid foam used to insulate buildings.** Polyurethane products that are highly effective insulators will benefit from the incentives offered to homeowners for improving energy efficiency. Other products that will benefit include caulks/sealants, vinyl replacement windows, doors, films, coatings, weather stripping and wraps for ducting, pipe and hot water heaters. Dow Polyurethane products include PAPI™ polymeric MDI, VORATHERM™ polyisocyanurate, VORANOL™ polyether polyols and VORACOR™ polyurethane components. Other Dow products that utilize polyurethanes in their end-market products include GREAT STUFF™, THERMAX™ wall system and FROTH-PAK™ foam insulation.
- **High-value infrastructure protection that repairs and protects valuable public work assets.** Polyurethane and epoxy technologies can be combined to provide solutions for sewage treatment plants, water pipelines, bridges, roads, and rail tracks. Dow products include HYPERKOTE™ 500 concrete and waterproofing and protection systems, HYPERLAST™ SYNTACTIC™ polyurethanes, TRAFFIDECK™ waterproofing membrane and XiTRACK™ GeoComposite treatments.
- **Protective coatings and sealants used to increase the energy efficiency of buildings and windows.** Other products include plastic foam insulation and cool roofs utilizing Dow polyurethane products such as VORAMER™ industrial adhesives and binders, VERDISEAL™ waterproof roofing membrane and HYPERKOTE™ sprayable polyurethane systems.
- **Thermal insulation of appliances such as refrigerators.** The appliance market may see some stabilization in sales due to consumer rebates and credits in China. In addition, measures to support purchases of energy-saving appliances in Japan

promise to stimulate consumer demand. Dow PU products include PAPI™ polymeric MDI, VORANOL™ polyether polyols, and VORACOR™ and VORATEC™ polyurethane components.

A Sustained Recovery

Worldwide, government investment in energy efficiency, infrastructure repair and protection and renewable energy programs will create considerable demand for high-value materials produced by the polyurethanes industry. The challenge, and the opportunity, for Dow Polyurethanes, together with our customers, is to act quickly in order to tap this tremendous market potential and quickly develop solutions that help improve energy efficiency, lower maintenance costs, help reduce greenhouse gases and address customers' needs.



"We have the ability for a potential step change in technology when it comes to improving energy efficiency and reducing the costs of maintaining critical infrastructure assets," said **Herman Motmans, global marketing director for Dow Polyurethanes.** "Our business thrives on change, and, in the area of energy efficiency, changing regulations that drive us to respond more quickly with more energy-efficient solutions for our customers could offer a tremendous opportunity for us. These stricter regulations will change how things are built and will open greater opportunities in several of our key markets segments like construction, appliance and automotive. It means we can bring more polyurethane solutions to a dynamic market." ◆

Source List:

McKinsey & Co. study, ACC statement before Congress: http://www.americanchemistry.com/s_acc/bin.asp?CID=217&DID=9727&DOC=FILE.PDF

United Nations Environment Programme study: "Economic Crisis Hits EU and US Clean Energy As Emerging Economy Investments Rise 27% to \$36 billion": http://sefi.unep.org/fileadmin/media/sefi/docs/publications/Press_Release_2009.pdf

Policy Brief, February 2009, World Resources Institute: http://pdf.wri.org/green_global_recovery.pdf

HSBC Global Research, green stimulus spending chart: <http://usclimatenetwork.org/resource-database/A%20Climate%20for%20Recovery%20Feb%202009.pdf>

IMF Infrastructure statistics: <http://www.imf.org/external/pubs/ft/survey/so/2009/POL020709A.htm>

\$1,000 spent on non-residential construction/ACC: <http://pubs.acs.org/cen/news/87/10/8710notw2.html>

\$17,000 housing start: http://www.americanchemistry.com/s_acc/sec_employment.asp?CID=443&DID=1536

Insulation Performance Is Critical to Sustainable Building

In the building and construction world, "sustainability" has been defined many ways, from renewable resource content in building materials, to avoiding materials that deplete the ozone layer or cause global warming, to sourcing locally to reduce fuel for transporting building materials, and to the energy-saving performance of the construction material. These actions offer positive contributions, but perhaps the single greatest contribution from insulation is the reduction of energy needed to heat and cool buildings over the lifetime of the building.

Many people don't realize it, but about 40 percent of all the energy consumed in Europe and North America is consumed in buildings. That's more than any other sector, including transportation. So it stands to reason that increasing energy efficiency in buildings through insulation would be one of the most important contributions to sustainability – not to mention saving money. And, because insulation continues to help reduce energy use year after year over the lifetime of the building, the impact multiplies as long as the building is in use.

The Long-Term R-Value of Polyurethanes

More than 90 percent of all the products Dow Polyurethanes sells to the building and construction market go into insulation in one form or another. These products are used in insulation boards for roofs, walls, and floors; insulated metal panels for commercial and industrial buildings; spray foam insulation, water heaters, and cold storage rooms.

"There are other materials that also can be used for insulation, including polystyrene, fiberglass, mineral wool, and cellulose," said **Brian Powers, global marketing leader for Dow Formulated Systems' rigid construction group**. "Some proponents tout the 'green' advantages of natural cellulose materials or recycled fiberglass or mineral wool, but a great environmental contribution is from energy efficiency. Materials with higher R-values* are more efficient, saving energy, and can help reduce CO₂ emissions. Polyurethane is at the high end of the scale in terms of long-term R-value, plus it's lightweight, strong and has compatibility with various other materials."

Francesca Pignagnoli, global development leader of the rigid construction and appliance group within Dow Formulated Systems, added: "Take, for example, rigid-faced insulated panels for building. For many years, in many places, the energy-saving role of these elements has been almost considered a given. However, the selection was not necessarily focused on taking one of the best insulants to achieve the best result. Fortunately, new regulations are now pushing in this direction."

Environmental Sustainability + Increased Personal Safety

Polyurethanes can also be formulated to be fire resistant. In the building sector, this is important to architects and contractors who must meet more stringent fire safety codes. Dow can help fill that need by offering a new family of formulated products to the rigid foam market – VORATHERM™ polyisocyanurate (PIR). Today, rigid panel manufacturers can offer products with the same insulating performance and with the added benefit of better fire safety protection.

Did You Know?

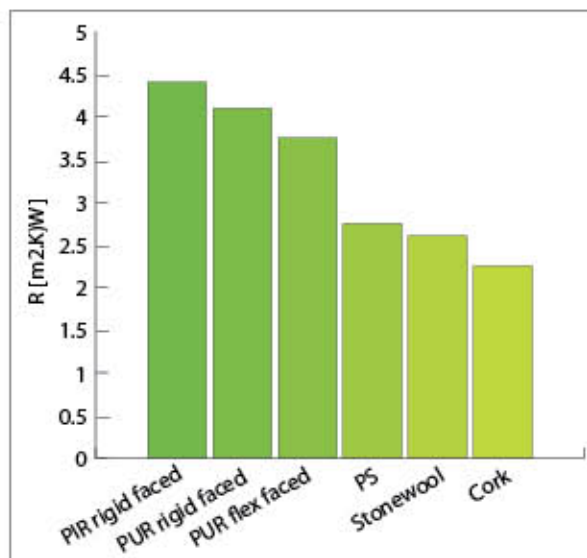
More than 90 percent of all the products Dow Polyurethanes sells to the building and construction market go into insulation in one form or another.

Introduced in the spring of 2009, VORATHERM PIR is available in three fire performance levels, each of which can be further customized to address the needs of customers in specific regions since fire codes differ country to country.

"Producers have to comply with a very fragmented scenario of fire certifications – from small-scale tests to medium- or even large-scale tests on a building-like panel assembly," said Pignagnoli. "This is the main reason we are providing customers with a stratified offering – to give them more choices so that we are not giving them over-engineered solutions they don't need." ◆

VORATHERM™ Polyisocyanurate – A Broad Range of Options¹

The chart below indicates processability requirements and performance levels associated with VORATHERM polyisocyanurate. Molded densities are in line with the densities typically associated with PUR foam.



Value of thermal resistance R, measured in (m².K/W), using various building insulating panels, at constant thickness of 100 mm

¹Dow Internal Data

*R-value is a unit of heat resistance. The higher the R-value, the greater the insulating properties of a material.

With VORATHERM™ PIR, TD Group Introduces High-Performing Duct System Using Environmentally Friendly Blowing Agent



PT Kreasi Tata Udara (TD Group) has long been a pioneer in Southeast Asia industry – starting in air conditioning 35 years ago, then establishing a leadership position in sandwich panels and duct systems. Recently, TD Group decided to add a single product to its panel offering that would meet fire resistance standards worldwide and use the environmentally friendly blowing agent HFC-245fa in the manufacturing process. Unlike the standard blowing agent, R-141b, HFC-245fa, does not deplete the ozone.

After meeting with a number of potential suppliers, TD Group selected Dow's VORATHERM™ polyisocyanurate (PIR) foam, which offered improved fire resistance and other performance advantages over conventional polyurethane rigid foam (PUR) and could be produced with the HFC-245fa blowing agent.

"We saw the move to 245fa as critical to expanding our sales worldwide and also to doing our part for the environment," said **Mr. Budi Djamaludin, general manager, TD Group.** "Using VORATHERM PIR provides us with the high-grade product that will meet the fire resistance performance standards of just about any country in the world. Our customers are very, very excited about it and eager to promote the product. Earlier this year, we began selling this

product in Australia and Indonesia, and we are in the process of expanding sales to the United States, Europe and elsewhere."

Dow Technical Support Makes the Difference

The successful launch of TD Group's new duct panels featuring VORATHERM PIR and HFC-245fa was a result of excellent collaboration between TD Group and Dow Formulated Systems' R&D teams in Correggio, Italy and Guangzhou, China, and local **Dow Technical Sales Representative Meng Lai Lee** and **SiHo Lee, Dow Formulated Systems' rigid construction market development leader for the Pacific Region.** SiHo Lee oversaw the project.

"Dow's entire process was very efficient," said Mr. Budi Djamaludin. "SiHo Lee and Meng Lai Lee visited our site; then Dow developed the formulation over a six-month period. They returned for about a week to ensure we got everything up and running quickly. We made one adjustment to the formulation, and it was smooth sailing from there.

"The Dow personnel were helpful and knowledgeable. They were able to do things quickly, correctly and were able to help us every step of the way in making the process changes required to use 245fa. We were given clear guidelines on how to use the blowing agent, even down to details such as transferring it from the storage container to the production line."

SiHo Lee added, "TD Group's expertise in their panel and duct manufacturing process complemented our input perfectly. Any necessary modifications to equipment or the facility were made rapidly and efficiently. Equally important, this is a company that is decisive and dedicated to moving forward, and willing to make the changes to introduce this new product line. Their commitment made it possible to accomplish so much in a relatively short timeframe."

An added benefit of using VORATHERM PIR is that it allows TD Group to produce foam cores for its sandwich panels with an exceptionally smooth surface, even under a variety of manufacturing conditions. That makes it easier to apply the necessary aluminum foil coating on both sides, and presents more options for using foil from different sources.

Mr. Budi Djamaludin was also impressed with more than the performance of VORATHERM PIR in the sandwich panel production. He appreciated the decades of experience Dow has working with polyurethanes, and the value it provides his customers.

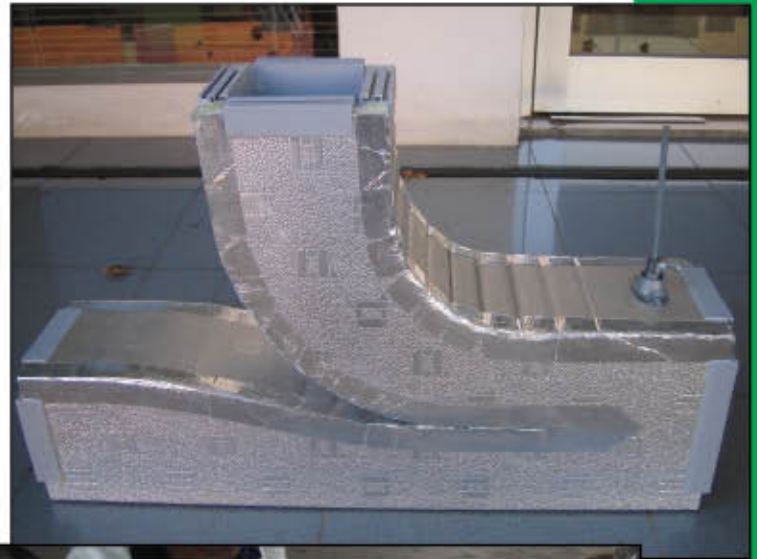
"Since we began production of our TD Pre-Insulated Aluminum Ducts in 2004, we have worked closely with Dow on a number of projects," said Mr. Budi Djamaludin. "I think Dow really shines from a customer service standpoint. Dow has demonstrated a deep commitment to our company with extensive service, technical and development support. We appreciate all the Dow team did for us while implementing our change to VORATHERM™ PIR, and we look forward to continuing to work together." ◆

Find out more about TD Group at www.tdduct.com and Dow's VORATHERM PIR at www.voratherm.com.

About TD Group

TD Group is a leader in air conditioning and aluminum duct manufacture in Southeast Asia.

- TD Group began as an air conditioning manufacturer, adding aluminum duct systems to its portfolio in 1996 in Jakarta, Indonesia, and is the largest duct panels producer in Southeast Asia
- TD Group exports to nine countries, with a global distributor located in Shanghai, China, and additional distributors in New South Wales, Australia; Selangor, Malaysia; and Tehran, Iran
- Their panel and duct systems are used in several major airports, theaters, government buildings and other facilities across Indonesia



Fast Facts about VORATHERM™

- Offers exceptional fire-performance properties, with a wide range of levels that can be customized to individual specifications
- Passes demanding GM 4880 insurance standard, as well as strict requirements of LPS 1181 and LPS 1208
- Is a lightweight material with high structural strength
- Features inherent adhesion to metal facings
- Offers excellent thermal insulation properties
- Works with a variety of applications, including commercial, industrial, office and residential buildings

Combining Technical and Sales Support in One: Dow's High-Value TSR Model



Andreas Ottens,
*Senior TSR for Rigid Business
and Market Development Manager,
Northern Europe
2001 and 2009 Pinnacle Award Winner*

"Our PU systems customers gain an advantage from our technical sales representative (TSR) model: fast response and quick decisions made by our flexible business organization of TSRs, manufacturing and system house management. Furthermore, both commercial and technical tasks for our customers are handled by just one person, the TSR. Our customers also benefit from the TSRs being present across all geographies. The TSR has an excellent understanding of local needs and an awareness of local regulations. He or she can deliver the optimal product to the local customer facility by using Dow's advanced and differentiated technology, developed globally, but implemented locally.

"The combination of sales and technical services is much more challenging, but it also makes the job more interesting since the TSR can contribute more to customer success. The TSR works very closely with the customer. He plays a major role in helping the customer to be more competitive by producing a differentiated product that is ready for their particular market."

"The primary advantage of the TSR model for the customer is to have a single contact person with both technical and commercial expertise. This model enables Dow to meet the customer's specific needs through fast, accurate problem solving and product tailoring.

"The world-wide system house network, with TSRs located close to customers, is a key for success. We speak the same language as the customer and are familiar with the specific environment where the customer is operating. The close proximity to the customer allows faster response, trouble shooting and problem solving."



Maurizio Guandalini, *TSR
Italy, Greece, and Cyprus*



Peter Choi, *TSR
United States*

"The most common feedback I receive from customers is how easy it is to work with Dow. With one person serving as the main interface, it simplifies the process for the customer, decreases the potential for mistakes, and improves our response time and quality of service. Our world-wide TSR network is also a great benefit to customers – that we can use our knowledge of varying local requirements to allow customers to successfully branch into new regions and promote growth.

"I like the variety the TSR model offers, and the ability to be 'hands on' with the customer. It is very satisfying for me to be able to participate from start to finish with a customer."



Dow Participates in First Phase of Sewer Pipes Rehabilitation Project in Mexico City

Formulations Repair, Protect and Strengthen Pipelines

Mexican federal agencies identified the technical solution provided by Dow as one of the qualified options to renovate pipelines in one of the most ambitious and complex underground projects undertaken in Latin America to date: the rehabilitation of the sewer pipelines in Mexico City. The first completed phase of the project covers approximately six kilometers of pipeline, while the total length of the pipeline to be rehabilitated is 120 kilometers, with a diameter of 5.5 meters.

The first phase of the project involved the application of a protective solution to refurbish the pipelines, which took place over a five-month period from December 2008 to April 2009. The next step for the Mexican government is to wait for the end of the rainy season (May-November) to confirm the effectiveness of the completed work and select protective coating suppliers that will complete the second phase of the project. The project is scheduled to last until 2012.

Constructed in 1975, with no regular maintenance since the middle of the 1990s, the sewer pipes in Mexico City have deteriorated to a point that the iron bars are exposed along the lines. For this project, Dow created a multi-layer anti-corrosion formulation that combines the extensive expertise and experience in both epoxy primer and polyurethane elastomer chemistry. First, an epoxy primer is applied directly over the concrete, followed by a layer of spray-applied polyurea elastomer. This solution offers excellent adhesion to the concrete, excellent resistance to the acidity of the tunnels, easy application, fast return to service (seven seconds drying time) and provides a harder surface, strengthening the pipelines.

Expertise in Formulated Systems Yields Customized Solution

"Dow's extensive knowledge of polyurethane systems and epoxy coating solutions, combined with over 30 years of expertise in formulated systems, enabled the development of specific products to meet the needs of the Mexico City project," said **Juan Antonio Merino, global general manager of Dow Formulated Systems**, a newly formed global business that combines the strength of Dow Polyurethane Systems and Dow Epoxy Systems. "As reinforced by our recent acquisition of Poly-Carb – a leader in bridge and road repair solutions – as well as Hyperlast – a leader in providing pipe protection solutions through polyurethane elastomer chemistry – and the recently announced global alliance with RS Technik Group, Dow Formulated Systems continues to significantly invest in developing tailor-made solutions for the infrastructure asset protection market. By working intimately with our customers to better understand their needs, Dow strives to be their preferred partner, able to develop and provide solutions that protect and extend the life of high-value assets around the globe."

Julio Mortarotti, Dow Formulated Systems director of the North region of Latin America, who actively participated in the entire Mexico City project, stressed that the system used for this rehabilitation project can be leveraged to many other customer needs throughout the globe. "We can adapt the formulation used in Mexico to the needs of any city in the world. Dow is ready to do this type of work that, in addition to being preventive maintenance, results in the improvement of the living conditions for the population," concluded Mortarotti. ◀

Lighting Sensors at Heathrow's Terminal 5

When **Highlight Parking Ltd.** conceived its signage system for displaying vacant parking bays to car drivers at Heathrow's Terminal 5 in London, England, they approached an engineering design company to create a suitable protective housing for the outdoor electronic sensor. The design company, being unfamiliar with the properties of polyurethane, discussed the project with **Custom Moulded Polyurethanes Ltd.** Together, they designed and produced a mould and prototype for the outdoor, floor-based sensor manufactured using Dow's HYPERLAST™ polyurethane elastomer. The first production order for 300 sensor units was installed on the top deck of the Terminal 5 car park and bonded to the polyurethane roof substrate.

Highlight Parking's system updates car park information displays the moment a sensor detects that a vehicle has vacated a bay in order to direct drivers to the nearest space. While sensors are ceiling mounted on multi-story decks, external bays require a ground-mounted wireless sensor that is durable and waterproof.

David Harrison, managing director of Highlight Parking Systems, commented: "The system saves the driver from roaming round and round the car park looking for a space and so can reduce carbon emissions."

Custom Moulded Polyurethanes of Lydney, Gloucestershire – a specialist in manufacturing a range of products from polyurethane – designed and produced the sensor's protective case, which is comprised of three parts manufactured from Dow Hyperlast materials:

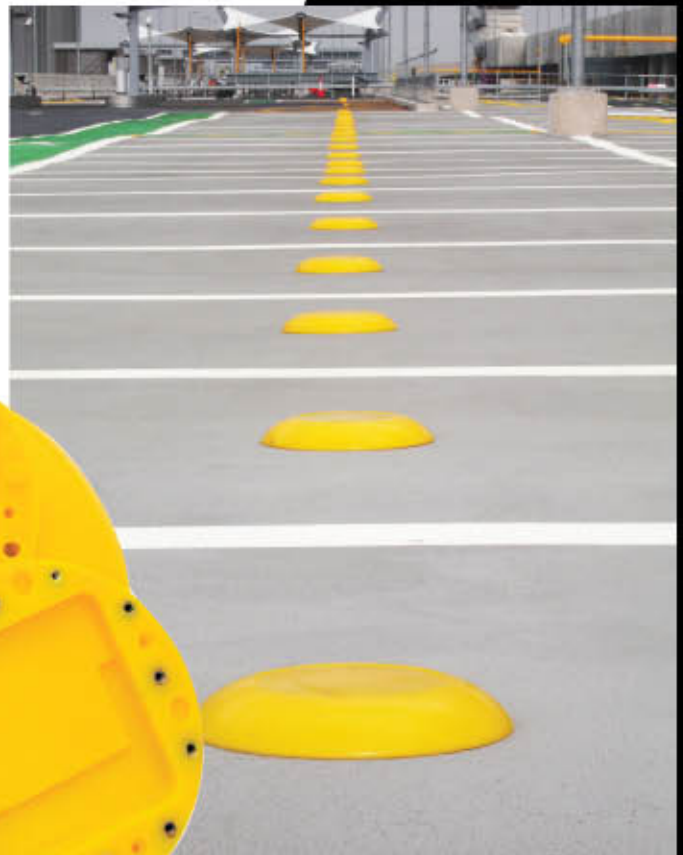
- A soft and malleable polyurethane outer assembly that allows compression from passing vehicles and returns to its original shape
- A two-part rigid and tough polyurethane inside section with no compression properties that can help to protect the sensor, radio transmitter and lithium batteries (which normally have a 5-year life)

These are assembled around a stainless steel base plate.

Developed and supplied by Dow Hyperlast, HYPERLAST is a tough and durable elastomer that has excellent wear and tear properties. The HYPERLAST range of products can be applied by cast or spray and are suitable for manufacturing, engineering, electrical, filter, mould-making, marine and other applications.

Phil Thorne of Custom Moulded Polyurethanes commented, "We could use other suppliers, but we find the technical and sales office support from Dow Hyperlast to be excellent. It's important to have good suppliers if we are to have good customers."

Highlight Parking's system at Terminal 5 demonstrates the flexibility and suitability of HYPERLAST as a material for the manufacture of innovative products for high class applications. ◀





TRAFFIDECK™ Provides Waterproofing and Anti-Skid Protection at London's Brent Cross Shopping Centre Car Park

As part of the large-scale regeneration of the Cricklewood and Brent Cross areas, which form part of the London Boroughs of Barnet, Brent and Camden, major refurbishment of the Brent Cross Shopping Centre specified introduction of the Dow's TRAFFIDECK™ TD system for the resurfacing and waterproofing of the roof top parking level.

With over 120 stylish shops, cafés and restaurants and spaces for 8,000 cars, Brent Cross Shopping Centre requires a high standard of protection and waterproofing for its car parking as well as a high quality aesthetic appearance. The TRAFFIDECK system, developed and supplied by Dow Hyperlast, delivers both.

After repairs and regulation of the existing surface, application of the TRAFFIDECK system to the 20,000 m² area by approved installer **Waterseal Ltd. of Croydon** involved:

- Applying Flex 2000 SG elastomeric membrane in liquid form to provide a fully bonded and seamless coating for the entire area
- Coating this with a fully aggregated Grip 10000 wearing course to provide a hard wearing surface for both vehicle and pedestrian traffic
- Finishing the deck with a true UV stable Topcoat ASP sealing coat in a variety of contrasting colours for parking bays, aisles and walkways

Because TRAFFIDECK is fast curing, does not contain solvents, and can be applied even in marginal conditions, Waterseal Ltd. was able to apply consecutive TRAFFIDECK™ coats quickly to build up the system swiftly and enable the car park to be returned to service fast. Waterseal's experienced workforce completed 14,000 m² before Christmas 2008 with the remaining area completed in early 2009 – all within budget.

Working together with Dow Hyperlast, Waterseal's application of the BBA (British Board of Agrément) accredited TRAFFIDECK system now provides effective waterproofing of the car



park, backed by Dow Hyperlast's long-term manufacturer's guarantee, and is designed to increase the design life of the structure and protect the owner's investment. As well as delivering structural protection, TRAFFIDECK also improves the aesthetic appearance of the structure and provides anti-skid properties to protect both motorists and pedestrians.

Brent Cross Shopping Centre is just one part of the regeneration of the area, which will also include major construction projects featuring roof top gardens to create a high quality urban living environment. Dow Hyperlast's TRAFFIDECK range and its green roof waterproofing VERDISEAL™ products are ideal for these applications, having been designed for high profile, prestige developments in cities across the USA and Europe. ◀

Laying the Groundwork for Leak-Free "Green Roof" Decks



From an underground car park in historic Assisi, Italy, to a busy metro hospital in Long Island, New York, VERDISEAL™ Waterproofing System is laying the groundwork for leak-free "green roof" decks.

Placing a 300-space modern car park in the scenic town of Assisi, Italy, without taking away from the historic authenticity and natural beauty of the area, is easy – if you look beneath the surface. That's exactly what the designers of Mojano Parking di Assisi did when they placed the parking facility beneath the city, near the ancient Porta Mojano gate. A beautiful living roof garden now covers the hillside structure, to help it further blend with its surroundings.

To enable the living roof to support a full garden, while simultaneously protecting the car park from water and root invasion, the construction company, **Nord Resine SPA**, applied the Dow's VERDISEAL Waterproofing System – including primer, elastomeric membrane and wear coat – to the roof's 4,500 m² of prepared concrete. The application required no reinforcing sheets or flashings, and because it is applied in liquid spray-on form, there was no need to worry about punctures during storage or transport to the remote village.

Spray-on convenience was also an important consideration during the restoration of a leaking plaza deck and courtyard at Nassau University Medical Center in Long Island, New York. After the old concrete topping slab and membrane were removed and the decks and walls were prepared, the new membrane was applied over a very complex roofing surface. Fortunately, the seamless, lightweight elastomeric VERDISEAL membrane begins curing soon after application, enabling even vertical or multi-level surfaces to be waterproofed effectively. The waterproofing system also has very little odor – an important concern, as patients were located closely below.

After the membrane system was applied, a 100 percent solids polyurethane wear coat was applied to the roof, making it suitable for a variety of garden roof coverings, from soil to pavers.

"Since its launch in the fall of 2008, VERDISEAL Waterproofing System is enabling architects to offer sustainable and aesthetic designs for their commercial or industrial structures by providing leak-free performance with flexible installation," said **Paul Fitzgerald, global business leader for the engineering elastomers group of Dow Hyperlast.** ◀

Get more information on VERDISEAL at www.verdiseal.com.

Benefits of the VERDISEAL™ Waterproofing System

- Can be applied onto complex shapes, including drains and upstands
- Adheres evenly to horizontal or flat surfaces, as well as combinations of levels and undulations
- Protects against water leakage, mineral residue leaching, garden chemicals and oil spillages
- Resists root penetration on garden roofs
- Can be repaired without removing the whole membrane – minimizing replacement or disposal costs
- Easy and quick to install as a fast-setting spray membrane
- Tough enough to withstand full construction traffic without any need for protection board
- Cures quickly and is ready for use within hours of application, even at low temperatures
- Can be applied "cold" (without the use of hot kettles or flames)

Pipeline Pigs Last Longer with DIPRANE™ Polyurethane Elastomers

In the oil and gas industry, pipeline maintenance is critical both for operational efficiency and environmental protection. Pipeline inspection gauges (pigs) are essential equipment used to inspect and clean pipelines while product is still flowing inside. That means pipeline pigs must be able to withstand harsh conditions of high heat, a variety of different chemicals and significant abrasion.

To better assist customers in the oil and gas industry, Dow Hyperlast recently conducted practical tests to demonstrate the performance benefits of the DIPRANE™ 53 polyurethane elastomers series, a polyurethane elastomer based on diphenylmethane diisocyanate (MDI) in pipeline pig applications.

Putting Pig Materials To the Test

Dow Hyperlast collaborated with pig manufacturers to produce gauges made from three different compounds and then tested them in a dry transmission line of a major natural gas company. The pigs were run through an 80-mile pipeline at five miles per hour, and then examined for wear and tear, as well as cleaning effectiveness. The results were striking:

- The first type of pig, made with conventional toluene diisocyanate (TDI) polyester, showed significant wear after just one run (80 miles) and could not be used for a second run.
- The second type, manufactured from a low-monomer TDI polyester prepolymer, showed better performance, but survived only two runs (160 miles) before wearing out.
- The third type, made from DIPRANE 53 quasi MDI prepolymer developed by Dow Hyperlast, completed two runs (160 miles) successfully and was still ready for more, showing signs of only mild wear. And, this type also demonstrated the best cleaning capability. According to the engineers who conducted the test, the quasi MDI pigs were able to "remove lots of material while showing excellent resistance to wear."



As demonstrated in the pipeline pig performance test, quasi MDI prepolymers offer superior resistance to wear and chemicals, making them ideal for a variety of demanding applications throughout the oil and gas industry. Quasi MDI prepolymers can also be processed at ambient temperatures, allowing for improved safety in the handling and manufacturing of the product, and up to 25 percent energy savings when compared with full TDI prepolymers.

According to **Janet English, global marketing manager for the engineering elastomers group within Dow Hyperlast**, "With more than 25 years of experience in engineering elastomers, we continue to build upon Dow Hyperlast's portfolio of proven, high performance products to meet customer needs," she said. "Our DIPRANE 53 quasi MDI prepolymers are a testament to our efforts to create more efficient, sustainable solutions for the oil and gas industry."

DIPRANE polyurethane elastomers are available both as full prepolymer and as quasi MDI prepolymers – both provide excellent durability and performance. ◀

To learn more visit www.dowhyperlast.com.

Dow Hyperlast Advances Sustainable Development in Offshore Oil Operations with New Mobile Technology



Imagine a vast oil reserve off-shore a hundred kilometers from a population in need of fuel. A critical step in creating a pipeline to transport the oil is coating thousands of pipes for protection and insulation, and to assure oil flows smoothly through the pipeline. Now imagine a novel mobile unit that can be assembled – even in an extremely remote location – in just two weeks, to formulate the flow assurance insulation coating onsite. The coating will be formulated in a safe, closed system with low energy needs. And once all the pipes are coated, the unit can be disassembled, containerized, and removed within just two weeks, leaving the environment as it was before the unit arrived.

Enter Dow's new ETNAFLOW™ Portable Mixing Plant, which was developed for onsite assembly and coatings formulation. This mobile unit is playing an important role in ensuring the oil, in one of the largest deep-sea pipeline projects in the world, will reach shore – and ultimately, the 26 million Malaysians in need of fuel for their cars, homes and businesses.

Gumusut-Kakap – One of the Largest Projects of Its Kind

The massive Gumusut-Kakap development, located off the coast of Malaysia, will export oil from ocean depths of up to 1,220 meters (about 4,000 feet) and through 170 kilometers (105 miles) of pipeline. Not only is the project, which is operated by **Sabah Shell Petroleum Company**, one of the largest of its kind but it involves demanding physical conditions, flow assurance and logistical challenges.

Sabah Shell is using glass syntactic polyurethane (GSPU) insulation systems from Dow Hyperlast for the development's pipelines. The GSPU insulation systems enable oil and gas producers to manufacture high-performing pipe coatings and insulation that ensure oil flows smoothly, deep under the ocean and in extreme conditions – from pipe to people.

"Our materials provide excellent thermal insulation, protection, adhesion, impact strength and are durable in harsh working environments – all critical challenges facing the oil industry today," said **Alex Lane, business leader of Dow Hyperlast's pipe and tank group**. "In addition to the materials, we've drawn on our 25 years of experience in the oil and gas industry to design the ETNAFLOW Portable Mixing Plant specifically for large-scale offshore pipeline coating projects where conventional processes and resources may not be sufficient to meet project deadlines. The ETNAFLOW unit enables both Dow Hyperlast and our customers to marry business productivity with social and environmental responsibility."

The ETNAFLOW™ Difference

Using conventional GSPU technology, the Gumusut project would require shipping and reconstituting, through mechanical mixing, thousands of drums of formulated coating. Using the ETNAFLOW™ Portable Mixing Plant, there are no drums and coating reconstitution is not necessary. The coating raw materials are shipped in three bulk containers and formulated onsite via the ETNAFLOW technology, using local labor. This positions the coater to apply the flow assurance insulation at a very fast rate – quite possibly the fastest flow assurance insulation coating process in the world.

The portable plant includes dosing units plus blending apparatus for mixing polyurethane and glass microspheres. As a closed-loop system, ETNAFLOW minimizes the risk of chemical exposure to workers and the environment.

The ETNAFLOW™ plant is also equipped with an advanced process control system to ensure formulation accuracy and quality and consistency of the final coating. In fact, the ETNAFLOW unit uses the same state-of-the-art process control system used in many of Dow's manufacturing facilities. This process control system includes remote telemetry and thereby allows for long distance troubleshooting and process monitoring.

Dow Hyperlast – Committed to Supporting the Customer Onsite

Dow Hyperlast shipped the new unit to the project coating site, and assisted with the installation and training. In addition, onsite technical support was provided to **Wasco Energy Group**, the pipeline coatings company for this phase of the project. As with all projects, Dow Hyperlast provides onsite technical support through both regional and global support teams.

Did You Know?

Chosen for its depth capabilities and thermal performance, HYPERLAST™ SYNTACTIC™ DW 512/300 targets water depths of approximately 10,000 feet or 3,000 meters and allows for operating temperatures of up to 115 degrees Celsius.

"Development drilling for the Gumusut-Kakap project commenced in January 2008, and the field will eventually be using 19 subsea wells, with oil exported via a pipeline to a new oil and gas terminal under construction in Kimanis, Sabah, Malaysia. Because of the project's large scale and remote location, conventional resources for GSPU mixing would not have been sufficient to meet project deadlines," says **Martyn Wilmott, executive director for Wasco Energy Group**.

"The Gumusut-Kakap development is really important to the economy in Malaysia, because the project makes the difference between Malaysia being a net importer and net exporter of oil," Wilmott explained. "The project itself, when it comes on-stream, will account for 20 percent of Malaysia's oil production. The products and technology being supplied by Dow Hyperlast are critical to the success of the project."

A Solution Poised to Address Future Needs

As offshore drilling continues to move farther offshore into deeper waters, delivering oil from remote deep-sea beds will require constant innovation. Through its 25 years' experience in the oil industry, materials knowledge and a desire to bring customers cost-effective, usable answers to their technological challenges, Dow Hyperlast is helping to bring oil from deeper depths and closer to the people that need it.

"Our pioneering effort with Shell can be summed up in two words – sustainable development," said **Wayne Lynn, global marketing**

manager for Dow Hyperlast's pipe and tank group. "Drawing from our 25 years of experience in the oil and gas industry, we developed ETNAFLOW™ to improve the efficiency and productivity of pipe coating operations while maximizing worker safety and optimizing logistics. As offshore oil drilling continues to move farther offshore into deeper waters, with the need for even more flow assurance insulation, we believe the ETNAFLOW plant – accompanied by Dow Hyperlast's local support and technical expertise – will become an increasingly valuable resource for large-scale offshore pipeline projects." ◆

TEGA Uses DIPRANE™ for Hopper Chute Liners

TEGA Industries Ltd., headquartered in Kolkata, India, is a leading internationally recognized company providing technical solutions for material handling and wear resistant applications in the mining industry in India and overseas.

TEGA was awarded a major contract in India for hopper chute liners for handling iron ore, which require high abrasion and impact resistance. Dow's DIPRANE™ TDI prepolymer was successfully used for these liners. **Mr. Graeme Kibell, head of production of TEGA** says, "Dow provided us with the technical support to process their material and timely deliveries, to meet our tight project schedules."

Paul Fitzgerald, global business leader for the engineering elastomers group of Dow Hyperlast, says, "The supply of the DIPRANE TDI prepolymer to TEGA was a pioneering project for the engineering elastomer team. It demonstrated the strength of the technical and commercial team, and global reach of the organization to win and supply on the project. It was a great effort, including technical support from Dow's formulated system houses in Marietta in the US and Birch Vale in the UK, manufacturing in Cardona, Spain, and sales by the Indian team from Mumbai and Kolkata." ◆

Dow Continues Investment in Polyurethanes Production Technology and Capacity

Dow Polyurethanes and Dow Formulated Systems continue to invest in better, more efficient, cost effective capabilities to meet customer demand in a broad range of markets and applications. Dow continues to raise the level of manufacturing excellence so that we cost-effectively produce high-quality products in a reliable fashion while minimizing our environmental footprint. In addition to the major projects and milestones listed below, Dow continues to implement improvements across our manufacturing sites daily using Six Sigma and other methodologies.

"Contained" Estarreja Plant Meets Growing MDI Demand Safely

Dow Polyurethanes' newly expanded diphenylmethane diisocyanate (MDI) plant in Estarreja, Portugal, successfully started production in May 2009. The world-scale facility provides both polymeric and crude MDI, offering customers increased flexibility and a reliable supply of this essential polyurethane raw material. The expansion, which was announced in 2006, was completed with no interruptions in customer service and no injuries or lost-time accidents.

"The expansion is the result of a great relationship with our suppliers and the Portuguese government, and enables Dow to provide customers with quality products from our world-scale facilities," said **Steven English, global business director for Dow's Isocyanates business.**

"This expansion is the most recent example of Dow's commitment to the MDI market and our ability to supply our customers long-term.

"Dow is currently the only chemical company that now has three fully contained MDI facilities," English added. "Our proactive approach to enclose our MDI production is a testament to Dow's commitment to worker safety, as well as the safety of the neighbors in our plant communities."

Revolutionary HPPO Technology Delivers Sustainability and Competitive Advantage

The successful start-up of a 300,000 metric ton propylene oxide (PO) complex in Antwerp, Belgium, in March 2009 marked the beginning of a new era in PO production, based on innovative HPPO technology developed jointly by Dow and BASF.



HPPO plant in Antwerp, Belgium

"The complex provides economies of scale, and numerous environmental benefits including reduced wastewater, energy usage and infrastructure and physical footprint," said **John Smith, global product director, Dow PO/PG.**

In April, the **SCG-Dow Group**, a joint venture between Dow and **The Siam Cement Group (SCG)**, Thailand's largest industrial conglomerate, announced the construction of a 390,000 kiloton hydrogen peroxide to propylene oxide (HPPO) plant within the Asia Industrial Estates (AIE) site near Map Ta Phut, Thailand. The new plant will bring all the advantages of HPPO technology to Asia-Pacific, which currently has one of the highest demand levels in the world for propylene oxide. The plant is scheduled to start up in 2011, providing needed capacity to serve Dow's growing customer base in the region.

Polyols Expansion on Two Continents

Dow continues to invest in polyols production around the globe to serve a range of downstream markets in strategic regions.

Dow has further developed its specialty polyol manufacturing capability at the Company's Freeport, Texas, site. Polyols manufactured at the site support demand for specialty products and systems in North America.

"Sustained market needs in specialty products have been a driving factor in this capability enhancement," said **Doug Warner, global business director for Dow Polyols**. "We want to make sure our customers have a family of differentiated products they need to remain successful, even in today's challenging conditions. It's good business sense for Dow, and part of our long-term commitment to be a reliable, responsive, solution-minded partner for our customers."

Across the Atlantic, expansion of Dow's polyurethanes plant in Terneuzen, The Netherlands, is expected to be completed by the end of 2009. The expansion will increase production capacity by 180 kilotons per annum (KTA), making Terneuzen the largest polyols production site of the eleven polyols sites that exist within Dow.

"The expansion at Terneuzen allows us to take advantage of production of propylene oxide at the new HPPO facility in nearby Antwerp," Warner said. "This investment will bring value to Dow, our customers, and the people of Terneuzen for many years to come."

Dow Systems and RS Technik Group Sign Global Alliance for Sewer Pipe Rehabilitation

In June, Dow Formulated Systems and RS Technik Group announced the formation of a global commercial alliance between the two companies, which will focus on the sewer pipeline rehabilitation market, specifically on the trenchless technology called cured-in-place pipe (CIPP).

"This alliance with Dow will further enhance RS Technik Group's ability to be a global leader in trenchless technology solutions, accelerating our growth and the development of the CIPP technology against other less competitive solutions and the traditional dig-and-replace options," explained **Klaus Mueller, president of the Board, RS Technik AG**. "The expanding pipeline rehabilitation sector will benefit from the progressive leveraging of Dow solutions, a significant factor in this alliance."

Did You Know?

Dow currently produces and distills MDI at facilities in Freeport and La Porte, Texas; Yeosu, South Korea; Stade, Germany; Delfzijl, The Netherlands; and Estarreja, Portugal.

"This alliance will significantly enhance the value to our customers by combining Dow's technology, innovative formulations and industrial strength, high performance products and global reach with RS Technik Group's state-of-the-art technology, experience and proven business model," said **Juan Antonio Merino, Dow Formulated Systems global general manager**. "It is a perfect demonstration of the strategic intent of the newly formed Dow Formulated Systems global business that combines Dow's Polyurethane Systems and Epoxy Systems businesses."

Dow Izolan Opens State-of-the-Art Facility

The Dow Izolan joint venture, formed by Dow and the Russian company Izolan, recently completed construction of a state-of-the-art production plant in Vladimir, Russia. From rigid foam systems used in construction panels and insulation to flexible foam systems used for arm rests, head rests and seating in automotive applications, the facility will produce a broad range of polyurethane systems. The new facility will enhance Dow Izolan's offering to Russian customers serving the fast-growing automotive, consumer, footwear, furniture, appliance and construction markets. ◀

DEDICATED TO EXCELLENCE – Washington Dantas began working at The Dow Chemical Company as an operator in 1976. After earning a degree in chemical engineering, he chose a varied career path, working in several countries before achieving his current position in 2002 as the Estarreja site leader in Portugal. Washington is deeply appreciated by the Estarreja community. In 2008, he received the Personality of the Year award by Radio Voz da Ria and the Anibal Drummond Prize by the Rotary Club of Estarreja. Washington recently led the Estarreja site through an MDI plant expansion with no injuries, lost-time accidents or interruptions in supply to customers. This expansion – which took about 17 months in all to be implemented, is one of the biggest recent construction projects in Portugal and has fostered pride within the Estarreja community. Washington's positive leadership and determined drive for excellence embodies the spirit of the Human Element.



With Dow Polyurethanes, Furniture & Bedding Customers Can Take Comfort



Herman Motmans, Global Marketing Director, Dow Polyurethanes



Raquel Fortes, Global Application Technology Development Leader for Furniture and Bedding, Dow Polyurethanes

Fully Aligned Marketing and Technology Development Adds Value and Delivers Solutions

Herman Motmans, global marketing director, and Raquel Fortes, global application technology development leader for Dow Polyurethanes' furniture and bedding group, spoke with *RE:Invent* about how Dow's Marketing experts collaborate with their colleagues in Research & Development (R&D) to ensure furniture and bedding customers all over the globe have access to the technologies and application development support that gives them a competitive edge. This approach is designed to meet the specialized needs of furniture and bedding foamers and manufacturers in different geographies.

Interviewer: Help us set the stage for this discussion. How do the needs of Dow Polyurethanes' furniture and bedding customers differ from one region to another?

Fortes: First of all, the value chain functions differently in different areas of the world. In Europe and North America, we mostly sell to foamers, but in Latin America, for instance, foamers are forward-integrated, so often they are also mattress producers, which impacts the way we serve them.

Motmans: That is a very important point. The level of integration in the value chain is critical. We speak with customers at different entry points in the value chain to get an overall view of what the market wants. We also offer customers a broad knowledge of market trends, as well as a clear understanding of the different technology requirements in different regions. As an example, the North American viscoelastic market is primarily MDI-based, while in Europe, it is more TDI-based. All these variables are factored in to our pipeline of new products and technologies in order to deliver the right solutions for our customers for the region they serve.



Dow's Furniture & Bedding Center of Excellence in Horgen, Switzerland, is dedicated to developing solutions to meet furniture and bedding needs throughout the value chain. The Center enables Dow to:

- Develop technology solutions globally
- Implement solutions through regional teams
- Accelerate key technology developments

Fortes: Of course, the other major differences from region to region are differences of language, culture and business practices. That is why it is so important to have our regional teams on the ground close to the customer, talking with customers in their own facilities, in their local languages. It allows us to respond quickly and accurately to the customer's needs.

Interviewer: How does Dow Polyurethanes' unique integration of Marketing and Technology – combining technical, marketing and sales support in one team – benefit customers?

Motmans: Our marketing and technology alignment has been a great asset in providing targeted value to customers. We have the right people focused on our customers' needs in every region. Our area sales representatives and marketing leadership are actively engaged with our technical service leaders and customers as application technology development partners. So you have Dow marketing and technology experts conducting joint visits with customers to ensure a complete understanding of their needs.

Fortes: When we develop our overall R&D technology road map, it is grounded in a comprehensive market understanding. By aligning marketing and technology at every point, we can translate marketing requirements into technology solutions that give customers an advantage in their markets.

Interviewer: Can you give some recent examples of how your marketing and technology teams have developed solutions that are helping customers succeed?

Fortes: One example is the way we are using our formulation know-how to achieve different performance attributes for both MDI- and TDI-based viscoelastic or "memory" foam. Depending on region and the isocyanate the customer is using, we have products that offer ranges of hardness, recovery time, and viscoelastic behavior. Also in the viscoelastic area, we're helping producers continue to improve the "breathability" of visco foams – improving the comfort of the foam and meeting a critical consumer need.

Motmans: Another example is VORALUX™ HF 4001, a new product we've introduced in Asia to give customers there a broader range of performance capabilities in high resiliency (HR) foam. VORALUX HF 4001 was developed as a mid-range performance product that gives our customers in Asia yet another option for balancing the cost-performance equation in HR foam and meeting the market needs.

Interviewer: In addition to regional teams, do you have global alignment of technology and marketing for furniture and bedding?

Fortes: Our Furniture & Bedding Center of Excellence in Horgen, Switzerland, gives us the capability to develop technology solutions on a global basis, which we can then implement through our regional teams. This global focus helps us accelerate and streamline key technology development projects, and offer new options to our customers on a timely basis, ahead of the curve.

At Dow, the collaboration of Marketing and Research & Development (R&D) has led to the introduction of a number of new furniture and bedding products for our customers around the world. Here are a few examples from our Viscoelastic and High Resiliency offerings:

Viscoelastic

- **VORALUX™ HT 762 and DHT 703.01 In Europe** – these polyols meet industry requirements across a broad range of temperatures and allow manufacturers to customize foam properties
- **VORANOL™ 3150 In Asia Pacific** – this polyol enables foamers to have a wider processing latitude and enables foam to perform across a broader range of temperatures
- **VORALUX HK 493 In Latin America** – this system includes the necessary additives and provides improved foam properties and higher yields
- **RENUVA™ Renewable Resource Technology** – available globally, delivers high levels of renewable content in foam

High Resiliency

- **VORANOL 6150 In Europe** – this new 6000 molecular weight polyol for the production of TDI- and MDI-based HR slabstock foams, provides excellent density and hardness distribution throughout the block and exceptional foam color retention during processing
- **VORANOL WL 4073 In Latin America** – this polyol provides a better processability window, while enabling high resilience properties in the foam
- **VORALUX HF 4001 In Asia** – provides a performance balanced product offering that offers greater flexibility on resiliency and strength at an affordable price
- **RENUVA Renewable Resource Technology** – available globally, delivers high levels of renewable content in foam

Interviewer: What opportunities do you see ahead for the furniture and bedding industry?

Motmans: As the global trend in mattresses moves away from innerspring construction toward more full foam construction, we see a lot of growth in both HR and viscoelastic mattress foams. As the economy recovers, more people will be willing to pay more for greater comfort and healthier sleep. The market for HR foams is fairly small today, at least when compared to the market for conventional foam, but we expect continued growth in Europe and expanding markets in North America, and we believe HR foam will continue to grow globally long-term. Viscoelastic foam is an even more specialized market than HR, but we believe it will also continue to grow, because people are becoming more aware of the importance of good sleep to good health. We already offer a full range of viscoelastic products, and as viscoelastic technology continues to evolve, we see it as a category where Dow can be an innovative leader, by addressing key issues – for example, as Raquel mentioned, the breathability of the foam.

Fortes: Another major trend in manufacturing is toward the use of renewable resources. We are making great progress with our RENUVA™ Renewable Resource Technology, which uses soybean oil and other renewable resources to produce polyols, fundamental building blocks of polyurethane foam. But, not only does RENUVA deliver a high level of renewable content in the foam, this technology also is a greenhouse-gas-neutral process that uses up to 60 percent fewer fossil fuel resources than manufacturing conventional polyols. So, RENUVA offers numerous environmental benefits. Dow has been at the forefront of developing natural oil polyols for specialty foam applications such as viscoelastic, high resilience and molded foams.

Motmans: We are also responding to other sustainability needs in the furniture and bedding industry, including the need for cleaner foam with fewer VOC (Volatile Organic Compounds) emissions. Fewer emissions are already required to meet regulations in Europe, and will likely soon be required elsewhere. And of course consumers want cleaner, fresher air in their homes. From a production standpoint, we are exploring solutions that will help customers reduce scrap and waste in the manufacturing process.

Interviewer: Do you have any final words you would like to share with us?

Fortes: I'm very proud that our approach of aligning marketing and technology has been working so well. And by that, I mean that by working closely with our customers, we are developing the right technologies to meet their goals – and our innovations will continue to be very focused on their needs and their success.

Motmans: I'd like to echo Raquel's comment. Around the world, our teams are talking to customers and really listening to them and acting on these conversations. We truly are applying the resources of a global company like Dow locally in a very meaningful way. That might mean introducing a new technology or product to meet specific regional needs, or working side-by-side with a customer in their facility to improve a manufacturing process. Every customer is unique, and so is our response. ◆

A Fresh Use for Polyurethane Systems Brings New Mattress Core, Lower Emissions and a Streamlined Manufacturing Process

Ovattificio Fortunato is an Italian manufacturer with a reputation for innovation and precision, providing high-quality mattress boxes, felts, paddings for mattress and materials for bedding, furniture and various other applications. Normally, manufacturers of mattresses use felt and wadding for stuffing. Ovattificio Fortunato, with the help of Dow Formulated Systems, developed new applications for polyurethane flexible systems that led to the creation of new products and new market opportunities.

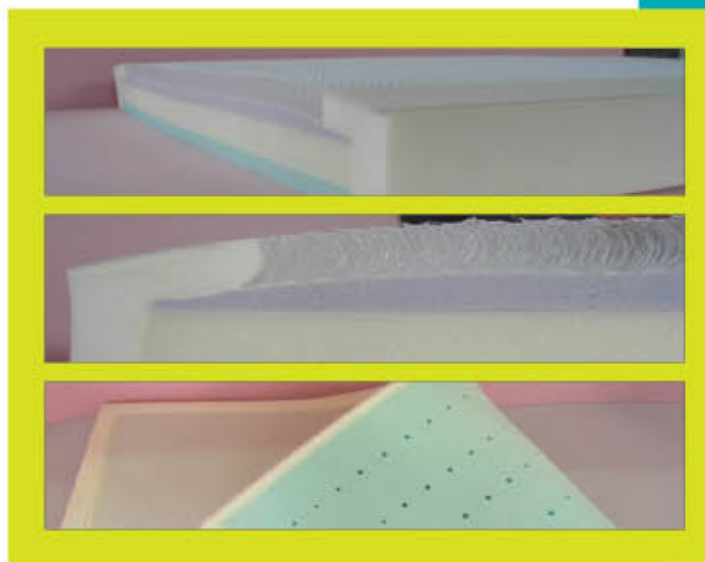
The key to Ovattificio Fortunato's innovation is a three-dimensional textile, honeycomb-shaped elastic mattress core system that provides greater comfort than traditional springs. Dow Formulated Systems worked with the company to enhance their product by injecting a flexible, low emission polyurethane foam system, VORALUX™ HK 489, around the honeycomb. The new mattress core utilizes the polyurethane system to encapsulate the components of the box, binding together the multiple layers with a breathable, open, viscoelastic polyurethane foam to provide even more comfort. And, the new polyurethane mattress core is easier to wash and sanitize than traditional boxes for mattresses, making it ideal for children's mattresses.

The collaboration with Dow has allowed us to develop a new sector of our company that is very interesting.

Equally important was the fact that Dow's low emission polyurethane system uses VORANOL™ VORACTIV™ polyols, which emit virtually no Volatile Organic Compounds (VOCs) or odors. This enhances indoor air quality in the bedroom and is especially significant for consumers when you consider that people spend at least a third of each day asleep and in contact with their mattresses.

Streamlined Manufacturing Process Reduces Waste and Emissions

To best utilize the newly developed Dow polyurethane system, Ovattificio Fortunato designed a new manufacturing process. This process enables the item to be manufactured to the exact size and shape of the final product, so they don't need to be cut to size. This streamlines the manufacturing process and reduces foam scrap waste dramatically.



The new molded foam process uses a liquid, flexible polyurethane system to create foam on-site and in place, so it requires far less storage space compared with storing large quantities of slabstock foam in the plant. And, the molding process uses a closed-mold system that is friendlier for workers, since it requires far less manual involvement and virtually eliminates emissions and odors in the factory.

"Dow TSRs (Technical Sales Representatives) worked with Ovattificio Fortunato every step of the way to develop the new mattress – from supporting the mold process development, to selecting the foaming machine, to perfecting the process of injecting the polyurethane flex foam into the mattress. We really wanted to help them arrive at the right solution for their needs," said **Alberto Mercati**, **Dow Formulated Systems House director, Italy**.

"The collaboration with Dow has allowed us to develop a new sector of our company that is very interesting. The competence and the availability of Dow TSRs has enabled us to achieve the desired objectives. We believe that in the future, our collaboration will lead us to further develop innovative products and new markets with mutual satisfaction," said **Mr. Pasquale Fortunato**, **Ovattificio Fortunato's owner**. ◀

Hot Buttered Elves and Dow Team Create New "Green" Wallables™, Fun Wall Décor in Touch with Kids and the Environment

Wallables™ are 3-dimensional, sculpted wall décor products that kids and parents love because they're touchable, moveable, safe and fun. Now, there's even more to like about Wallables, because they are made of soy-based foam created with RENUVA™ Renewable Resource Technology from Dow.

Wallables are manufactured by **Hot Buttered Elves**, a creative Los Angeles-based company owned by **entrepreneur Dan Garr**. Garr developed Wallables after working on an interior design project for the pediatric wing of a California hospital. The popularity of the unique wall art that he created for the hospital eventually grew into the Wallables business.

When he began developing Wallables for retail sales, Garr wanted the products to be fun, safe and as environmentally friendly as possible. Once he learned about RENUVA Technology, which replaces petroleum-based raw materials with soy-based materials, Garr immediately saw the market potential of offering children's toys made with soy-based foam.

"Many consumers are putting the word out that they want more 'green' products that have less impact on the environment and less packaging," Garr said. "Dow was the first company on my radar as soon as I got the idea to create Wallables from soy-based foam."

When he first called Dow to discuss his idea, Garr spoke with **Umberto Torresan**, **Dow Polyurethanes' global marketing manager for RENUVA**, who was intrigued by the entrepreneur's unique company and product.

"Dow may be a large company, but we're very interested in working with companies of any size that have big ideas," Torresan said. "Dan brings great creativity and passion to his work, and he thinks big. As we worked with Dan to help him achieve his vision, we learned more about the vast opportunities for RENUVA™ technology in toys and products for kids. Wallables made with RENUVA truly embody the sustainability premise of enhancing the quality of life of current and future generations."

You Don't Have to Be a Chemist to Design Your Own Polyurethane

From Garr's perspective, working with Dow Polyurethanes helped him become a "polyurethane architect" and design a material that suited his unique needs. "One of the things that most impressed me about Dow was their willingness to work with



Fast Facts about Wallables™

Wallables are:

- Three-dimensional sculpted wall décor made from soft polyurethane foam that attach to the wall with Velcro® patches for easy on/easy off and repositionable application
- Touchable, interactive toys that play music, teach the alphabet and glow in the dark
- Safe for children, meeting ASTM and CE toy safety standards for all countries
- Produced by Hot Buttered Elves, Inc., a creative design firm based in Los Angeles, California, U.S.A

Find out more at www.wallables.com and www.hotbutteredelves.com.



me in designing the exact formula I needed to get the detail in the Wallables that make them so special, while ensuring that they are safe for young children," Garr said.

"I worked closely with **Michael Coffman, a technical sales representative** from the Dow Formulated Systems House in Marietta, Georgia," he continued. "Michael showed me the technical side of how he creates formulas with the library of polyurethanes. I needed a formula that would allow us to create more intricate details on our characters while not sacrificing safety. Mike put together the most amazing formula, and now small parts can't be pulled off. This new RENUVA™ formulation truly defines our product, and will allow us much more freedom in sculpting.

"There was never a language barrier in terms of my working directly with a technical person at Dow and being able to convey my needs and translate them into a unique formulation. Michael directed the development of the formula, working with a **senior Dow R&D chemist, Dave Honkomp**. It only took about a month to get my first sample. Then by the second sample, we had the formulation I needed. And all along the way, the group in Marietta, Georgia, was great to work with – very friendly and family-oriented."

Throughout the process, Garr appreciated Dow's understanding of his product and his vision. "When I grew up, I always heard 'don't touch' – but touch is natural and necessary for learning," he said. "The very first Wallable I made was for a friend's child who was born blind and couldn't hear. I made him something

There was never a language barrier in terms of my working directly with a technical person at Dow and being able to convey my needs and translate them into a unique formulation.

with so much detail, he could see it through his hands, and he loved it. That's why Wallables are so unique and fun for children – they encourage a child's natural yearning to touch, explore and imagine. Dow is helping me do that in a more environmentally friendly way on a large scale."

Socially Sustainable Soy-Based Toys

Another important concern for Garr in using RENUVA Technology was that it does not take soybeans out of the food chain, since it's made from soybean oil, a by-product of soybean processing. "I'm designing products that make people happy and help them feel good," Garr said. "RENUVA Technology can do this on a huge scale without impacting the food supply. That's one more reason to feel good about what we're doing. Eventually, I want to make Wallables from 100-percent soy. I realize that this will take some intense chemistry, but Dow is the kind of company that can make it happen. It won't be long before you go green, or you are gone in this market!"

The "Jungle Sweeties" line of Wallables will be the first to be made with RENUVA Technology and will be available for retail sales during the fourth quarter of 2009. ◀



New Energy Efficient, Environmentally Conscious Standard-K and Low-K Systems for Appliance Insulation

Prodded by increasingly stringent regulations globally, today's appliance makers are continually seeking ways to make household refrigerators and freezers more energy efficient, while at the same time meeting environmental requirements and customer demands for cost-efficient, high-performing products.

Thanks to a new generation of lower-emission rigid polyurethane foam systems that provide strong insulating performance, Dow is taking a leadership role in helping ensure that its customers can meet both the environmental and energy requirements for more environmentally conscious refrigerator and freezer technology in every part of the world.

Standard and low-k systems within the VORATEC™ polyurethane components product line give appliance makers the option to select insulating foam systems that can provide improved performance in a targeted and cost-efficient way in each region of the globe. And, because of the lower-emission blowing agents, these new-generation foams also enable more sustainable appliances that reduce greenhouse gas emissions and help stabilize global warming.

"Energy-efficiency and environmental legislations are increasing rapidly across the globe and are a driver for new technology and innovation in the industry," said **Bruno Barbet**, **global appliance market leader for Dow Formulated Systems**.

"Dow is positioned to meet the broad range of the current market needs as well as anticipate future needs."

Dow Innovations Save Energy and Minimize Emissions

Worldwide, household refrigerator-freezers are currently the most popular major appliance. Approximately 60 million units are produced annually, and about 500 million units are in service across the globe. But because refrigerator-freezers run 24/7, they tend to use more household electricity than any other appliance.

Energy-efficiency improvements in refrigerator-freezers are directly influenced by the overall thermal performance of the cabinet and doors, where up to 75 percent of the cold can escape. (The remaining 25 percent of the cold is lost when the door is opened or by cooling food.) In the last 10 years, refrigeration technology has improved by leaps and bounds, and the insulation has improved along with it, as manufacturers have made the switch from ozone-depleting chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) to more environmentally friendly, low-emission blowing agents.

However, compounds for foam manufacture that have no ozone depletion potential have not always retained the same high levels of thermal performance. In some cases, alternative production systems were required.

Dow's novel standard and low-k-factor and fast-curing VORATEC™ polyurethane systems increase energy savings by 3 to 5 percent without compromising any process and foam behavior such as demolding time (which affects productivity) or applied density (which impacts costs). This outstanding performance is achieved primarily in two ways. First, the fine, closed-cell structure of these foams improves their thermal insulating properties. Second, the foams contain cell gases that are poor heat conductors, limiting the refrigerator-freezer heat loss.

"Dow's standard and low-k polyurethane systems formulations offer combined high energy efficiency and fast productivity for outstanding performance in the domestic appliance industry," said **Vanni Parenti, global appliance technology leader for Dow Formulated Systems**. "Our technology allows refrigerator manufacturers to achieve both enhanced insulation properties and cost-saving manufacturing efficiencies, while meeting environmental standards. It's a real win-win."

Meeting Global Needs

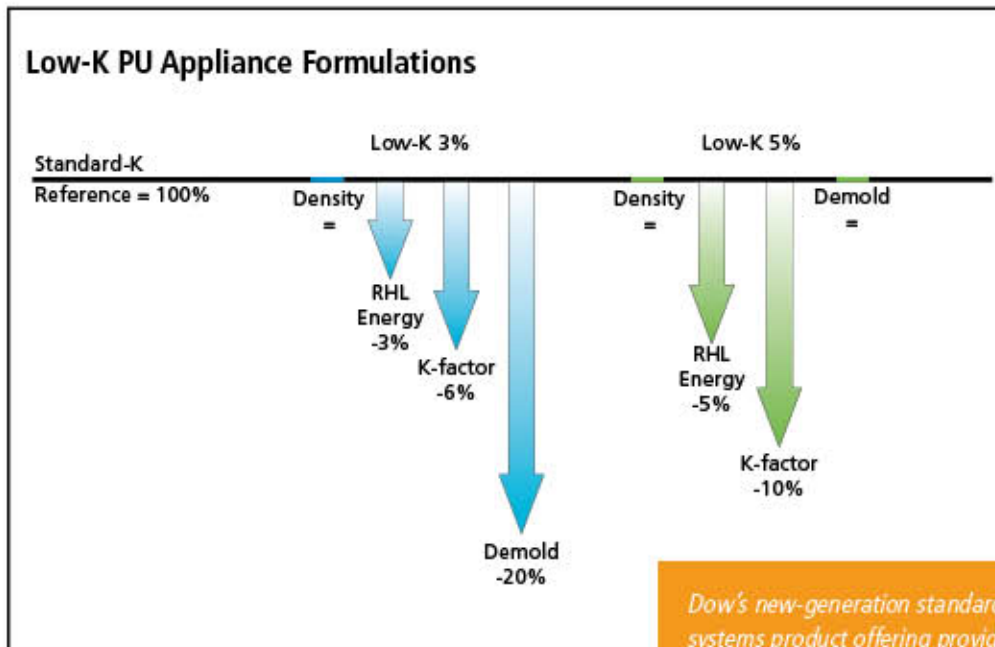
Because legislative and manufacturing requirements differ among the many countries and appliance customers it serves, Dow Formulated Systems has developed a portfolio of new-generation solutions to address the

unique needs of developed, developing and emerging countries for energy-efficient and environmentally conscious refrigeration. These advanced rigid polyurethane foam technologies are designed to increase productivity and manage cost for appliance manufacturers, while providing excellent thermal insulation values and reduced greenhouse gas emissions.

Some systems utilize hydrocarbon blowing agents, while others incorporate HFC blowing agents. Specific systems are also tailored to deliver other key properties, such as fast demold times and enhanced foam esthetics, to meet the specific original equipment manufacturer (OEM) requirements.

These new-generation foams are another example of how Dow is dedicated to anticipating changing customer and market needs and developing solutions to meet them.

"We take the responsibility for contributing to sustainability very seriously," Barbet said. "The household appliance industry demands a variety of solutions to fit the differing legislative, manufacturing and consumer needs in every part of the world. We believe our new generation of rigid polyurethane systems addresses these needs, and will give our customers a strong competitive advantage in producing high performance, sustainable appliances." ◆



Dow's new-generation standard and low-k polyurethane systems product offering provides energy savings that range from standard savings up to as much as 3 to 5 percent without compromising any manufacturing process or foam behavior. Applied density remains the same. K-factor, or thermal conductivity, improves. Reverse Heat Energy Leakage (RHL) performance also improves. Demold remains the same or improves, enhancing productivity depending on the system used.

Dow India's Jaipur Foot Initiative Looking to Take the Next Step



It's already 20 percent lighter than its predecessor, more flexible and more efficient to manufacture. Now Dow is looking to modify the polyurethane material further to add more "mileage" to the product's life. It's all part of Dow's ongoing collaboration with customer **Pinnacle Industries**, India's largest commercial vehicle seating and interiors company. But the product they have collaborated on for the last five years is not related to the automotive industry at all. It is a prosthetic foot that is part of a philanthropic effort by non-governmental organization, **Bhagwan Mahaveer Viklang Sahayata Samiti (BMVSS)**, based in Jaipur, India.

BMVSS is the world's largest organization for the handicapped, benefiting more than one million handicapped in India and abroad since its inception in 1975. BMVSS fabricates and provides artificial limbs, calipers and other aids and appliances free of charge to handicapped people. For many of those years, the prosthetics provided were made from vulcanized rubber. In 2005, Pinnacle and Dow worked together to develop a polyurethanes model, enabling a more efficient fabrication process. This would allow prosthetics to be custom-made onsite at non-manufacturing locations, where recipients would receive them.

The result of this collaboration – the Jaipur Foot – was not only easier fabrication and distribution, but also, numerous other benefits for the artificial limb recipients. The polyurethane foot was lighter than its rubber counterpart and much more flexible, allowing it to twist and bend more like a natural foot. The Jaipur Foot is also more natural looking than most prosthetics – including other polyurethane prosthetics.

Since the initial development in 2005, Dow has continued to work with Pinnacle and BMVSS to fine-tune the material composition. Current efforts are focused on modifying the material of the keel – the structural center of the sole, running from toe to heel – to improve compatibility and adhesion. This is expected to extend – possibly doubling – the foot's useful product life.

BMVSS fabricates and distributes the Jaipur foot at Jaipur Foot Camps held in various parts of the country. This makes it easier

for the disabled persons, many of whom live in rural areas of India, to access the free rehabilitative services. Dow India helped by organizing three such camps in 2008 – in Mumbai, Pune and Chennai – and by providing volunteers to assist with fitting and fabrication. A polyurethane dispensing machine was funded by the Indian government, and Dow's **Shivkumar Mehra, technical business manager**, provided technical support with start-up and production stabilization.

Talking about the experience, **Vanaja**, who accompanied her handicapped mother at this camp, said "Two years back my mother had lost her leg due to high diabetes, she hasn't walked since then. This camp has been truly a blessing for my family. My mother can walk now and be independent again. We are very thankful to Dow India and BMVSS for making this happen."

In response to its efforts with the Jaipur Foot Camp Initiative, the **Kolhapur Paralympic Association** presented Dow India with the Solace of the Handicapped 2008 award, during the 49th World Disability Day. Dow India and BMVSS are organizing three Jaipur Foot camps for 2009.

"With the generous financial help of Dow India, more than 5,000 poor, physically challenged people got artificial limbs through BMVSS Jaipur in 2008, helping them to regain their mobility and dignity," said **D. R. Mehta, founder patron of BMVSS**. "The new polyurethane foot, developed in collaboration with Dow and another well known scientific institution, is a development that could revolutionize foot technology in the world." ◀

Read more about the Jaipur Foot program at www.jaipurfoot.org.



THE ENERGY TO TURN CHALLENGES INTO OPPORTUNITIES. Rigid panel manufacturers don't have to give up energy efficiency to increase the fire safety performance of their products. VORATHERM™ polyisocyanurate Insulation from Dow not only offers excellent thermal insulation performance, it can be tailored to meet a range of fire resistance specifications. Innovations that can help save energy *and* save lives – that's the spirit of the Human Element.



www.voratherm.com
www.dowpolyurethanes.com

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Dow Izolan Starts Up New Manufacturing Plant in Vladimir, Russia

The Dow Izolan joint venture company, formed in the second half of 2006 by Dow and the Russian company Izolan, recently completed construction of a new, large and state-of-the-art production plant in Vladimir, Russia. The plant will begin production in December 2009, which will further enhance Dow Izolan's ability to service a growing customer base in Russia and the Commonwealth of Independent States (CIS) with tailored high-performance and high-quality polyurethane systems.

"We have been progressing with the construction work as planned, and as anticipated we will be able to start up production before the end of 2009," commented Mikhail Tsarfin, Dow Izolan general manager.

"We are proud of having been able to confirm to our customers, to the local authorities and the community in Vladimir, to our employees and to the market that Dow Izolan succeeded in meeting our schedule and that the first products made by our new and technologically advanced manufacturing plant are commercialized, helping our customers further grow and differentiate from their competitors," Tsarfin added. ◆

Visit www.dowizolan.ru to learn more.

Polyurethane Technology Offers Competitive Advantage for Growing Composites Market

Even amid global economic challenges, the \$80 billion composites market continues to grow. For fabricators who would like to take advantage of this growing market, polyurethane composite technology from Dow can provide a significant competitive advantage. With products such as SPECTRIM™ RL Reaction Moldable Products, current polyurethane molders can diversify their capabilities to produce polyurethane composites for a wide variety of applications, from flooring to transportation, and much more.

Polyurethane Composite applications include:

- Agricultural & Construction Vehicles
- Construction Decking & Cladding
- Door Skins
- Recreation & Sport
- Automotive & Commercial Transportation
- Equipment Enclosures
- Furniture
- ...and more

Substantial Benefits with Greater Flexibility

Compared with other composite technologies such as vinyl ester, polyurethane composites offer substantial benefits for greater flexibility:

- **Strength and thermal resistance:** Polyurethane-based composites have a good balance of thermal resistance and impact resistance, which are key in transportation applications. Formulators can also use a spraying technique to reinforce the strength of the product for even more application possibilities.
- **Light weight, part design flexibility and creativity:** Polyurethane composites can be produced at various densities, and yet remain very lightweight – a competitive advantage compared to thermoplastics. Polyurethane composites also accommodate complex shapes, allowing for part integration and innovative design. Low tooling costs allow favorable economics on shorter product runs.

- **Increased productivity:** The faster reactivity of polyurethane chemistry improves cycle times and increases productivity. For example, polyurethane composites can save time when it comes to the painting process, since paint can be applied in the mold before parts are made. In this instance, parts are already painted when they emerge from the mold. New fabrication processes such as Long Fiber Injection (LFI) offer significant cycle time reduction versus traditional processes such as Resin Transfer Molding (RTM).
- **Environmental benefits:** When compared with polyester composites, polyurethane composites provide environmental advantages and a clean working environment since no styrene is involved and emissions are lower overall.



Harita Seating Systems Limited is a fabricator that diversified its business into the agricultural vehicle market through an innovative application using polyurethane composite technology.

"The advantages of polyurethane composites give fabricators the flexibility to compete in a wide variety of applications and expand their businesses by tapping into the tremendous growth of composites," said **Marcel Loyson, Dow Formulated Systems global marketing leader for composites.** "Even in these challenging times, polyurethane composites from Dow can help fabricators diversify and grow their businesses into markets and applications that they may have never considered before."

The advantages of polyurethane composites give fabricators the flexibility to compete in a wide variety of applications and expand their businesses by tapping into the tremendous growth of composites.

For example, **Harita Seating Systems Ltd.** is a polyurethanes fabricator based in India that invested in equipment to enter the agricultural equipment market with tractor engine covers. The innovative application uses a long fiber injection (LFI) process using polyurethane composite resin technology from Dow Formulated Systems.

During the LFI process used by Harita, paint is applied in the mold, so the parts emerge from the mold with an eye-catching, high-gloss finish. Extensive endurance tests of the engine covers showed that they are durable as well as attractive. The company increased its monthly production capacity significantly, and they have plans to step up production for export to China and Europe in the future.

"When we planned our product diversification, our intention was to add content per vehicle offering. In line with this objective, we developed a cost-effective LFI which is a polyurethane composite and could replace metal and plastic for vehicle interior and exterior," said **Mr. Thalgarajan, president – Harita Seating Systems Ltd.** "In this effort of ours, Dow Polyurethanes played a significant role in the development activities. We felt that this joint effort of ours would bring in newer solutions for the automotive industry."

Harita is just one example of a fabricator that has successfully diversified its business using SPECTRIM™ reaction moldable system from Dow. With an \$80 billion global opportunity



just waiting to be tapped, formulators can dream about entirely new applications – and make those dreams a reality through polyurethane composite resins from Dow Formulated Systems. ◀

Get more information on SPECTRIM systems at www.dowpolyurethanes.com.



THE SECRET TO SUSTAINABILITY IS THE SEAMLESS INTEGRATION OF NATURE AND HUMANITY. Green roofs enhance aesthetics while reducing greenhouse gases, rainwater runoff and electricity use. And with VERDISEAL™ Waterproofing System from Dow Polyurethanes, green roofs are easy to install, leak-proof and include renewable content. Just one more example of how, through the spirit of the Human Element, Dow Innovation is unlocking the door to a sustainable future.



www.verdiseal.com
www.dowpolyurethanes.com

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The award-winning Acerbis X-Seat was designed with assistance from Dow Formulated Systems and its SPECFLEX™ polyurethane systems. The X-Seat earned a prestigious Kikstar award at the 41st Indianapolis Dealer Expo, one of the world's most important showcase events for professional motorbikes.

Helping Acerbis Deliver a High-Comfort Ride

Acerbis is a cutting-edge company that produces high-performance seats, fenders and other innovative products for competitive motorbikes. In the past, Acerbis relied solely on traditional materials such as rubber, cotton and felt to manufacture its motorbike seats and hadn't considered polyurethanes. But when they wanted to design a seat that provided riders with more comfort without sacrificing durability, Dow Formulated Systems helped them arrive at a stylish solution.

We started to test several plastic materials to be used in combination with elastomers rotomoulding technology. Thanks to Dow Formulated Systems, we found a PU foam solution with outstanding properties and performance.

A One-Piece Solution with SPECFLEX™ Polyurethane Systems

Acerbis worked with Cesare Greco, a technical sales representative (TSR) from Dow Formulated Systems, to learn more about the many different possibilities that could be achieved with polyurethanes systems. Ideally, they wanted to create a high-tech seat from the inside out: using a new material and foam-injected design with a one-piece outer shell.

Working with Acerbis, Greco was able to show them that the SPECFLEX NR integral skin system from Dow provided exactly what they were looking for. Over time, they co-developed the new seat from concept to implementation on the production line. Dow Formulated Systems also formulated the material to meet the specific performance qualities that Acerbis needed: durability, cushioning, vibration dampening and unique style.

"We were looking for a new idea in order to create an improved bike saddle," said **Walter Signori, general manager, Acerbis**. "We listened to biker professionals, who lamented the problem of durability of the saddle, in particular, in tough sport disciplines like motocross. So we started to test several plastic materials, to be used in combination with elastomers rotomoulding technology. Thanks to Dow Formulated Systems, we found a PU foam solution with outstanding properties and performance."

The result of the collaboration is now the award-winning Acerbis X-Seat, which was selected as one of the top ten products of 2009 for its originality, design and unique qualities. The seat is already being sold for major motorbikes brands including Honda, Yamaha, Kawasaki, Suzuki and others. ◀

Find out more about Acerbis at www.acerbis.it.

Get more information on SPECFLEX and Dow Polyurethanes at www.dowpolyurethanes.com.



Dow in Ukraine Helps Orphans Live Better Lives

In the Ukrainian city of Feodosia, hundreds of children are living better lives today because of the teamwork of Dow Polyurethanes, local Ukrainian construction companies and **Dow Izolan**, a joint venture between The Dow Chemical Company and **Izolan**, a leading Russian polyurethanes producer.

Dow Formulated Systems specialists recommended a new roof system using technology and products from Dow Izolan, with installation by two Ukrainian construction firms. The new roof system provides both thermal and waterproofing insulation to make the school safer and more comfortable year-round.

Since 2007, Dow has been working in Ukraine to provide clean drinking water for more than 1,300 under-privileged children in the region, including the children who live in Feodosia's boarding school for orphans. After installing water purification equipment at the school, Dow employees saw the need to renovate the building's aging roof, which was leaking badly and making the school both unsafe and unhealthy for the children and teachers inside.

Oksana Pilatova, Dow country manager for Ukraine, led a project to provide a new roof for the orphans' school. After consulting with specialists from Dow Formulated Systems, the project team decided to use products made locally by Dow Izolan to keep the existing roof structure. This helped save time and money for the project, while also providing the best roof performance for the country's challenging weather conditions.

"Our desire was to provide real help to the children at the boarding school in Feodosia, and we're so proud that Dow's polyurethanes products and technology allowed us to reconstruct the roof – as well as provide thermal and waterproofing insulation for the building," Pilatova said. "It has truly been a rewarding project for everyone involved, and we're honored to have had the opportunity to help." ◆



A crumbling roof at a Ukrainian boarding school for orphans was causing considerable water damage, resulting in unhealthy and unsafe living conditions for the school's students and teachers.





Improving Air Quality in Your Car and in Your Home

In response to the stringent requirements of European automakers, Dow Automotive Systems is working with several Original Equipment Manufacturers (OEMs) and leading first tier suppliers to implement systems and provide raw materials that help to enable very low emission foams for automotive interiors. The new solutions deliver improved cabin air quality, as well as advanced performance properties for applications like headrests, armrests, seating and NVH (Noise, Vibration, Harshness).

"With polyurethane systems created with VORANOL™ VORACTIV™ polyol technology, automakers can reduce VOCs (Volatile Organic Compounds) inside their vehicles, limiting unpleasant odors and improving air quality, providing a healthier and more comfortable environment for occupants," said **Eugenio Tocciano, marketing manager, Dow Automotive Systems**. "Thanks to the built-in amine catalyst technology, we also can help foamers eliminate a formulating step and streamline their process, which can save them time, improve their yields, and ultimately reduce waste."

A few years ago, Volkswagen took the lead setting specific VOC requirements and driving the development of polyurethane systems tailored to its own specifications. These have now by far become the industry standard. At the same time, more stringent specifications, driven by other premium German and/or Japanese OEMs, are emerging, requiring tailor-made systems, which Dow Automotive Systems is developing with VORANOL VORACTIV polyol technology. This technology excellence and differentiation helps Dow to be one of the market leaders in Europe for polyurethane flexible seating and NVH foam systems used in automotive applications. Other tailor-made PU systems, like the one used to back foam instrument panel and interior trims, or to create integral skins for steering wheels, are and can further benefit, from Dow's differentiated VORANOL VORACTIV technology

"Even with the automotive industry facing unprecedented challenges, we're doing a great deal with VORANOL VORACTIV polyol technology right now," Tocciano said, "They look at it as an enabler to help OEMs address regulatory requirements while at the

same time delivering clear productivity improvements for the foam converters and ultimately meeting the need of consumers requiring 'cleaner/healthier' alternatives."

However, the automotive industry is not the only industry interested in the benefits of VORANOL VORACTIV polyol technology.

"We continue to work closely with our customers to help them develop foams for mattresses and upholstered furniture with reduced emissions," said **Marcel Loyson, global market leader, for Dow Polyurethanes' flex specialties & composites group**. "Eliminating emissions is very important inside the house, because people spend so much time at home, including sleeping many hours each night in a relatively closed environment. If we know a foamer is not already working on low emission formulations, we make them aware of this market opportunity and offer our best sustainable solutions to help them participate."

A Growing Portfolio of Sustainable Solutions

Dow Polyurethanes continues to act as an industry leader offering a portfolio of sustainable solutions. An example of this is Dow's combined offering of RENUVA™ and VORANOL™ VORACTIV™ technologies. The combination of these products would offer customers an additional solution that delivers both low VOC emissions and renewable content in a single system.

"VORANOL VORACTIV continues to be a technology and product offering that is valued by certain key customers, and in certain regions and applications – like automotive and furniture and bedding," said **Herman Motmans, global marketing director for Dow Polyurethanes**. "The Dow Polyurethanes business will continue to support VORANOL VORACTIV technology in the markets where it is valued by our customers." ◀

To learn more about the benefits of VORANOL VORACTIV visit www.voractiv.com.

Bentley Motors and Dow Hyperlast Develop Advanced Suspension Design



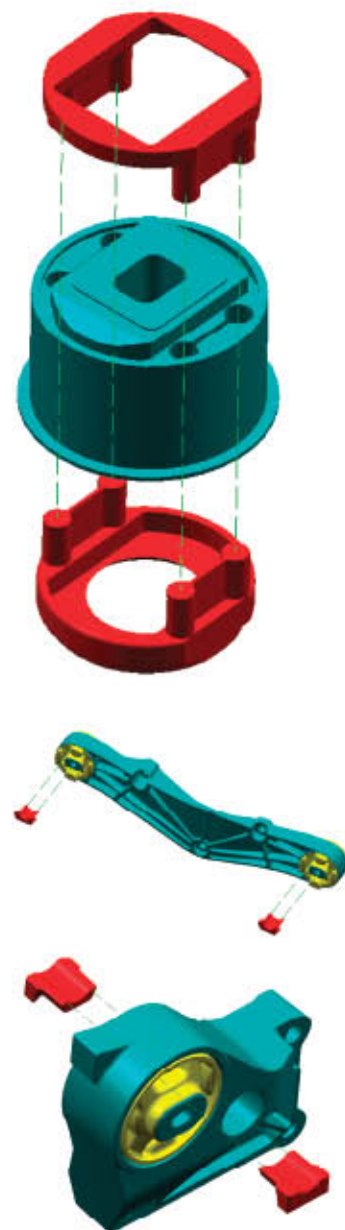
Drawing on the exceptional properties of AUTOTHANE™ microcellular polyurethane elastomer to modify the behavior of specific shock and vibration management components, Dow Hyperlast and Bentley Engineers have produced advanced suspension designs that provide enhanced ride and handling performance for the Bentley Continental GT.

Working closely together, the engineers have optimized the component geometry to provide prototype components for extensive ride and handling evaluations. The result is a series of insert and cushioning components, used to limit the reaction and traverse of vibration isolation bushings by progressive reaction stiffening of torque loads.

The excellent properties of AUTOTHANE microcellular elastomer allow it to be compressed and returned to its original shape repeatedly under heavy loads within the mechanically harsh working environment of a suspension unit. Knowing how AUTOTHANE microcellular elastomer behaves under various loads and at various temperatures is critical to the design of the jounce bumpers themselves, since the load to weight deflections at certain temperatures is vital to the performance of the vehicle.

Aimed specifically at vehicle suspension systems, AUTOTHANE microcellular elastomer is sold globally through licensed distributors, and is now performing on the race track and through a growing range of everyday vehicles, from passenger cars to haulage trucks, across the world.

The Bentley concept of using AUTOTHANE™ microcellular elastomer to moderate and control the behavior of other elastomeric engineering components represents a significant advancement in the development of composite polymer engineering to achieve greater standards of NVH performance, and delivers the enhanced levels of driver and passenger comfort represented by the Bentley marquee. ▶



Eco-Sandal Steps Up Sustainability and Innovation Efforts in Mexico

Dow, **Grupo Ravi** and **Wal-Mart** joined forces to introduce a new product to the Mexican market – the first ecological sandal for women. Following an intense and creative collaboration across the entire value chain, including design, manufacturing, packaging and distribution, the ecological sandal – named “Green Comfort” – was launched in December 2008. After 15 days, 50 percent of the inventory was already sold, proving once again that good environmental stewardship also means good business.

Through a shared vision of creating sustainable footwear, Grupo Ravi is a well-recognized Mexican company with more than 50 years of expertise in the local footwear market. The soles of the sandals were developed in collaboration with Dow, using an innovative Dow polyurethane system that creates polyols based on natural oils. In addition, the sandal is produced with vegetable-pigmented leathers, zero solvents in the manufacturing process, and sold in 100-percent recyclable and recycled packaging.

In this challenge, Dow’s support and high-technology materials produced the perfect fit.

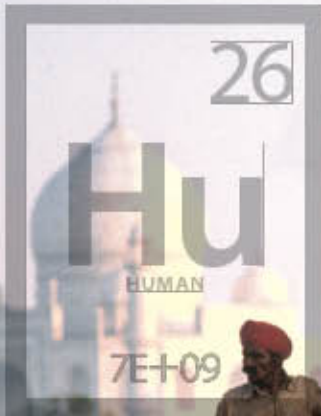
“Due to the great response, we are planning to grow the array of ‘Green Comfort’ designs including a new model for men, expanding the scope of the market segments we cover,” said **Victor Campos, general director of Grupo Ravi de México**. “Our ecological sandal maximizes comfort by combining great flexibility to reduce tiredness, improved anti-skid properties, high impact-absorption for prolonged-use, and a whole ergonomic and biomechanics applied to the insole and sole design. In this challenge, Dow’s support and high-technology materials produced the perfect fit.”



“‘Green Comfort’ is an innovative product in terms of design and technology, but it is also a strong demonstration of the value that collaborative work can bring not only to our businesses but to everyday consumers,” said **David Blakemore, president of the North Region of Dow Latin America**. “Aligned to our corporate commitments, we have delivered a sustainable alternative to footwear consumers thanks to innovation across the value-chain that sets the example for sustainability in Mexico.”

Due to the positive response from consumers, Grupo Ravi is working to expand their line of Green Comfort sandals with a new model for men. And Wal-Mart is looking forward to offering the expanded product line to their customers.

“We are committed to providing our customers with an ample array of products that serve their needs while preserving the environment for future generations. This task requires the support and cooperation with other companies that take sustainability seriously like Dow and Grupo Ravi. We have established a virtuous relationship where companies, customers and planet, create a win-win-win cooperation,” said **Raúl Argüelles, senior vice president for Corporate Affairs and Human Resources, Wal-Mart de México**. ◀



THE SCIENCE OF HERE TO THERE. Our very survival depends on our ability to move ourselves and our needs from place to place. And the science of it, the chemistry of it, is the endless pursuit of ways to do it that use less energy and are less harmful to the planet. Always mindful, as we develop better batteries and more effective  filters to make electric and diesel power relevant, that the most important element of the story is the story of the elements. Carbon. Hydrogen. Oxygen. And human.

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Green Footprint Project Showcases Renewable Polyurethanes for Footwear

The Green Footprint Project, led by Dow Italia, was created to showcase the possibilities for stylish, high-quality footwear made from new, bio-based polyurethane materials made with RENUVA™ Renewable Resource Technology.

With the contribution of the European Union's LIFE financial instrument*, Dow Italia is partnering with **Mondial Suole** (www.mondialsuole.com) to demonstrate that renewable polyurethanes provide attractive options for footwear manufacturers.

Dow utilizes RENUVA Renewable Resource Technology to provide many environmental benefits in the polyurethane manufacturing process, including the ability to reduce fossil fuel usage up to 20-25 percent, lower energy costs for savings up to 13 percent, and reducing the carbon footprint by 0.7 tons of CO₂ per ton of polyurethane. ◀

For more information about the Green Footprint Project, please visit www.greenfootprintproject.eu. More about RENUVA Renewable Resource Technology is available at www.dow.com/renuva.



RENUVA™
Renewable Resource Technology

* LIFE is the European Union's financial instrument supporting environmental and nature conservation projects throughout the EU, as well as in some candidate, acceding and neighboring countries. Source: <http://ec.europa.eu/environment/life>.



Footwear

PG USP/EP: A Recipe for Purity



While Dow's products are often hailed for their exceptional quality, the high purity levels of its Propylene Glycol USP/EP (PG USP/EP) allow it to be used as an ingredient in products subject to very stringent standards, including foods, beverages, cosmetics, personal care products, pharmaceuticals and animal feeds.

Purity Plus

Since these PG USP/EP applications have a direct impact on human and animal health and safety, Dow follows some of the most rigorous quality-control processes in the industry. Thanks to Dow's unprecedented *Purity Plus* standards, customers worldwide can count on receiving a high-quality product that offers one of the highest specified purities available on the market.

To fulfill the *Purity* portion of this commitment, Dow produces and handles PG USP/EP using Good Manufacturing Practices (GMP) based on the International Pharmaceutical Excipients Council (IPEC) and Pharmaceutical Quality Group (PQG). Strict adherence to these GMP guidelines means PG USP/EP meets rigorous manufacturing and shipping standards. Precise documentation at every stage helps ensure that the product's high level of purity is maintained every step of the way, from manufacturing to packaging to shipment around the world.

...what really impressed the manufacturer was that the addition of PG USP/EP helped extend the product's shelf life by keeping it moist longer.



The *Plus* promise takes it one step farther, allowing customers to count on Dow's:

- Nearly 60 years of experience as a manufacturer and supplier of propylene glycol
- Global, reliable supply that meets quality and purity requirements
- Global Technical Service & Development and Quality Assurance groups
- Extensive education and training resources
- Unrivalled product stewardship, health, safety and environmental protection
- Commitment to quality

Making the Switch For Better Pet Food

The *Purity Plus* benefits were among the reasons a leading pet food manufacturer made the switch from sorbitol, a natural product, to Dow PG USP/EP in its dog food earlier this year. But what really impressed the manufacturer was that the addition of PG USP/EP helped extend the product's shelf life by keeping it moist longer. And since PG USP/EP also acts as a lubricant for processing equipment at concentrations as low as 1-2 percent, there is less wear and tear on some equipment, reduced time intervals for cleaning and reduced power consumption.

Dow Technical Service & Development Representative Andrew Larson visited the company's pilot plant to ensure a smooth transition to Dow PG USP/EP. "I worked with the customer on-site to smooth out the manufacturing process so that the end product met their exact quality specifications. We also wanted to be sure that their production process made the most efficient use possible of the PG, with little or no waste."

John Smith, global product director for Dow PO/PG, adds: "By adhering to strict GMP guidelines, we could ensure the customer that high levels of purity and cleanliness are maintained every step of the way. It's the only way to provide the quality and performance required of a food, cosmetic or pharmaceutical component." ◆

For more information on Dow PG USP/EP visit www.dowpg.com.

Fast Facts About PG USP/EP

- PG USP/EP can be used as a solvent, wetting agent, coupling or compounding agent, emulsifier, humectant, preservative or stabilizer
- PG USP/EP is "generally recognized as safe" (GRAS) for use in pharmaceuticals and foods by the U.S. FDA
- PG USP/EP has been tested for compliance with specifications and quality regulations of:
 - United States Pharmacopeia (USP)
 - European Pharmacopeia (PhEur or EP)
 - Japanese Pharmacopeia (JP)
 - Food Chemicals Codex (FCC)
 - Brazilian Pharmacopeia (Farmacopéia Brasileira)
- PG USP/EP is listed by the Cosmetic, Toiletry and Fragrance Association as an approved ingredient in cosmetics
- PG USP/EP is Kosher-certified and complies with Halal requirements



PURITY IS A PRIORITY when it comes to products used in food, beverages, pharmaceuticals, personal care products and animal feed. That's why we follow some of the most rigorous and demanding quality-control procedures in the industry when manufacturing, storing, packaging, transporting and distributing Propylene Glycol USP/EP around the world.



We call it *Purity Plus*. It's part of our commitment to product safety, and providing our customers, and consumers, with peace of mind.

Making sure the foods we eat and the pharmaceuticals we use are safe – that is the spirit of the Human Element. To learn more about Dow Propylene Glycol USP/EP and our *Purity Plus* standards, visit www.dowpg.com.

Dow Lays Groundwork for U.S. DOT Headquarters

"To ensure a fast, safe, efficient, accessible and convenient transportation system that meets our vital national interests and enhances the quality of life of the American people, today and into the future."

That's the mission of the **United States Department of Transportation (DOT)**. It's also a perfect reflection of the flooring project at the DOT's new headquarters in Washington, D.C. While this was an enormous undertaking, the project went smoothly, with extremely effective results that positively impact the workday lives of all who set foot in the building.

The new DOT headquarters is part of the Southeast Federal Center (SEFC) located on the Anacostia River in southeast Washington, D.C. It encompasses 11 of the 55 acres that were once part of the Washington Navy Yard. Inside, the facility required flooring that would meet the demands of government regulations and offer comfort underfoot for employees. DOT project management chose **Milliken's Remix modular carpet with ComfortPlus®** backing made with polyurethane technology from Dow. "With more than 35 years' experience with federal, state and local level projects, Milliken has a proven track record in government interiors," said **Tom Welsh, Milliken marketing manager for federal sales** in the metro D.C. area. "The success of past federal projects, especially one we completed for the FAA (Federal Aviation Administration), definitely played a role in the carpet selection process for the DOT. That, combined with the host of benefits this particular flooring has to offer government facilities, made it a perfect choice."

The cushioned ComfortPlus backing system, made with Dow's ENHANCER™ Technology, helps create a more durable, comfortable and ergonomically sound carpet.

The style and custom colors of Remix carpet paired with the bio-based TractionBack® installation system resulted in an attractive, yet sustainable flooring for the DOT facility. In fact, it contributes the maximum number of points for a carpet tile toward achieving LEED® certification. The use of TractionBack meant this project would comply with some of the federal government's strict sustainability standards. TractionBack allows carpet to be installed without adhesives. Not only does this eliminate VOCs, leading to improved indoor air quality, but it also reduces both the cost and time of installation.

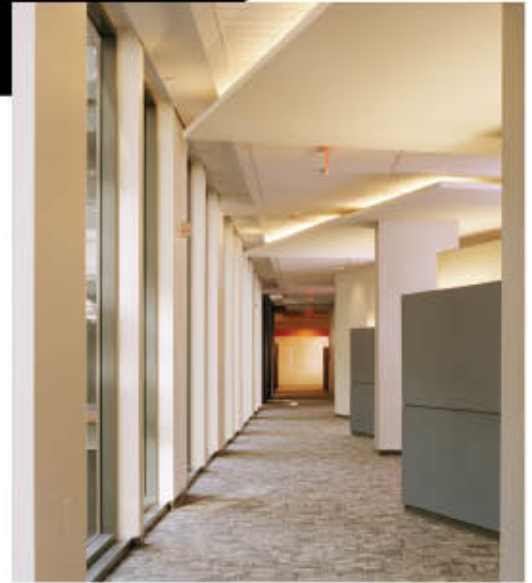
Reaching far beyond the installation process, the cushioned ComfortPlus backing system, made with ENHANCER Technology,

helps create a more durable, comfortable and ergonomically sound carpet. By extending the carpet's life, Dow polyurethane technology also helps extend

government budgets. Polyurethane's strong adhesion to carpet yarn maximizes tuft bind performance for the life of the carpet. This helps minimize edge ravel and disfiguring snags and pulls, even in the DOT building's most intensive use and high-traffic areas. Plus, it reduces the likelihood of delamination – a concern for areas subjected to heavy rolling traffic, including desk chairs.

In addition to extended life cycle attributes, Dow polyurethane carpet backing allows the use of post-consumer materials as part of its technology. It also is designed to comply with the Carpet and Rug Institute's Green Label standards. The cushioned backing system has an impact on the comfort of the more than 5,000 employees working in the DOT building. Made of high-density polyurethane, ENHANCER Technology adds comfort underfoot. It reduces heel-strike force and leg muscle response, two prime causes of standing and walking fatigue. To further add to employees' comfort and promote productivity, ENHANCER Technology helps reduce noise levels in the DOT facility. It minimizes the sound of foot traffic, absorbs airborne sound and reduces sound transmission from one office space to another.

From inception to completion, the DOT project has been a success. "This project went extremely well," said Welsh. "We were able to meet a very specific schedule that called for all carpet to be installed prior to the placement of furniture. Even the installers agreed that the use of TractionBack made this one of the cleanest, easiest jobs they've worked on." The end result has been an environment that helps meet the DOT's needs for a comfortable, attractive and sustainable facility. Previously located in several different buildings in need of renovations, the DOT has now brought all its employees together under one roof that offers so much more underfoot. ◀



Dow and Recticel Collaboration Yields New Products, Added Safety

To meet increasing safety standards at its production facilities, Recticel, a market leader in the manufacture of polyurethane foam products, needed to phase out a key ingredient of one of its highly successful products – a TDI-based binder. The challenge was to find a replacement binder that would deliver the same great performance and comply with their safety standards. Recticel chose Dow, based on Dow's expertise in polyurethane science, to help them formulate the replacement binder.

Sports Surfaces Rely on re-bounce® Foam

For more than a decade, hundreds of the world's sporting arenas have come to rely on re-bounce foam underlays – foam padding that is installed beneath wood, linoleum, rubber and other sports playing surfaces. In 2008, Recticel sold over three million m² of re-bounce foam underlays to indoor and outdoor sports arenas in 28 countries worldwide.

"It was vital that we find a replacement binder that would not compromise the mechanical properties required for re-bounce foam, which had proved successful for indoor sport applications when we launched it in 1998, and saw further success when we expanded to outdoor arenas in 2001," said **Bart ten Brink, group business unit manager at Recticel**. "Time was also of the essence, because our customers were perfectly happy with the foams produced with our previous TDI-based pre-polymer and we wanted to ensure a seamless transition for them."

Bouncing Back

Working together, Recticel and Dow qualified the MDI pre-polymer grade VORAMER™ RF 1025 Isocyanate at a number of Recticel's composite foam manufacturing sites, supporting the company's TDI-reduction plans in composite foams. The binder is now used across Recticel's expanding range of re-bounce underlay products for indoor and outdoor sports surfaces.

On Your Toes Above the Boards

Success with re-bounce prompted further trials with MDI-based pre-polymers in another Recticel application – thermoformed foam for shoe soles – which resulted in the development of an entirely new Dow product and another increase in sales for Recticel.

It's a perfect reminder that even in these tough times, the industry hasn't lost its power to innovate, and that by developing solutions designed to push a market forward we can continue to create opportunities for growth.

"We were pleased with the performance of Dow's VORAMER RF 1025 Isocyanate in foam underlay applications and wanted to investigate whether it could lead to further reductions in TDI-based pre-polymers in another of our key markets, shoe applications," explained ten Brink. "However, we required excellent thermoforming capabilities and exceptional softness for such an application, which meant further research and development was needed."

Composite foam produced with the new binder – commercialized as VORAMER MF 1504 Isocyanate – produced excellent performance in trials against Recticel's previously-used TDI composite foam, and catapulted from initial sample to bulk order in just six months.

Great Performance and Safety Compliance

"We achieved Recticel's objectives by controlling the pre-polymer functionality and the use of acceptable diluents from an environment, health and safety perspective," said **Andrew Miller, Dow Formulated Systems House director, Erstein, France**. "This enabled us to meet the requirements of high mechanical performance, excellent thermoformability, ease of processing and, perhaps most importantly, environment, health and safety improvements at the same time."

"Both projects are great examples of how two companies working closely together to solve specific challenges cannot only achieve the original objectives, but can actually exceed expectations by sharing ideas," added ten Brink. "It's a perfect reminder that even in these tough times, the industry hasn't lost its power to innovate, and that by developing solutions designed to push a market forward we can continue to create opportunities for growth." ◆

The Polyurethane Group of Textile Rubber & Chemical Company: Walking Away Happy with RENUVA™

The Polyurethane Group of Textile Rubber & Chemical Company, which develops polyurethane cushion and laminate systems for the carpet, pad, and artificial turf industries, has successfully integrated post-consumer recycled content, including plastic and glass bottles, into its products for years. Expectations are growing that building materials contain more rapidly renewable resource content, defined by the U.S. Green Building Council as "product (made from plants that are typically harvested within a ten-year cycle or shorter) for 5 percent of the total value of all building materials and products used in the project." So The Polyurethane Group turned to Dow and RENUVA™ Renewable Resource Technology for help.

"Demand for 'greener' carpet backings has grown to three or four times what it was five years ago, partly due to the desire to earn LEED* credits for using recycled materials and rapidly renewable resources," said **Terry Wilson, director of sales and marketing for The Polyurethane Group**. "We wanted to incorporate a rapidly renewable resource into our backings to meet that growing demand. Our goal was to include as much rapidly renewable resource material, along with our other environmentally friendly components, as possible in order to be a good environmental steward. At the same time, product performance on the floor had to be paramount to any change we would make in our formulations."

Dow's RENUVA Technology, which converts soybean oil into polyurethane products for a range of applications, provided the perfect solution for use in The Polyurethane Group's high-performance polyurethane carpet-backing systems, including EPIC-18, System TR/18 and KangaTRAC attached cushion backings.

Matching Performance of Petroleum-Based Polyols

The Polyurethane Group's selection of RENUVA Technology over comparable soy-based products was based on its long and excellent working relationship with Dow and the exceptional product performance of RENUVA. They found the functionality and properties of RENUVA™ technology's bio-based polyols were virtually identical to petroleum-based polyols, with no significant difference in performance or application processes. Carpet backings produced with RENUVA

continue to meet customer targets for continued comfort underfoot, good roller mobility, resilience and durability.

"RENUVA met our functionality requirements as it does not negatively affect the reactivity of our process or the physical properties of our product," said **Mark Cline, vice president and general manager of The Polyurethane Group**. "Some earlier soy-based rapidly renewable products were basically liquid fillers similar to salad oil. They did not function well and, in some cases, even degraded the polyurethane-based system. With RENUVA Technology, we are able to keep pace with 'green' demands and offer high levels of renewable content in carpet without compromising the performance our customers demand, or increasing costs."

"Five years ago, none of the materials we used were post-consumer recycled content or a rapidly renewable resource," added Cline. "Today, most of our attached polyurethane commercial products contain 30 percent post-consumer recycled content and 10 percent rapidly renewable resources."

Fast Facts About Textile Rubber & Chemical Company

- Founded in 1953 and headquartered in Dalton, Georgia
- The Polyurethane Group has been Dow Polyurethanes' exclusive formulator and distributor for the flooring market since 1983
- Does business on six continents, with manufacturing interests around the world
- Develops polyurethane cushion and precoat/laminate systems for carpets and synthetic turf, as well as latex backings for carpet and rugs, and more



**Textile Rubber
& Chemical Co. Inc.**

Lower VOC Emissions Hit Green Label Targets

The use of RENUVA™ technology is also helping The Polyurethane Group meet the Carpet and Rug Institute's Green Label program requirements, which set limits on the level of Volatile Organic Compound (VOC) emissions from carpet, adhesives and cushions that can be released into indoor air. Associated labeling assures customers they are purchasing one of the lowest emission products available.

And life-cycle analysis done by Dow shows RENUVA is greenhouse gas neutral and uses 60 percent fewer fossil fuel resources than the conventional polyol technology.

"The Polyurethane Group of Textile Rubber & Chemical Company started by looking for a way to meet customers' demands for a more sustainable product," said **Randy Jenkines, application development specialist, Dow Formulated Systems' carpet group.** "One of the competitive advantages RENUVA Technology offers over other soy-based systems is that it doesn't have the odor associated with other natural oil polyols. That's certainly a sensitive area for a business or homeowner. Dow is proud that we were able to work with The Polyurethane Group to develop formulations that meet their Green Label requirements and still perform as expected."

Expanding Opportunities with RENUVA™ Technology

The Polyurethane Group is exploring additional ways to incorporate RENUVA Technology in its products, including carpet backing systems for the residential market, which has a different level of performance expectations.

"We know that's coming, as homeowners are asking for the same thing in terms of sustainable building materials," said Wilson. "In some aspects, it will be easier to include even higher levels of rapidly renewable resource content since there is less wear and tear on residential carpeting than in commercial carpeting."

The Polyurethane Group is already working within the carpet value chain to bring carpet backings with RENUVA™ to the residential markets.

In the meantime, The Polyurethane Group and Dow Research & Development are hard at work developing formulations that contain more and more recycled and rapidly renewable resource content that continue to hit performance targets.

"When the market dictates higher and higher content, we'll have formulations ready, and RENUVA will be a part of our polyurethane backing systems," said Wilson. ◀

To find out more about Textile Rubber & Chemical Company, visit www.trcc.com.

Learn more about RENUVA™ at www.dowrenuva.com.

*The U.S. Green Building Council, a nonprofit coalition promoting high-performance green building design, has developed Leadership in Energy and Environment Design (LEED), a voluntary, consensus-based standard. The LEED rating recognizes the life-cycle costing of construction. Learn more at www.usgbc.org.



OPENING DOORS, OPENING MINDS

Girls' Day in Germany was designed to stimulate interest in young girls in jobs traditionally held by men in Germany. In late April, girls accompany one of their parents – generally their father – to work. In some areas, like Stade, young boys also participate. The Dow Chemical Company (Dow) saw this as an opportunity to inspire young people to explore careers in science and technology. Around 40 young people came to Dow's Stade manufacturing site where propylene oxide, propylene glycol and MDI are produced for the Polyurethanes business to observe first-hand the exciting careers available to them. Dow opened its doors to young people of the community and opened their minds to the world of chemistry. That's the spirit of the Human Element.



80 Million Pounds of Rubber Bounce Back with Ecore International and VORAMER™ Binders



TRAINING GROUND™

NIKE GRIND

Professional grade home gym flooring engineered to protect all hard surface floors.

Manufactured By:

ecore

www.traininggroundusa.com

ECORE International is transforming millions of pounds of scrap and recycled rubber from tires into high quality, sustainable products for commercial flooring, sound deadening, vibration dampening, playground surfaces and other high-value applications. Dow Polyurethanes has been collaborating with Ecore, providing the VORAMER™ polyurethane binder systems that help make this possible.

These products are creating profitable and expanding markets for both Ecore and Dow, as well as providing major environmental benefits. By utilizing tons of rubber that would otherwise be burned or landfilled, these innovative applications reduce air and ground water pollution and conserve a million barrels of oil annually. At the same time, solvent-free VORAMER polyurethane binder systems can help to minimize Volatile Organic Compound (VOC) emissions associated with other binder systems.

VORAMER binders are also key to the performance and differentiation of Ecore's recycled rubber products, enabling excellent adhesion of shredded rubber and other materials for a wide range of flooring applications. A good example is Ecore's Everlast sports surfacing – the recycled rubber floors and/or matting used in most Nike stores. All Everlast sports surfacing products contain Nike Grind Rubber. Nike Grind Rubber is made from sports footwear manufacturing by-products as well as post-consumer athletic shoes collected through the Nike Reuse-A-Shoe program. The Nike Grind material is processed and refined using technology developed by Nike engineers. The Nike Grind material is blended with premium recycled tire rubber to create Everlast sports surfacing products.

"Because VORAMER™ is a prepolymer, we can vary the properties to provide the specific flexibility, strength and elasticity they need in each of their applications," said **John Knoblich, North America market manager, cASE, Dow Polyurethanes.** "VORAMER systems make a major contribution to the quality of the end product. Our binders are not just holding the rubber flooring together, they're delivering the properties the customer wants."

VORAMER systems make a major contribution to the quality of the end product. Our binders are not just holding the rubber flooring together, they're delivering the properties the customer wants.

ECORE's Leadership Supported By Dow's Material Science Experience

As the market segment for recycled rubber products has taken off over the last 10 years, Ecore has moved into a leadership position, with about 80 percent of their business in commercial markets (e.g., schools, non-residential) and 20 percent in industrial markets (e.g., gasketing, industrial manufacturing applications).

According to Knoblich, the 'green' movement has been a factor in their growth. However, their success to date has been based on differentiated quality.

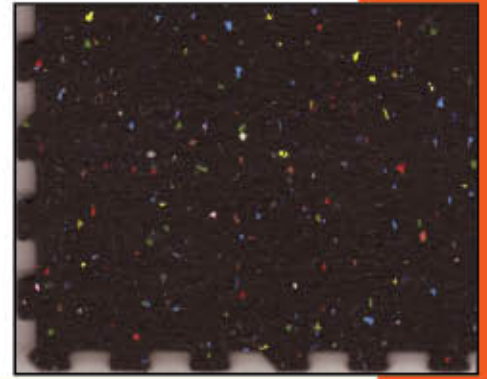
"They're a very forward-looking company," Knoblich said. "They're not afraid to invest in backward integration, downstream acquisitions and other creative business approaches to support their growth."

"ECORE, with an extensive portfolio of diverse products and brands, maintains an active pursuit of opportunities for both business and product development," stated **President and CEO, Art Dodge**. "We have established ourselves as an industry leader in high quality and sustainable product solutions with a strong foundation in recycling technology and an ongoing commitment to innovation and partnerships."

Even More Opportunities on the Horizon

As new applications for recycled rubber develop, VORAMER™ systems will grow and deliver differentiation for more and more customers.

"For instance, we've recently introduced a controlled reactivity formulation at one of Ecore's subsidiaries for use in the playground surfacing market. This helps the product cure faster and gives them higher throughput, which they are very interested in," Knoblich said. "We have an outstanding relationship with Ecore. They are pioneers and leaders in this area and are continually seeking new opportunities to expand their capabilities." ◀



Everlast sports surfacing products contain Nike Grind Rubber, which is made from sports footwear manufacturing by-products as well as post-consumer athletic shoes collected through the Nike Reuse-A-Shoe program.

Learn more about Ecore and Everlast sports surfacing at www.ecoreintl.com and www.everlastsportssurfacing.com.

For more information on VORAMER visit www.dow.com/pusystems/product/voramerm.htm.

WE'RE WHERE YOU ARE

Manufacturing your products, providing technical and service support, engaging in research and development – Dow Polyurethanes and Dow Formulated Systems have locations around the world to bring you the benefits of working with a global company, delivered with a local touch.



Dow Polyurethane Carpet Backing May Reduce Life-Cycle Costs

When University of California-Merced Librarian Bruce Miller was presented with carpet samples for the new campus library, he poured himself a cup of coffee. Then he promptly spilled it – quite deliberately – to see which carpet samples stained and which were easy to clean.



Miller found that even after a quick cleanup with paper towels, the carpet with polyurethane backing from Dow had no permanent staining. The carpet backing includes a functional liquid barrier to impede liquid and dirt from penetrating the subfloor, reducing the occurrence of wick back staining and odors. With conventional backing, removing a spill from the carpet surface can be ineffective because the residual liquid can wick back and reappear.

"We don't have the funds with which to replace carpet on a regular basis," said Miller. "That's why carpet must function well and look good for a very long time."

Just as importantly, the carpet selected for the library had to meet the University's environmental goals. The UC-Merced campus, which is located alongside Lake Yosemite in Merced, California, employs principles of sustainability in building, design, construction and operation, and all carpet is required to be PVC-free and made

of recycled content. To earn top grades from Miller, the carpet also had to absorb noise to help accommodate quiet study and hold up to the foot traffic of hundreds of students daily without snagging or fraying.

By selecting the right carpet and a cushioned backing system made with Dow ENHANCER™ Technology, UC-Merced ended up with flooring that can withstand intensive use and still offer sophisticated style and sustainability. ENHANCER Technology's environmental benefits include the use of pre-consumer materials and low VOC emissions. It also can contribute toward LEED® credits for carpets.

"To meet our specific needs, the carpet backing system was very important," said UC-Merced Project Director Min Jang. "We explored several options but in the end went with polyurethane backing, primarily for its environmental, sound absorption and cushioning qualities."

In addition to these properties, carpet backed with Dow polyurethane technology simply looks better longer – extending the life of the carpet and reducing its life-cycle costs.

"By using an attached cushion carpet, you can extend the life of your carpet by several years," said Todd Crook, global marketing manager of Dow Flooring. "When you think about it from that standpoint, there's a lot less resources being used for maintenance and replacement, and less carpet going to the landfill. Customers achieve many environmental attributes and a substantial cost savings when they only have to replace the carpet half as much."


Indeed, a study conducted by Brigham Young University* concluded that carpet backing using Dow polyurethane technology was able to increase the life expectancy of the university's carpet from an average of 7.5 years to 11.5 years – an improvement of 53 percent. This amounted to an annual cost savings of \$0.15 per square foot, or \$360,000, to the university. Among the factors that the university used to calculate these savings were the costs of business interruption to lay new carpet, carpet removal costs and landfill costs. Additional savings were also realized through maintenance costs.

Polyurethane also helps the carpet and cushioned backing to absorb the pounding motion of foot traffic and support the heavy weight of furniture, without bottoming out. "This improved durability and performance can add up to an extended carpet life, which ultimately helps improve the environmental footprint," said Crook. "Improved performance partnered with sustainability and life-cycle cost advantages make polyurethane carpet technology from Dow a winning choice." ◆

For more information on Dow's carpet backing technology, including ENHANCER, go to www.dow.com/carpet.

*White Paper: "BYU Research Shows Polyurethane Technology Adds Life to Carpet," Jeffery L. Campbell, Ph.D.



WITH SINGULARITY OF PURPOSE. That is the path of science. It is in constant forward motion mapping a world of problems and solutions. Making diesel run cleaner, solar energy more accessible and carbon  emissions more containable. Science is in the business of solving problems. And we are in the business of science. Following a path illuminated by the values of the Human Element.

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