October 2023

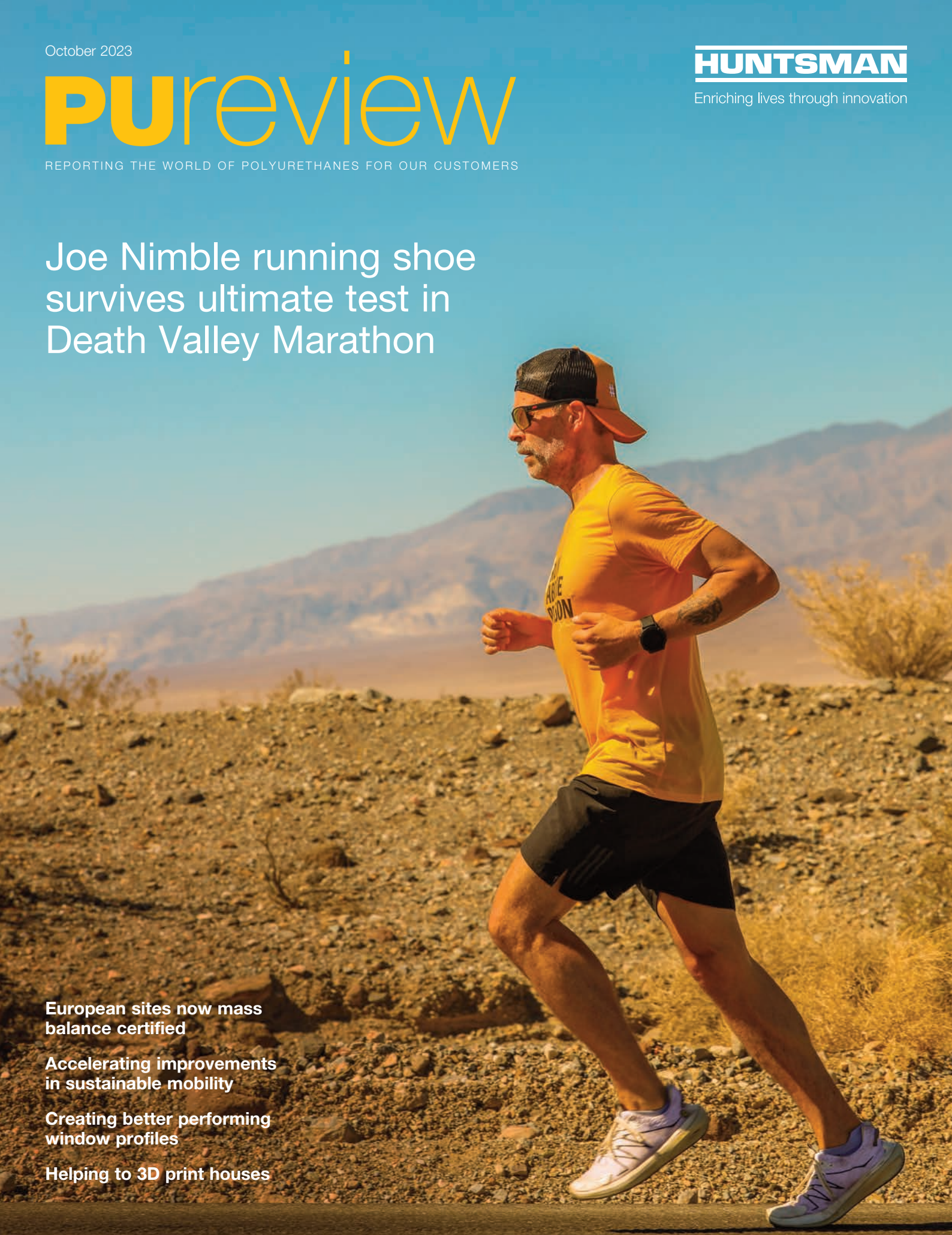
PUreview

REPORTING THE WORLD OF POLYURETHANES FOR OUR CUSTOMERS

HUNTSMAN

Enriching lives through innovation

Joe Nimble running shoe survives ultimate test in Death Valley Marathon



European sites now mass balance certified

Accelerating improvements in sustainable mobility

Creating better performing window profiles

Helping to 3D print houses

Innovation is vital to survive global challenges and thrive in the future

Tony Hankins, President, Huntsman Polyurethanes

Dear Reader,

The purpose of this publication is to showcase innovation breakthroughs that we have achieved in partnership with our customers. Through this, we hope to stimulate new thinking, spark ideas and of course, develop new business relationships. In today's world of economic turmoil and the associated uncertainties, innovation and trusted partnerships are more important than ever.

Innovation is not just about the new products and product improvements that we are developing; it is much broader than that. In an economic environment of high interest rates, high inflation, volatile energy costs, and dislocated supply chains, it is essential that we get creative about how we manage our business overall.

Huntsman has a deserved reputation for not only embracing change, but for initiating it. One need only look at our history of M&A transactions to appreciate this. And that is why we have taken proactive, innovative steps this past year to re-organize our business in Europe – a region facing perhaps the greatest challenges – such that we not only survive the current difficulties, but that we thrive once they've abated.

By early 2024, we will have four new sites in Europe. We're establishing a new regional headquarters in Frankfurt, which will be home to the European leadership teams of Huntsman's three business divisions (Advanced Materials, Performance Products, and Polyurethanes). This will be the first time that we've housed all our regional leadership teams under one roof. Secondly, we're moving out of our old R&D and administrative offices in Everberg, Belgium into a state-of-the-art R&D center, primarily serving the Polyurethanes business, in Tienen, near Leuven. Thirdly, we're moving out of our old R&D and administrative offices in Basel, Switzerland to a state-of-the-art R&D center, primarily serving the Advanced Materials business, still located in Basel. And finally, we have a new business services center in Krakow, Poland, which is now home to many of our business functions, including customer service, purchasing, and accounting. This office has been operational since October 2022.

This re-configuration of our European footprint will enable us to remain competitive in the new market environment, and the associated investments are testament to our long-term commitment to the region. You'll be able to read more about the new Tienen R&D facility in the next issue of *PU review*.

As with continuous improvement, sustained innovation is a way of life at Huntsman, through good times and bad. In the following pages, you'll be able to read about some of the latest outputs from our innovation teams. From our raw materials – MDI and polyols – that have recently received new certifications, to applications in multiple sectors – including Automotive, Coatings, Footwear, and Insulation. The common theme that runs through everything is the sustainability benefits that our customers are demanding and which our products help deliver.

When environmental challenges are overlayed with economic challenges, there is no question we must harness our innovation 'engine' ever more effectively. We are here ready to help navigate these challenges together with you, our customer.

European PU manufacturing sites now Mass Balance certified

Our Rotterdam and Wilton, UK manufacturing facilities have recently achieved the International Sustainability & Carbon Certification (ISCC PLUS) for mass balance following audits by Bureau Veritas.

ISCC PLUS is a global sustainability certification system that makes it possible to track the amount and sustainability characteristics of circular and/or bio-based content in our value chain and attribute it via the mass balance approach based on verifiable bookkeeping.

With ISCC PLUS certification, we can now offer our customers methylene diphenyl diisocyanate (MDI) that has been manufactured based on mass balance principles, which can help reduce the attributed carbon footprint of customers' products.

Steen Weien Hansen, Vice President Europe at Huntsman Polyurethanes, said: "Across all the industries we serve, demand for products that have a lower carbon footprint is rising – particularly for solutions that are linked to bio-based or recycled feedstock and that can contribute to a circular economy."

"Chemistry by its nature is complex, combining a variety of raw materials. The mass balance approach gives us the ability to verify the sustainable inputs we use in our products and so improve their sustainability footprint. Throughout our business, we're taking steps to transform our portfolio and lower the impact of our manufacturing. Our ISCC PLUS certification is further evidence of that commitment." |

ISCC
International Sustainability & Carbon Certification

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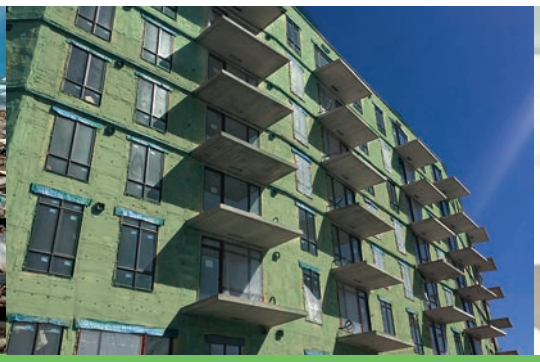


New certificates reaffirm recycled content of TEROL® polyols

Our TEROL® polyols technology, which is made using waste PET (polyethylene terephthalate) has obtained two important third-party recycling certificates that will further the use of this important product line in key application areas.

The technology is now certified to the Recycled Claim Standard (RCS) – an international voluntary scheme used to track recycled raw materials through supply chains. Originally developed in partnership with the Outdoor Industry Association's (OIA) Sustainability Working Group's Materials Traceability Taskforce, the standard is issued by the Global Recycled Standard, and managed by the Textile Exchange. The RCS is widely accepted in the textiles industry and other consumer goods markets, and is intended for use with any product that contains at least 5% recycled material.
To obtain the certification, the presence and amount of recycled content in a final product needs to be verified. The production process also needs to be evaluated from the first recycling stage to the end including the final business to business transaction with the customer.

The other international certification achieved – UL 2809 – relates to the use of TEROL® polyols in the construction sector. UL 2809 – provided by the Underwriters Laboratories – evaluates the amount of recycled content in products including post-consumer recycled content; pre-consumer (post-industrial) recycled content; and closed loop recycled content. Achieving UL 2809 certification confirms that a product contributes to LEED (Leadership in Energy and Environmental Design) points – raising visibility and interest among key specifiers. Companies that are UL accredited can then feature the UL Environmental Claim Validation Badge on their packaging and marketing materials. Information about the product is also stored on UL Spot – a free online tool that allows specifiers to identify green products.

Both standards are voluntary and helpful in demonstrating eco credentials to customers in target markets – who can find it hard to differentiate between products that are genuinely environmentally preferable, and those that are not.

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Breakthrough bio-based system for lower carbon automotive acoustic components

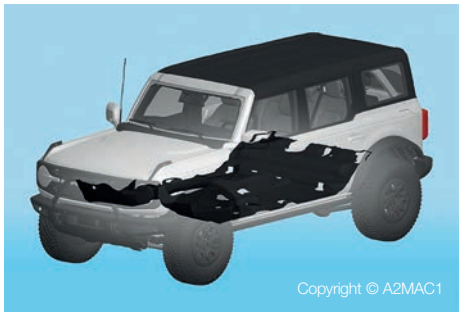
Our automotive team has developed a pioneering bio-based viscoelastic foam technology for molded acoustic applications in the automotive industry that contains up to 20% bio-based content, derived from vegetable oils. ACOUSTIFLEX® VEF BIO system can lower the carbon footprint of automotive carpet back-foaming by up to 25% compared to existing systems for this application*. The technology can also be used for dash and wheel arch insulation.

ACOUSTIFLEX® VEF BIO system addresses rising demand for material technologies that can help automotive manufacturers lower their carbon footprint – but are still high-performing. Through careful formulation, our automotive experts have integrated bio-based content into the system with zero impact on any of the acoustic or mechanical characteristics that automotive component manufacturers and OEMs seek to achieve.

Irina Bolshakova, Global Marketing Lead for Automotive Polyurethanes at Huntsman, said: "Previously, there was a frustration that incorporating bio-based content into a polyurethane foam system would have a detrimental impact on performance, specifically on emission and odor levels. The development of our ACOUSTIFLEX® VEF BIO system proves that doesn't need to be the case."

When it comes to acoustic performance, ACOUSTIFLEX® VEF BIO system achieves the same magnitude of sound reducing capability as Huntsman's original VEF systems, which can outperform standard high resilient (HR) foams at lower frequencies (<500 Hz). The system is both low emission and low odor – continuing Huntsman's work in the development of zero-amine, zero-plasticizer, and extremely low aldehyde emitting PU foams**. ACOUSTIFLEX® VEF BIO system is also lightweight – introducing bio content while keeping the weight of components under control.

In addition, our automotive team has also ensured there are no associated processing disadvantages. ACOUSTIFLEX® VEF BIO system can still be used to quickly create components that have complex geometric shapes and sharp angles, with high productivity rates and demold times as low as 80 seconds – depending on part design.



Continuing, Irina said: "Polyurethanes are very hard to beat when it comes to pure acoustic performance. They are incredibly effective at muffling sound, reducing vibrations, and dampening down any harshness caused by the movement of a vehicle. Our ACOUSTIFLEX® VEF BIO system takes that to the next level. Incorporating bio-based content into the mix to deliver a lower carbon acoustic solution, that does not compromise emission or odor requirements, is far better for vehicle brands and their partners and customers – but also the planet."

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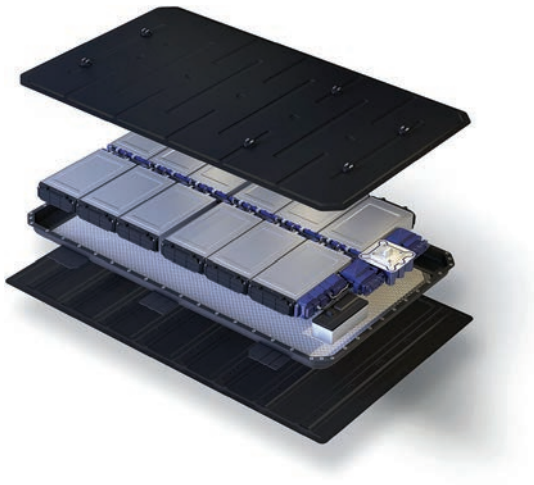
ACOUSTIFLEX® VEF BIO system can lower the carbon footprint of automotive carpet back-foaming by up to 25% compared to existing systems for this application*

** Internal LCA study, CML GWP including biogenic CO_2 indicator. Percentage depending on the source of the bio based raw material.*

*** Zero refers to not detected in ISO 122144/7 emission test. Extremely low means < 30 microgram/m³.*

Boosting the productivity and performance of EV battery casing parts



When it comes to creating glass fiber-reinforced plastic (GFRP) composite parts for electric vehicle battery casing applications, manufacturers are under continual pressure to innovate and deliver components that are lighter, stronger and quicker to process.

Now, it's easier than ever for battery casing manufacturers to make new gains in all these areas. In a move that can help to deliver high performing composites, alongside extra design and production flexibility, our automotive team has assembled a portfolio of polyurethane products that can be used to create under body and upper cover battery protection components up to 30% quicker than some existing technologies. Crucially, the products can also lower overall part weight and increase strength and structural performance.

Covering numerous battery protection needs, our one-stop shop includes a unique mix of customizable, quick cure, high strength, polyurethane resins for energy efficient wet compression molding (WCM), molded foam cores (FC) and long fiber injection (LFI) molding.

All technologies are available globally with support from local technical experts, who can provide advice at every step, from modelling and testing to material application and final part production. |

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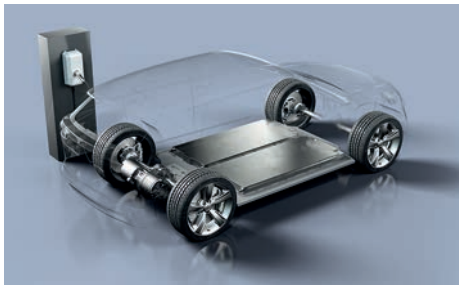


A portfolio of polyurethane products has been assembled that can be used to create under body and upper cover battery protection components up to 30% quicker than some existing technologies.

Products for (GFRP) composite parts for electric vehicle battery casing applications

RIMLINE® WCM

RIMLINE® WCM polyurethane system developed for underbody battery protection:

Formulated for use on high pressure mix machines, this low viscosity liquid resin enables molding of high fiber volume fraction composites under low pressure. Balancing a long working life and short cure time with easy mold release, this system can help reduce overall cycle times.

RIMLINE® FC

RIMLINE® FC polyurethane system developed for battery underfloor protection:

Offering a cost-effective solution for manufacturing sandwich composites, this lightweight foam core system can be versatile and durable in equal measure. Great flow properties mean complex 3D shapes can be achieved, enabling greater design freedom. The system can outperform other materials in terms of cycle times thanks to its quick cure properties. It also offers good adhesion to different overmolding materials while leaving low residual levels on the tool surface, which helps cut cleaning times.

RIMLINE® LFI

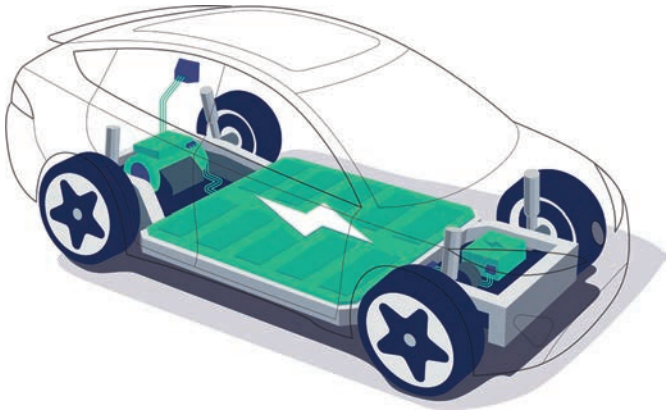
RIMLINE® LFI polyurethane system developed for battery underfloor protection:

With glass reinforcement, the RIMLINE® LFI resin system can be molded into strong stiff parts with a density of – for example – 1100 kg/m^3 including 30% fiber reinforcement. The result is lower total sandwich thickness and improved damage tolerance.

VITROX® WCM

VITROX® WCM polyurethane system developed for upper battery covers:

This composite resin system was developed for the production of lightweight and mechanically stable EV battery casing covers and can be applied on glass or carbon fiber reinforcement, achieving better thermal resistance and enabling limited flame spread of battery covers.



Joe Nimble running shoe survives ultimate test at Badwater Ultramarathon

Running shoes featuring a high energy return polyurethane midsole based on our DALTOPED® foam technology were put through their paces at Badwater 2022 in California, the world's toughest road race – and survived the test in style.

In another successful innovation project, Huntsman's footwear experts collaborated with Joe Nimble and Footwear Innovation Lab GmbH to create the Ultreya – a revolutionary, high-performance running shoe that offers extra comfort to marathon and long-distance runners, and can help minimize the risk of pain and injury.

Designed by Joe Nimble founder, Sebastian Bär, alongside acclaimed biomechanics expert Lee Saxby, Ultreya shoes have a unique design that helps protect the feet of serious runners, who can typically cover around 40 miles per week. While conventional running shoes restrict the toes and prevent their natural anchoring and stabilizing function, Ultreya utilizes Joe Nimble's toefreedom® technology into the shoe-last design to increase stability of the foot in motion. Adding extra comfort and performance-enhancing potential, Ultreya running shoes feature a high energy return polyurethane midsole. Based on a special dual density DALTOPED® polyurethane system from Huntsman – named nmblFOAM® by Joe Nimble – this technology delivers a running shoe with physiologically balanced cushioning and zero heel elevation.

Sebastian Bär, Head of Joe Nimble, said: "The idea for our Ultreya shoes arose while watching runners compete in the Badwater® Ultra Marathon. I was the crew captain for top ten runners twice at the race and noticed how many elite athletes cut open the front of their running shoes to give their toes more freedom. This led me to introduce our toefreedom® technology into a pair of trainers for the first time. When it came to making samples of the Ultreya, I knew Huntsman and Footwear Innovation Lab would deliver from a materials and manufacturing perspective – and they did. Together, we've created a shoe that uses less energy, less water, less solvents and less labor. This exciting collaboration and product launch proves that with the right approach, the correct materials and methods, and the best team, it is possible to create shoes that can avoid the running related pain and injuries associated with repetitive impact and shock absorption."

To support the launch of Ultreya, Joe Nimble sponsored the 2022 Badwater® 135. Eighty runners competing in the event were given a pair of Ultreya Shoes to put through their paces on the 135-mile course through Death Valley, California. The results were incredible.

One runner commented that the trainers were ‘the best thing that I ever used to run an ultramarathon!’ Another said: “I love these shoes. I can’t wear a shoe right out of the box. I usually bring two to three pairs but at mile 17, I just said ‘give me those shoes’. I don’t have fat pads on the ball of my forefoot anymore. It’s like skin on bone. To get a shoe that doesn’t hurt right there – it’s a miracle!”

Lee Saxby said: “Mother Nature provided humans with a well-padded and well-rounded heel bone for a reason; to maximize shock absorption and ensure a smooth rolling transition to the foot-flat phase of the gait. The geometry of Ultreya shoes supports this and the polyurethane midsole – made using Huntsman’s technology – provides extra cushioning to propel the wearer into the propulsive phase of running. It’s a powerful combination that enables Joe Nimble to deliver on its mission of creating running shoes that can help facilitate pain-free running, for life.”

Joe Nimble was also the official shoe of Badwater 2023, which took place from 4-6 July 2023, and covered 135 miles (217km) non-stop from Death Valley to Mt Whitney, California.

To watch the Ultreya in action, go to: https://www.joe-nimble.com/int/badwater-135-2022

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Running above reason

Huntsman and Shincell create fully recyclable TPU foam

Huntsman has developed a new thermoplastic polyurethane (TPU), which is fully recyclable, ultraviolet (UV) protected and can be extruded into a film and then easily expanded into foamed sheets. The special grade of IROGRAN® TPU was developed in conjunction with the Shincell New Material Company Ltd, a Chinese company that is using the material to create foam sheets that are then used in insole, midsole and forepart insert applications by some of the world's leading footwear brands.

SHINCELL
Committed To Sustainable Foaming Technology

Designed as an alternative to ethylene vinyl acetate (EVA), the new material has high energy return properties and provides long-lasting cushioning performance. The TPU film can be easily expanded in a high-pressure vessel, using gas assisted technology, and without the use of additional chemicals typically needed for foaming or cross-linking. This makes the resulting expanded foam sheet, and any post-production scraps and final footwear components, super lightweight and easy to recycle.

Huntsman developed the grade of IROGRAN® TPU after in-depth discussions with Shincell about how best to improve the production of expanded TPU sheets, which are growing in popularity across the footwear sector. During a technical briefing, Shincell revealed it had several objectives.

From a manufacturing perspective, Shincell wanted a TPU grade that would increase its productivity, help it reduce waste and cut overall energy consumption. Shincell wanted to specify a TPU that was free of toxic or volatile chemicals and formaldehyde residues; and could be expanded without the use of butane, fluoride and azodicarbonamide foaming agents. When it came to performance, Shincell was also looking for a comfortable, durable, long-lasting TPU system that would be suitable for use in high performance sports shoes, would outperform EVA in terms of cushioning set properties, and be recyclable.

Dr Xiulei Jiang, founder of Shincell said: "As a business, we are focused on providing our customers with clean, environmentally friendly, high performance, lightweight materials. When we decided to find a partner to help us improve the sustainability of our foam sheets, I knew Huntsman was the company to talk to. As always, Huntsman did not disappoint. The team has come up with a very special product that satisfies all of our requirements. We see numerous novel applications for this versatile, recyclable material within footwear, and beyond."

For footwear applications, Shincell produces expanded foam sheets that its customers then cut into the shapes and sizes they want. Because this particular grade of IROGRAN® TPU is recyclable, Shincell can collect any excess or scrap material from its customers for reuse. Upon collection the scraps are ground down and reformulated. They can also be sold on to other customers.

Shincell is currently testing the new grade of IROGRAN® TPU for other consumer applications and is exploring the potential to use the material in the automotive industry. Other softer grades of the material are also in the development pipeline. |

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Bio-based polyurethane developed for KEEN's plant-based soles

Footwear experts at Huntsman have helped KEEN, Inc. (KEEN) develop a breakthrough production innovation – a range of sneakers with plant-based soles. The Field to Foot (F2F) sneakers were created by KEEN's Advanced Concepts Team, utilizing a specially developed bio-based polyurethane system from Huntsman that contains a by-product from agricultural processing.

Containing bio content ranging from 35% to 51%, the polyurethane system has a lower carbon footprint than petroleum-based alternatives that are readily available and currently the norm in footwear production. Developed at Huntsman's footwear center in Belgium, the system, which is based on Huntsman's DALTOPED® S polyurethane technology platform, is a bespoke soling solution created especially for KEEN.

The direct-on system offers KEEN comparable performance to conventional systems when it comes to resilience, rebound, hydrolysis, comfort and durability – but crucially is fully aligned with the brand's commitment to incorporating clean, environmentally focused, high-performance technologies into its footwear.

Commenting on the partnership with Huntsman, Erik Burbank, Vice President, The KEEN Effect, said: "KEEN's work with innovative partners like Huntsman advances our commitment to reducing our impact on the planet, and helps us extend and share those benefits with other businesses as well. We know that we have to work together to tackle the climate crisis."

Dave Burge, a UK-based expert on polyurethanes, who worked with KEEN and Huntsman to develop the technology, said: "The use of agricultural processing by-products within polyurethane is an important step toward transforming the footwear industry supply chain. While the science and technology behind these shoes is serious business, the product itself is fun and familiar. The Field to Foot collection is classic looking and forward thinking, with a lighter footprint on the planet. It reinforces our commitment to detoxing the planet, while demonstrating that cutting edge technology can be fun and comfortable." |

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Recyclates now easy to add into mix with new CASTECH™ dosing system

Our Elastomers experts have developed an innovative new piece of equipment that can be coupled with our CASTECH™ machines to add up to 25% recycled content (by weight) to hot cast elastomer systems.

In line with our customers' sustainability ambitions, the new filler dosing system can be bolted on to existing CASTECH™ machines – enabling different percentages of recycled content to be added to our TECNOTHANE® engineering elastomer systems, which are commonly used to create wheels, castors and rollers for mining equipment, warehouse vehicles, and even rollercoaster rides.

Using the new equipment, customers can choose to add fillers made from a variety of materials including recycled rubber, solid PU and TPU, and fibers. Recyclates can also vary in density and size depending on requirements.

CASTECH™ machines are popular with manufacturers of industrial components. A flexible, low maintenance, equipment solution, the machines are used to efficiently cast compact polyurethane elastomers and microcellular elastomer foams from all types of isocyanate and chain extender combinations. The result is durable components, optimized to perform in harsh industrial, and logistics applications.

To maintain overall part integrity, the new CASTECH™ filler dosing system has been engineered to minimize the risk of air bubbles forming as recycled fillers are added, which can have a detrimental effect on component quality. Using the new equipment innovation, manufacturers can now confidently meter a mixture of recyclates into any of the three components that are combined to make Huntsman's TECNOTHANE® hot cast elastomers. Once mixed with the system, the recycled content flows freely into the mold along with the rest of the system and bonds well with the matrix.

Andrea Ghermandi, Business Development Manager EAME, said: "Offering the highest levels of accuracy and flexibility, our CASTECH™ machines are among the most advanced equipment options available for the efficient manufacture of elastomers. Featuring a range of interchangeable parts, these machines are fully flexible and can be tailor-made to suit customers' requirements. Now, with the launch of our filler dosing system, component manufacturers have even more choice at their fingertips. With sustainability top of the agenda for many of our customers, they now have the freedom to incorporate recycled content into their parts – with zero compromise on component quality, durability, or performance."

Huntsman is the only hot cast elastomers producer to offer industrial component manufacturers a full system solution. Working with Huntsman, users of hot cast elastomer systems can access a comprehensive portfolio of polyols, fully formulated systems and casting machines.

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CASTECH

Polyurethane machines

Our CASTECH™ machines are among the most advanced equipment options available for the efficient manufacture of elastomers.

DALTOFOAM® system plays leading role in BRUGG heat pump pipes

Working in close collaboration with Danish company BRUGG Pipes, we've developed a next generation polyurethane foam system with excellent insulation properties. The material is being used to create highly flexible, thermally efficient, pre-insulated pipes for connecting ground source heat pumps and local heating units to domestic and commercial buildings.

Worldwide, demand for heat pumps – which capture warmth from outside and move it inside – is growing quickly. Historically, expanded polyethylene (PE) has been used to insulate the plastic pipes that join local networks and heat sources to individual buildings.

Our new SUPRASEC®/DALTOFOAM® TE system produces foam with better insulation properties (low lambda value) than PE. The result is pipes with a thinner layer of insulation compared to PE that still deliver good overall insulation performance (low U-value). In addition, thinner, lighter pipes are more flexible, meaning they are quicker and easier to transport and install.

Bora Yayla – Head of Marketing at BRUGG Pipes, said: "We'd been wanting to enter the heat pump market for a while and needed a competitive insulation solution that would enable us to quickly gain ground in this market. Key to our success was achieving a good degree of flex in our pre-insulated pipes to ensure ease of handling without compromising insulation performance. Pipes that are more flexible have a smaller winding radius, meaning they are easier to transport and quicker for heating engineers and installers to lay in confined spaces or where there are tight bends and building entry points to navigate. Working with Huntsman, we've achieved all of our project objectives and orders for FLEXSTAR are now being placed around the world."

Huntsman and BRUGG Pipes have worked together for several years on other pipe projects – including BRUGG Pipes' CALPEX PUR-KING pipe system, which remains the best insulated pipe in its class on the market.

BRUGG Pipes' Flexstar pre-insulated pipes are designed specifically for use in local heat pump systems and are made via a patented production process (according to DIN EN 15632-2 and DIN 4726) that ensures excellent bounding and longitudinal water tightness and a good oxygen diffusion barrier. BRUGG Pipes has five production sites across Europe and is part of the BRUGG Group. |

BRUGG
Pipes

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FLEXSTAR

Pour-in-place insulation used to 3D print homes

When you think of 3D printing or additive manufacturing you typically imagine small component parts or widgets being made from plastic, composite, or ceramic materials. Now, however, 3D printing is going to new heights with concrete being 'printed' to fabricate core building components and even entire structures. PU Review found out about two projects that Huntsman Building Solutions is involved in, which are ground-breaking in their approach.

HUNTSMAN
BUILDING SOLUTIONS

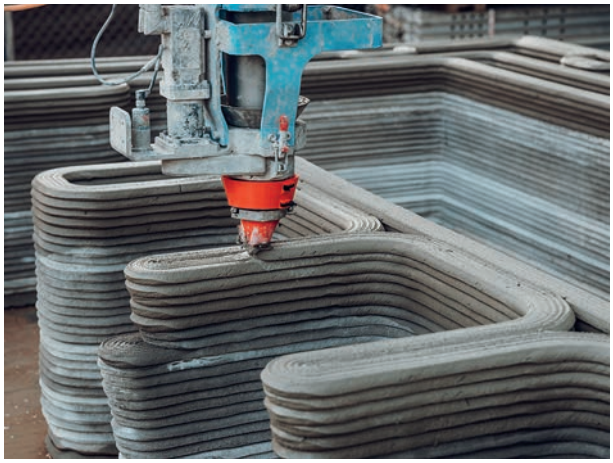
In Windsor, Ontario, not-for-profit organization, Habitat for Humanity Windsor-Essex, has recently completed the first 3D printed concrete homes in Canada. In a project that is providing affordable housing to those at risk of homelessness, the charity has built and certified four units where the design focus is on accessibility and net-zero emissions.

The project began in 2021, when Habitat for Humanity Windsor-Essex assembled a network of companies to help it achieve its vision of 3D printing homes. Partners included the University of Windsor, Great Northern Insulation (GNI), Huntsman Building Solutions (HBS) and Nidus3D.

Using funding from Canada Mortgage and Housing Corporation's Innovation Fund, project participants worked together to print, test, and analyze 3D-printed concrete samples to understand the best methodology for constructing homes using this innovative technique.

HBS' role was to work with GNI – Canada's largest full-service insulation contractor – to provide an insulation system that could be used to fill the cavity between the concrete walls once they had been printed. The unique construction of the dwelling required insulation to be installed into a 5 1⁄4" gap. Pour-in-place (PIP) foam insulation represented the only way to achieve a high-quality solution in such a unique space, while simultaneously offering a high level of comfort for residents and assisting the dwelling in reaching a state of net-zero emissions.

To create a high-quality building envelope, GNI specified the use of a HBS' PIP Foam 250 solution. Providing an air and vapour barrier and weather resistance, the use of PIP Foam means less materials are required for the building construction process, which translates into reduced costs, quicker construction times and a lower environmental impact. Using a PIP Foam 250 technology, which lowers air leakages and condensation levels, also means



residents will ultimately enjoy lower energy bills and more comfortable living conditions.

Rob Serino, Territory Manager at HBS, said: "What's great about using a PIP Foam 250 solution is that no maintenance of the insulation will be required. The product will remain durable and airtight for the home's lifetime. Habitat for Humanity Windsor-Essex and the University of Windsor worked incredibly hard to research and design materials, which would stand the test of time, so we wanted to match that commitment with a product that maintains prime condition far into the future."

In Houston, Texas, HBS has also been integral to the construction of the first two-storey 3D printed house in the United States. Utilizing a PIP Foam 250 product, the 4,000-square-foot family home showcases the potential to use 3D printing technology alongside conventional construction methods such as wood framing.

The project is spearheaded by architectural designers and assistant professors at the College of Architecture, Art, and Planning at Cornell University; HANNAH – an experimental design firm and research studio; PERI 3D Construction, an internationally leading provider for 3D construction printing; and CIVE, one of the leading engineering and design/build contractors in Houston. Once again, the role of HBS was to integrate a closed-cell foam insulation system into the project.

Concluding, Rob said: "Our PIP Foams are the ideal solution for use in 3D printed building projects. Our involvement in these projects shows us working alongside key industry partners to push the boundaries and accelerate the introduction of innovative building techniques that are better for business, but also better for people and the planet."

PIP Foams are two component, closed-cell, rigid polyurethane foam systems that have been specially formulated for pour-in-place applications. The systems use the Honeywell Solstice® liquid HFO blowing agent technology, an ultra-low Global Warming Potential and zero ozone depleting agent.

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New coating system has passive fire performance covered

Earlier this year our coatings experts launched POLYRESYST® IC6005 polyurethane system – a novel intumescent coating for the construction industry that can provide passive fire performance alongside strong protective properties.

Suitable for use on a variety of substrates, including steel, wood, and composites, our POLYRESYST® IC6005 system can offer improved chemical resistance, water resistance and durability. Spray applied, at any desired thickness, using standard equipment, the coating cures quickly and has a very fast drying time. It also contains no added solvents and has low VOC levels, for lower impact on air quality, human health, and the environment.

When exposed to fire, intumescent coatings systems expand, allowing them to act as an insulator to keep high temperatures away from structural building elements that need to be protected. This helps limit the spread of fire and extend evacuation times for building occupants in the event of a blaze.

POLYRESYST® IC6005 system was unveiled at the European Coatings Show in Nürnberg, Germany in late March, where customers could see the technology, up close and applied on an I-beam, a cross laminated timber panel and a series of tiles.

For more information about this coating innovation, please email:

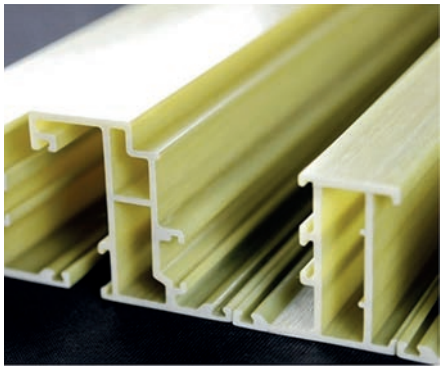
polyurethanes_eu@huntsman.com

RIMLINE® technology helps create better performing window profiles

Chinese window profile manufacturer, G-Ren Tech, has used our RIMLINE® technology in conjunction with a specialist pultrusion technique to create polyurethane window profiles that are eight times stronger than those made with aluminum and deliver greater insulation properties than PVC alternatives.

BAUEN WINDOWS & DOORS

RIMLINE®



The resulting profiles have been given the highest rating of level Ph A (cold & cool zone) by the Passive House Institute (PHI), which sets European window standards – achieving a Uf value of 0.7W/m²K.

To encourage the adoption of this technology worldwide, Huntsman and G-Ren Tech have been cooperating with several large window and door system brands in Europe, America, Japan and South Korea.

In Korea, the technology is proving particularly popular. Marketed under the name 'BAUEN window', the system has set a record as the first non-ferrous metal, single-frame, fire-resistant certified window with the highest fire-resistant rating (1st grade insulation: K value = 0.824W/m²K).

As a nation, Korea is urgently seeking fire-safe window solutions that are energy efficient. The size of Korea's urban population has led to the construction of housing that is often communal and densely situated. Constructing buildings close to one another – with narrow gaps in between – poses a risk in the event of a disaster, particularly in the case of a fire. To mitigate this problem, the Korean government has strengthened building regulations for fire resistance – a move that is expected to provide a significant boost to the $1.2 billion fire-resistant window market.

Where metal framed windows were once the most popular fire-resistant option, because of their safety track record, this kind of profile no longer satisfies the Korean government's zero-energy housing policy. Meeting economic, fire safety and efficiency criteria, Bauen's RIMLINE®-based system is a timely innovation that has the potential to become the most popular solution in the local fire-resistant window market.

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Opening up opportunities for TEROL® polyols in door and window insulation

Doors and windows account for about 40% to 50% of total building energy consumption – so enhancing the thermal insulation performance of these core construction components is key.

Polyurethane is now growing in popularity as an advanced solution for door and window profiles – as the G-Ren Tech/Bauen window story demonstrates. Compared to other materials, like metals, polyurethane has extremely low thermal conductivity. Its' mechanical properties are better in terms of strength and stiffness. The technology is free from volatile organic compounds.

To enhance the popularity of polyurethane even further in this sector, we are in the process of developing a new generation of pultruded profiles based on our TEROL® polyols. With up to 60% of content originating from recycled PET plastics, TEROL®-based profiles could make a substantial contribution to the construction sector's carbon neutral goals, while still delivering all the physical properties required for this demanding application, including good flame-retardant performance.

Developed in APAC, the new formulations are currently being verified and corresponding industry standards explored. Further information on our progress in this area will be made available in due course.

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Forthcoming events and technical presentations

2024

JEC World 2024 – Paris, France (5-7 March)

UTECH Europe – Maastricht, The Netherlands (23-25 April)

The Battery Show Europe 2024 – Stuttgart, Germany (18-20 June)

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