

October 2018

PUreview

REPORTING THE WORLD OF POLYURETHANES FOR OUR CUSTOMERS

HUNTSMAN

Enriching lives through innovation

Driving downstream with Demilec

**Huntsman expands footprint
in South America**

**Smart goggles – next generation
technology for hot cast customers**

**A potential game changer
in footwear production**

**Polyurethane chemistry –
helping to feed the world**



Our continued journey downstream

Tony Hankins, President, Huntsman Polyurethanes

Welcome to the latest edition of *PU Review*, our biannual publication, which showcases some of the key innovations that we're developing together with our customers, as well as strategic developments in the drive to take our business further downstream.

In this issue, we take you behind the scenes at Demilec, one of North America's leading spray polyurethane foam (SPF) insulation manufacturers, who Huntsman acquired in April. Just six months down the line, we're now working to globalize the business – leveraging the company's excellent reputation and best-in-class SPF technologies via our global network of 30+ downstream enterprises. We see excellent opportunities across Asia, Europe and South America to introduce Demilec's well-proven, highly innovative product range into national markets, which have demanding energy efficiency targets.

The prime purpose of SPF is to conserve energy, with MDI urethane being the most effective thermal insulant available today. This contribution to global sustainability is a theme that is repeated in several other stories in this issue. From partnering with Chinese flooring manufacturers to adopt alternative materials to wood, to making fertilizers that increase crop yields more effectively, we're continuing to apply our polyurethane chemistry expertise to focus on applications that make a real difference to the world we live in. These stories illustrate how Huntsman Polyurethanes is working to address today's challenging megatrends.

The quest to take our business downstream continues, and you can read about the latest investments we're making to support growth in Vietnam, Dubai and Chile – key locations where the regional demand for MDI-based polyurethanes products is growing at double digit rates.

Finally, if you're visiting the upcoming Center for the Polyurethanes Industry (CPI) Conference in Atlanta, Georgia, USA, we look forward to meeting you there.



The official opening of Huntsman's brand new, multi-purpose, formulations facility in Vietnam.

Huntsman opens formulations manufacturing facility in Vietnam

Huntsman has opened a multi-purpose facility at the Amata Vietnam Industrial Park, near Ho Chi Minh City, Vietnam. The site, a greenfield investment, will house Huntsman's Polyurethanes and Advanced Materials businesses and comprises manufacturing; R&D capabilities; a technical service center; warehouse and distribution space and a commercial office.

Commenting on the new facility, Huntsman's CEO Asia Pacific and President of the Polyurethanes business, Tony Hankins, said, "Vietnam is one of the largest and fastest growing countries in Asia Pacific. For polyurethanes, we've seen double-digit growth rates for a sustained period and fully expect this to continue. At the new site, we'll manufacture formulated systems for the footwear and automotive markets; rigid insulation foam used in construction and cold chain applications; and simulated wood for the furniture market. These products will be consumed primarily in Vietnam, with the balance being exported to Cambodia.

The facility will enable us to collaborate more effectively with Vietnamese customers and will also strengthen our strategy of globalizing downstream bolt-on acquisitions."

In addition to its new facility, Huntsman has a distribution warehouse in Vietnam located in the inland container depot at Long Binh in the Dong Nai Province. Huntsman also has a site in Hanoi, which offers technical service and includes warehouse and distribution space and a commercial office. |

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A new spray foam to advance the art of building design

Heatlok® HFO Pro® spray foam from Demilec Inc., is the latest technology in the Heatlok® HFO closed-cell spray foam series to leverage Honeywell Solstice® liquid blowing agent technology.

Designed at a molecular level to address the challenges of today's building envelope, Heatlok® HFO Pro® spray foam is certified by the Air Barrier Association of America (ABAA) for adhesion to most air barrier materials and achieves an R-11 to exceed ASHRAE 90.1 continuous insulation requirements at 1.5 inches. In addition, Heatlok® HFO Pro® spray foam provides a vapor retarder (less than 1 perm) at 1-inch thickness. That's a full 35 percent thinner than current Demilec materials, providing moisture vapor control within the exterior cavity.

Tom Harris, Vice President of Building Science at Demilec, said: "Why design a building to just meet today's code standards? You need to design for the lifecycle of a building and the performance needs of the future. With Heatlok® HFO Pro® technology, you can advance the art of building design. Working with Demilec and specifying our insulating air barrier solutions not only reduces risk, it also

enhances the overall performance of the building envelope, creating satisfied building owners and buildings that go beyond code and performance requirements. In this regard, Demilec is shattering the status quo."

Demilec was a front-runner in eliminating the need to use HFC blowing agents. The company introduced its Heatlok® HFO line of products three years ahead of the Montreal Protocol, which banned the use of HFCs in gas filled plastic insulation. Heatlok® HFO spray foam leverages Honeywell Solstice® liquid blowing agent technology, an ultra-low GWP (global warming potential) blowing agent that can be used instead of traditional blowing agents.

Heatlok® HFO Pro® spray foam was selected as a finalist at the coveted Innovation Award presented at the American Chemistry Council's 2017 Polyurethanes Technical Conference. The CPI Innovation Award is a

testament to the polyurethanes industry's commitment to technical progress.

The Demilec Building Science Group closely monitors International Building Code requirements to ensure that its products meet the highest possible standards. This allows construction companies and commercial design professionals to install and specify Demilec closed-cell spray foam products with complete confidence.

Building industry professionals and business owners can learn more about the benefits of Heatlok® HFO Pro® closed-cell spray foam at: www.nostatusquo.info.

You can also find out more about Demilec by turning to page 8, where you can read about the business, how it came to be part of Huntsman, and what lies in store in the future. |

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Elastomers team invests in new extruder

Huntsman has recently commissioned a new extruder at its Elastomers manufacturing plant in Ringwood, Illinois. The new equipment increases the company's capacity to produce its KRYSTALGRAN® PN range of aliphatic thermoplastic polyurethane film and sheet products.

Offering excellent UV resistance and wear, plus good low temperature performance, Huntsman's KRYSTALGRAN® PN film and sheet products are used in the manufacture of specialist surface protection films. Applied to the bodywork of cars and other vehicles, these products are designed to reduce the risk of stones chipping, scratching and damaging paintwork. The new extruder, which was installed in just four months, is housed in a former warehousing and storage space, which was renovated as part of the project. |

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New systems house coming to Middle East

Huntsman is building a new polyurethanes systems house in Dubai. Located within the Jebel Ali Free Trade Zone (JAFZA), the new facility will strengthen Huntsman's differentiated downstream capabilities in the heart of the Middle East.

Announced in May 2018, and targeted for completion by the second half of 2019, Huntsman's investment will increase the company's systems production capacity in the region and add a new dimension to its polyester polyol capabilities. The Dubai systems house will complement the company's two existing systems houses in the Middle East – in Turkey (Huntsman EMA) and Saudi Arabia (HAPC – a joint venture with the BCI Group of Companies) – forming three strong pillars for growth.

Tony Hankins, President, Huntsman Polyurethanes, said: "This is a bold and timely investment, which will serve as a strategic platform to expand our business in the Middle East and North Africa and build our market leading position. It represents the next step in our plan to strengthen our downstream network. We now have 30 facilities worldwide, which provide innovative solutions in close proximity to our customers."

Steen Weien Hansen, Regional Vice President, Huntsman Polyurethanes, added: "The MDI-based systems market in the Middle East has delivered strong growth in the last five years, and this trend is forecast to continue at estimated rates of seven percent annually. The construction of a new systems house will enable us to supply traditional and high-end rigid polyurethane formulations from a



local source. It will also enable us to leverage our development and production know-how in polyester polyols and polyol blends for the fast-growing flexible foam and footwear markets, as well as pre-polymers for adhesives, coatings and elastomers applications."

Gulum Kabil, General Manager of Huntsman Polyurethanes' business activities in the Middle East and Turkey, will manage the new systems house. |

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Huntsman has expanded its footprint in South America with the commercial registration of its business in Chile. The new legal entity, called Huntsman (Chile) SpA, is based in Santiago de Chile, and increases the capabilities of Huntsman Polyurethanes, and other Huntsman divisions, to supply materials and service Chilean customers from a local warehouse and customer service center.

Huntsman expands footprint in South America

Peter Huntsman Jr., Sales Director, Latin America, Huntsman, said: "Our Chile SpA site is further evidence of our growing commitment to the South American market. From this location, we will be able to better serve our regional customers through innovative technologies; an improved supply chain; and a strong commitment to product stewardship and local customer service. Chile is central to the young and growing region of South America and we are incredibly excited about this step forward."

With the commencement of activities in Chile, Huntsman now has polyurethanes operations at six sites in South America: in Cartagena and Bogota, Colombia; in Santiago, Chile; in São Paulo and Taboão da Serra, in Brazil; and in Buenos Aires, Argentina. These sites are supported by a solid and reliable distribution network spread across seven other countries in Central and South America.

Luis Mendonca, Director, Central and South America, Huntsman Polyurethanes, said: "Our new facility in Santiago gives us the ability to rapidly respond to customer requests with product stocks from a local warehouse. Along with our customers, we are incredibly enthusiastic about the prospects this brings. This investment will enable us to solidify our leading position in the Central and South American polyurethanes market, and will help our customers grow their businesses in Chile and the surrounding area."

With the recent acquisition of Demilec Inc., Huntsman now has a total of 17 polyurethanes locations in the Americas. Huntsman's polyurethanes footprint in the region spans all the way from Canada to Argentina and includes systems houses, manufacturing sites, R&D locations, customer / support technical centers and dedicated product distribution facilities. |

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Flowcrete uses Huntsman MDI to create flooring at world's largest hotel



Flowcrete Asia, part of The Flowcrete Group, has used Huntsman's MDI technology to create a robust polyurethane flooring system that is in use at the world's largest hotel – the Genting Highlands' First World Hotel and Resort in Pahang, Malaysia. *PU Review* found out more.

The Flowcrete Group is one of the world's leading specialists in seamless resin flooring solutions, as well as other specialty coating technologies. With operations on six continents, the Flowcrete Group has provided flooring products for use in some of the world's most iconic buildings, including the Dubai International Airport, Wembley Stadium in London and the Hong Kong Jockey Club.

When Flowcrete Asia was asked to find a flooring solution for the central kitchen and laundry facility at the Genting Highlands Hotel and Resort, the company's Malaysian team specified a sturdy, polyurethane-based concrete flooring system. The Flowcrete Group has a long track record of producing products that satisfy the demands of some of the world's toughest flooring applications. Renowned for their chemical and abrasion resistance, the company's flooring systems offer good tolerance to thermal shock pressure and can withstand high levels of mechanical stress. To meet the needs of the Genting



Highlands Hotel and Resort, Flowcrete Asia decided to use products from its Flowfresh antimicrobial polyurethane flooring range, which are based on Huntsman MDI.

With the ability to meet the strict standards and requirements of food and beverage industry flooring, the Flowfresh flooring system has successfully been accredited with HACCP International certification, a globally recognized program that evaluates materials, equipment and services used within the food industry.

Flowfresh products contain Polygiene® technology, which is a silver ion-based antibacterial agent. Homogenously distributed throughout the Flowfresh system, this agent actively targets bacteria that comes into contact with the floor and helps inhibit the growth of fungi, molds and mildew.

Two products from the Flowfresh range were installed across the 40,000 square meter kitchen and laundry area of the hotel. Products were applied at varying thicknesses, depending on the expected levels of traffic. To provide a long-lasting solution catering to the 24/7 working environment of the resort, Flowfresh HF was installed in cooking and wet areas, and given a textured finish to provide slip resistance for kitchen staff. Flowcrete Asia also supplied Flowfresh MF for the surrounding corridors, where lighter foot and cart traffic would be expected.

Two products from the Flowfresh range were installed across the 40,000 square meter kitchen and laundry area of the hotel.

Desmond Sin, Managing Director at Flowcrete Asia, said: "Located in Kuala Lumpur, our Malaysian team has worked with Huntsman for a number of years and together, we have a very strong relationship. We look forward to furthering our collaboration with Huntsman and continuing to use its MDI technology to create polyurethane-based flooring products that deliver exceptional results."

Flowfresh HF is a heavy duty, chemical resistant, antimicrobial polyurethane resin floor system that is ideal for areas where water and liquids may accumulate, such as food manufacturing, food preparation areas and chemical processing plants. As well as offering proven antimicrobial performance, Flowfresh HF floors are quick to install and offer heat resistance up to 120° Celsius – meaning they are easy to steam clean and sterilize.

Offering chemical resistant and antimicrobial properties, Flowfresh MF is suitable for use in dry or semi-wet processing zones. It is also a non-tainting and non-dusting material, and is a good alternative to acid resistant tiles. |

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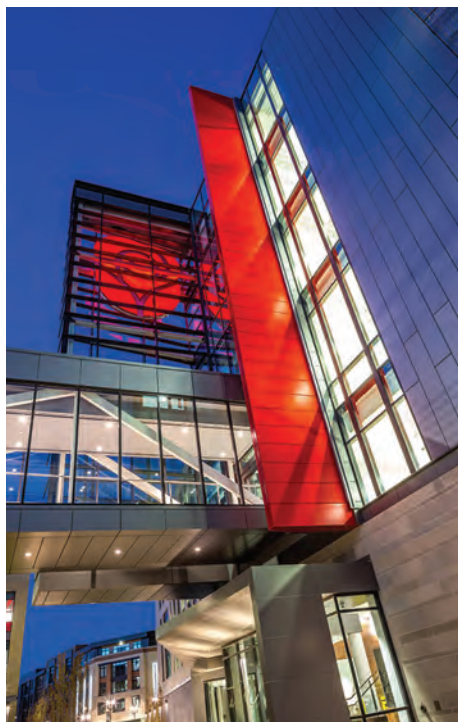
Huntsman helps CENTRIA meet its sustainability goals

Huntsman's technology is helping U.S.-based CENTRIA meet its voluntary sustainability goals by providing a halogen-free PIR system for its insulated metal panels (IMPs). In early 2018, CENTRIA, a leader in architectural metal wall systems, commercialized this halogen-free enhancement for its Formawall Dimension line of IMPs. With the elimination of halogens from the Formawall insulating foam core, CENTRIA is enabling the architectural community to create more sustainable building environments.



"CENTRIA wanted to offer a commercially available product, which reinforces the company's commitment to meet the sustainability and performance needs of its customers," said Kim Rager, Product Manager, Insulated Metal Panels, CENTRIA. "CENTRIA is the only manufacturer in the United States to currently offer IMPs with halogen-free foam as a standard product."

As a long-term producer of IMPs, CENTRIA knew it had to raise the bar to offer the construction market a product that was both sustainable and provided advanced thermal efficiency and moisture control in a single IMP component.



"When CENTRIA first approached the Huntsman team about creating a halogen-free PIR foam system, we knew we had a challenge on our hands," said Huntsman Innovation Manager, Lifeng Wu. "Technically speaking, it is very difficult to produce a PIR foam system without halogenated flame retardants in order to pass the most challenging fire tests required for this application. We had to work with some new formulation concepts to achieve the necessary fire performance."

The development program involved three years of R&D work with the team at the Huntsman Advanced Technology Center (HATC) in The Woodlands, Texas, and line trials at CENTRIA's plant in Sheridan, Arkansas. Product knowledge from other regions of the world helped create a strong starting point, which was able to be transformed into a technology designed to meet the needs of the U.S. market. The end result was a PIR system that passed the FM 4880 fire test.

"Sustainability has always been a key element of the CENTRIA business," said CENTRIA's Director of Research & Development, Mark Klos. "Huntsman's work exceeded our expectations by delivering not only the environmental aspects that we desired, but also superior fire performance and processing characteristics. Huntsman was with us every step of the way in this formulation change and I trust that our relationship will continue to provide value to the CENTRIA business long into the future." Sheridan Operations Manager, Dave Foerster, added, "The collaboration we had with Huntsman through the line trials and ultimate launch of the halogen-free product was excellent."

CENTRIA's Formawall Dimension IMP system, with halogen-free foam, offers advanced thermal efficiency and moisture control in a single component. Additionally, the products provide builders with an extensive range of colors, finishes, panel lengths, widths, thicknesses and reveals, which align with ever-changing sustainability goals and standards. Formawall has earned a Health Product Declaration (HPD) through the HPD Collaborative. This self-disclosed transparency program provides a way of reporting building product content and associated health information for architects and building owners.

"Our customers want to know and understand the materials employed in the products that they use to create sustainable indoor and outdoor environments," added Rager. "Removing halogen from our architectural line of IMPs was a voluntary decision and is a first step toward changing the status quo."

With the introduction of Formawall with halogen-free foam, based on Huntsman's technology, CENTRIA is paving the way for future innovations and delivering additional benefits to the architectural community. |

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Smart goggles support service available to CASTECH™ customers

Huntsman Tecnoelastomeri has launched a unique new service for its CASTECH™ elastomer processing machine customers. As part of a cooperation with GlassUp, an Italian technology company, Huntsman Tecnoelastomeri is now able to remotely provide technical support to customers using its CASTECH™ machines via an innovative smart goggles system. The new system lets equipment engineers see what CASTECH™ machine operators are looking at, in real time.



CASTECH™ elastomer processing machine customers that use this technology will have quicker access to our team's technical know-how.

GlassUp's smart glasses system is transforming how processing and equipment maintenance advice is deployed – enabling the rapid delivery of remote, front line technical support, in busy production environments. Featuring a built-in optical system and web cam, the GlassUp system lets Huntsman Tecnoelastomeri's machine experts share a customer's field of vision, while talking to them at the same time. Running on Microsoft® Windows® OS 8 (or later versions), the GlassUp goggles use a Wi-Fi connection to simultaneously stream images, videos and voice calls. The GlassUp system also comes with its own desktop software.

Johan Van Tongelen, Global Business Director, Huntsman Tecnoelastomeri, said: "GlassUp is taking wearable technology into the workplace and we are proud to be the

first elastomers producer in the world to adopt this system. The benefits that GlassUp can bring to industrial and manufacturing environments are huge. CASTECH™ elastomer processing machine customers that use this technology will have quicker access to our team's technical know-how, plus, more accurate on-the-spot advice and problem resolution."

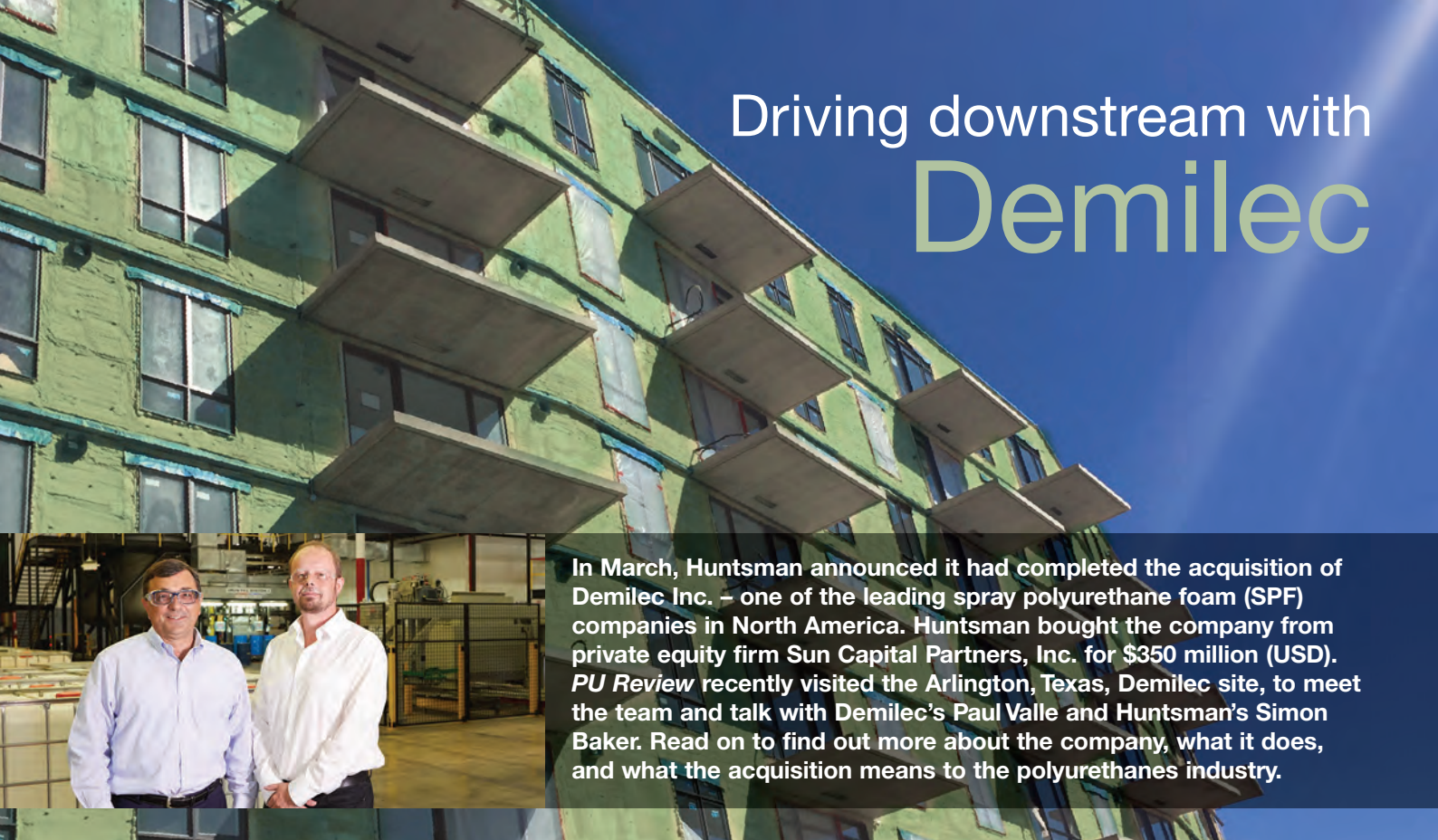
Huntsman Tecnoelastomeri will be incorporating GlassUp's technology into the 360-degree customer support services it currently offers to its elastomers customers.

Huntsman Tecnoelastomeri is one of the world's leading manufacturers of high-tech elastomers and elastomer casting equipment, and offers an end-to-end solution for hot cast elastomers companies. Under its TECNOTHANE™ / DALTOCAST™ brands, Huntsman Tecnoelastomeri provides a wide range of off-the-shelf and custom made hot-cast engineering elastomers. These innovative materials are used to create durable wheels, seals, rollers, pads and other technical parts for industrial, manufacturing and transportation applications. Huntsman Tecnoelastomeri also makes its own CASTECH™ machines for the efficient processing of polyurethane elastomers and microcellular elastomer foams. |

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Driving downstream with Demilec



In March, Huntsman announced it had completed the acquisition of Demilec Inc. – one of the leading spray polyurethane foam (SPF) companies in North America. Huntsman bought the company from private equity firm Sun Capital Partners, Inc. for \$350 million (USD). *PU Review* recently visited the Arlington, Texas, Demilec site, to meet the team and talk with Demilec's Paul Valle and Huntsman's Simon Baker. Read on to find out more about the company, what it does, and what the acquisition means to the polyurethanes industry.



PU Review (PU R): Can you start off by giving us a little background about Demilec; its history, locations and products?

Paul Valle (PV): In 1983, Demilec opened operations in Montreal, Canada. At the time, we were mainly providing closed cell spray polyurethane foam to the Canadian market. In 1997, we expanded the business into the U.S., and established an R&D and manufacturing site in Dallas, Texas.

In 2000, the company constructed a polyols plant at its Boisbriand, Quebec facility. Then, in 2014, we grew again, acquiring a 224,000 square foot location in Arlington, Texas to support continued growth and market demand in the insulation industry in North America. Today, Demilec has grown into one of the leading providers of open and closed SPF insulation products for commercial and residential building insulation in North America, with 150 employees and regional distribution centers located throughout the United States and Canada.

From a product perspective, our suite of SPF products for commercial and residential applications, includes APX® fire resistant SPF; AGRIBALANCE® USDA bio-preferred open cell SPF; Heatlok® SOY® closed cell SPF; and of course, our two flagship products – Heatlok® and Heatlok® HFO closed cell SPF and SEALECTION® open cell SPF. Additionally, we have a number of specialty polyurethane products for pour-in-place, container insulation, exothermal foam, concrete slab lifting and polyurea coating applications.

PU R: As one of the first companies in the spray foam space, you have probably seen a lot of changes in the industry. Can you elaborate?

PV: What started as a fledgling industry 35 years ago, has turned into a billion dollar market. We've been in the sector since the start and you're right, things have changed a lot. Today, commercial and residential builders, as well as consumers, know a lot more about SPF and its energy saving potential. In fact, the industry has reached the point where SPF

is now mainstream, and even a preferred solution for commercial and home insulation. Architects and builders are now specifying it into construction plans for new buildings, as well as for retrofit jobs. This was certainly not the case 20 years ago.

And, the story doesn't end there. We're now seeing a number of unique construction applications where SPF is increasingly being used. SPF is now finding a home within the agricultural market. Our BARNSEAL® closed cell SPF products were designed specifically to meet the challenges of mold minimization, ventilation control and bug infestation in the poultry, dairy, equestrian and farm industries. Oil and gas companies are using our GEOLOK™ exothermic foam to stabilize pipelines, manage erosion and hold pipes in place during the construction process. We have even created a complete air barrier system called Heatlok® ABS. Alongside our other SPF products, this innovation gives the construction industry a single-system approach for a complete building envelope.

PU R: The spray foam market is projected to grow 12 percent annually from \$1.2 billion in 2016 to more than \$1.9 billion by 2020. How does Demilec plan to keep up with this growth?

PV: The answer is simple: through innovation and enhanced customer support. To keep pace with the growth curve forecast, Demilec will continue to develop new and better products, closely aligned with market needs.



This is Demilec's strength. Today, applicators are demanding products with higher yields and higher R-values. Through our building science and R&D department, we are able to offer solutions with an average yield of 5,000 board feet per set. We also have an open cell SPF product with an R-value of 7.5 per inch. Additionally, we have created products that can be applied without an ignition barrier. Other applicators want materials that will allow them to work deep into the winter. In response, we've created a cold weather system that can be successfully sprayed in temperatures as low as -20° C (-4° F).

When it comes to sustainability, we've been recognized for creating spray foam products (Heatlok® SOY®) made from 14 percent recycled plastics and renewable oils, and for helping to block radon in new and existing homes and buildings. Our latest product, Heatlok® HFO Pro® SPF, also has excellent environmental credentials. It leverages Honeywell Solstice® ultra-low GWP blowing agent technology, to meet the Montreal Protocol, which bans the use of HFCs in insulation (read more about this development on page 4).

In addition, we're actively involved in helping to make sure applicators know how to spray specific products effectively and safely. We pride ourselves on having the industry's leading training program. Multiple times a year, at our sites in Arlington and Boisbriand, we host in-class and hands-on training sessions. We also have an on-site rig in Arlington, which we take to job sites to provide in-field spray trials. Lastly, we are heavily involved in the applicator certification program in North America, in conjunction with the Spray Polyurethanes Foam Alliance.

PU R: Over the past 18 months, the industry has witnessed a lot of consolidation, especially in the spray foam sector. What do you think the main drivers for this were?

Simon Baker (SB): There are several reasons why the SPF industry is seeing an increase in merger and acquisition (M&A) activities. Private equity firms have actively been involved in the SPF industry for several years. In general, private equity firms hold their investments for a limited amount of time and then, when the time is right, they divest, which was the case in the Huntsman acquisition of Demilec.



To compete in the SPF industry, companies must constantly be looking at their portfolio and developing new products to keep up with market expectations. This can be a challenge for smaller companies, who don't have the technical bandwidth or available resources. If SPF is only a small part of a company's overall portfolio, the costs may outweigh the immediate returns.

The increased M&A activity we are seeing isn't just limited to the SPF industry. We have seen a number of private equity firms, as well as larger players in the polyurethanes industry, make acquisitions in the slabstock, adhesives, coatings and elastomers market space.

Additionally, we have seen some larger players in the building materials industry, who want to diversify their portfolio, make acquisitions within the SPF industry.

PU R: How will Huntsman's acquisition of Demilec impact on the spray foam sector and the wider polyurethanes industry?

SB: We believe that Huntsman's acquisition of Demilec will be a win-win-win for the spray foam industry. As a supplier of spray foam systems and components (MDI and polyols), we've been dedicated to this market for over a decade. For a long time, we've been at the forefront, promoting the benefits of spray foam to a variety of markets, including the commercial and residential construction industry, the energy sector and the government.

Huntsman and Demilec are also fully aligned when it comes to product stewardship, education and the safe use and handling of spray foam and its components. Every year, we update our *Huntsman Polyurethanes-Americas: Safe Handling and Use Toolkit* and make it available to the entire industry in multiple languages. This toolkit features general guidelines for the safe handling of MDI, polyols, catalysts, and spray foam; loading, offloading, storage and the use and disposal of isocyanates and polyols; respiratory protection programs; and special topics / applications. Demilec is also taking a leading role in this respect in the SPF industry in North America.

Now, with Demilec's proven capabilities and technologies as part of our business, we have a very compelling offer. Both companies have a strong commitment to innovation, product stewardship and the principles of Responsible Care®. This, coupled with Demilec's leadership position in the market, will benefit all stakeholders in the spray foam industry and wider polyurethanes community.



Demilec's on-site and on-the-road training rig, which is used for in-field spray trials.



Huntsman and Demilec are fully aligned when it comes to product stewardship, education and the safe use and handling of spray foam and its components.

PU R: Why did Huntsman decide to buy Demilec and how will each company benefit from this deal?

SB: It is no secret Huntsman Polyurethanes is moving downstream. We believe this offers all our stakeholders a more compelling value proposition. The acquisition of Demilec, earlier this year; IFS Chemicals Ltd. in 2017; and Tecnoelastomeri in 2015, are all examples of how we are effectively executing this strategy. These acquisitions allow us to go from supplying polyurethanes components to supplying fully formulated MDI systems. Our integration strategy sees us working with these downstream companies, to provide support where necessary, but largely empowering them to do what they do best. In Demilec's case, that is to continue delivering high quality spray foam solutions, backed up by great building science expertise, excellent customer service and local hands on technical support staff.

PV: Demilec and its customers now have access to one of the world's leading MDI and polyol producers and to Huntsman's footprint, which spans around the world. It has always been our ambition to globalize Demilec and through Huntsman's established network of downstream enterprises (DSEs), we'll be able to achieve this ambition a lot faster.

SB: Paul's absolutely right. We can now leverage the Demilec name and our best-in-class SPF technology on a global basis. Demilec will be Huntsman's sole route to the global market for SPF systems and we're wasting no time making this happen.

We already have plans underway to roll-out Demilec's products in Russia, China, Japan, Eastern and Western Europe, the Middle East and Turkey. Via our DSE network and other existing facilities, we will soon be able to supply Demilec spray foam solutions worldwide, across key global markets with local sourcing and technical support, all of which are critical in this sector. Our near term goal is to have applicators in Russia spraying Demilec products in early 2019.

PU R: What has been the impact of this deal on the industry?

PV: It's still a little early to say, but we believe the impact will be positive, creating greater choice in the market. Feedback from Demilec's customers has been very encouraging. They are delighted Huntsman is the new owner of Demilec. The Huntsman name brings a long-term commitment to the spray foam and polyurethane industries; resources in the form of MDI and polyols; and a fundamental innovation capability, based on years of experience as a leading polyurethanes systems supplier.

PU R: Are there any more acquisitions on the horizon for Huntsman?

SB: At Huntsman, we're always interested in evaluating further strategic, bolt-on acquisition opportunities, which will enable us to move downstream in select value chains within the polyurethanes space, in specific locations around the world.

A HISTORY OF INNOVATIVE CONSTRUCTION PRODUCTS FROM DEMILEC



CONCRETE LIFTING FOAM

GEOLIFT™ concrete lifting foam helps home and building owners breathe new life into their sunken or uneven driveways, garages, sidewalks and patios. This environmentally-friendly injection foam contains 11 percent of materials made from recycled plastic and renewable soy beans, and uses a blowing agent with zero ozone depleting potential.



THE GEOTECHNICAL SOLUTION

GEOLOK™ low-exothermic spray foam was designed to stabilize in-ground pipelines versus laying down sandbags. GEOLOK™ spray foam helps pipeline companies manage erosion, minimize runoff, and prevent trench breaks and washouts, while laying pipes during the construction and backfill process.



THE COMPLETE BUILDING ENVELOPE

Designed for use in conjunction with SPF, Heatlok® ABS is a self-adhering air / vapor barrier membrane for walls composed of modified SBS and a tri-laminate woven polyether facer. Heatlok® ABS can be used as a masonry and through-wall flashing membrane. This system exceeds the performance requirements of the Air Barrier Association of America; ASHRA 90.1, CAN/ULS S705.3, Air Barrier Assemblies CAN/ULS S742 and the Canadian Government Standards for Insulation Material.



PREMIUM POLYUREA PROTECTION

MAXGUARD® premium polyurea coating systems adhere to all types of substrates, including wood, concrete, metal, fiberglass, PVC and geotextiles, in hot and cold temperatures. They can be used in a variety of applications including water / storage towers, truck bed liners, agricultural buildings and water, oil and sewer pipes, to protect against abrasion, rust and corrosion.



Helping Brugg achieve record levels of pipe performance

With help from the polyurethane insulation experts at Huntsman, Brugg Rohrsystem AG, a leading manufacturer of pre-insulated pipes for the heating distribution sector, has significantly improved the insulating capacity of its CALPEX® pipes – setting a new standard for the energy efficiency of these components, which are widely used in district central heating (DCH) systems.

DCH systems are a clever means of generating and distributing heat, en masse, for people living and working in densely populated areas or multi-occupancy buildings. They use centralized power plants to create heat by, for example, incinerating municipal waste or biomass materials. This heat is then used to create steam or, more commonly, hot water, which is subsequently circulated to its destination via a network of pre-insulated underground pipes.

Since 2010, Brugg's CALPEX® pipes have consistently delivered foam that has a thermal conductivity (also referred to as lambda) of 0.0216 W/m*K. This already very low number was always considered a magic threshold, which was thought difficult to get beyond. However, undeterred, Brugg decided to test the boundaries of technical innovation in an attempt to take the performance of its pipes to the next level. In 2015, Brugg enlisted the support of its long-standing polyurethanes supplier Huntsman, and together, the two companies embarked on an intense R&D project. The aim was to create a brand new kind of polyurethane insulation, tailored to Brugg's insulation ambitions. As a result of this relationship, Brugg has reduced the thermal conductivity of its new CALPEX® PUR-KING pipes to a groundbreaking value of 0.0199 W/m*K (λ 50).

Linda Carillo, Application Specialist in the European Innovation Team at Huntsman, explained more: "We've worked closely with the team at Brugg for many years and have been the sole supplier of polyurethane to the company's Swiss production plant since 1996. Over the last decades, we've helped Brugg advance the performance of its pipe products in line with market trends and new legislation. In 2002, we smoothed the switch from water-blown to pentane-blown technology. Then, in 2006, we helped the company make the transition from low to high pressure processing. When Brugg came to us to discuss improving the lambda value of its CALPEX® pipes for its new PUR-KING range, we were happy to get involved. We're always keen to take part in innovation projects, particularly where there is a clear environmental benefit; in this case, the creation of more energy efficient DCH systems."

BRUGG launched its next generation CALPEX® PUR-KING pipes to the insulation market in April 2018. |

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A project with the potential to shake up footwear manufacture

A unique footwear material from Huntsman sits at the heart of an innovative new way of making shoes, which has the potential to transform shoe production worldwide. In the biggest change to footwear assembly in 40 years, Spanish company Simplicity Works – together with Huntsman and DESMA a leading shoe machinery specialist – has developed a revolutionary new shoe production method that offers game-changing possibilities to manufacturers looking to produce products closer to customers in Europe and North America.



In collaboration, the three companies have created a highly automated, cost effective way of bonding together two-dimensional components, in a single shot, to form a seamless, three-dimensional upper.

Simplicity Works' patent-protected 3D Bonding Technology is a world-first. Requiring no stitching and no lasting, the process connects all pieces of a shoe simultaneously, in just a few seconds. Faster and cheaper than conventional footwear manufacturing techniques, the new technology can be customized to suit requirements and is already proving popular with a number of big brand shoe companies – helping them bring local production overheads into line with lower labor cost countries.

The 3D Bonding Technology employs an innovative 3D mold design created by Simplicity Works; a specifically designed, injectable material from Huntsman; and a state-of-the-art DESMA injection-molding machine. In the first step, individual upper components are placed into the mold, in slots separated by narrow channels – a bit like putting a puzzle together. A counter mold then presses each piece into place. The network of channels between the upper components is then injected, in a single shot, with the high-performance polyurethane developed by Huntsman. The end result is a shoe upper, held together by a flexible, polyurethane skeleton, which is both functional and stylish. Available in different colors, the texture of the bonded

3D BONDING TECHNOLOGY



Shoe Last



Material placement
(leather fabric, rubber,
metal, wood)

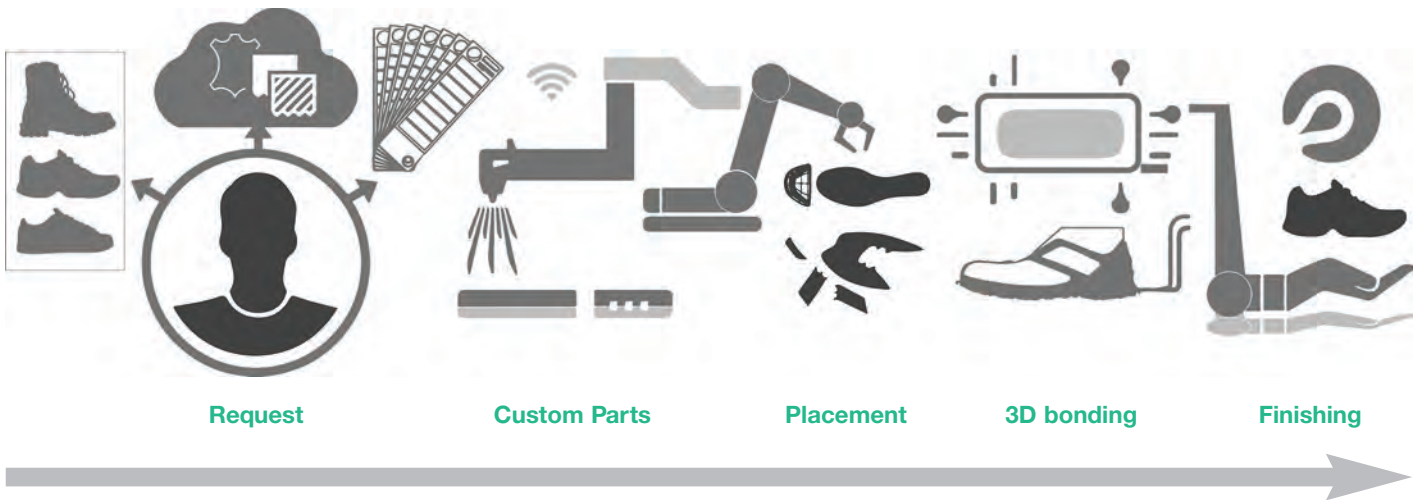


Polymer injection
(in a 3 dimensional mold)



Finished product

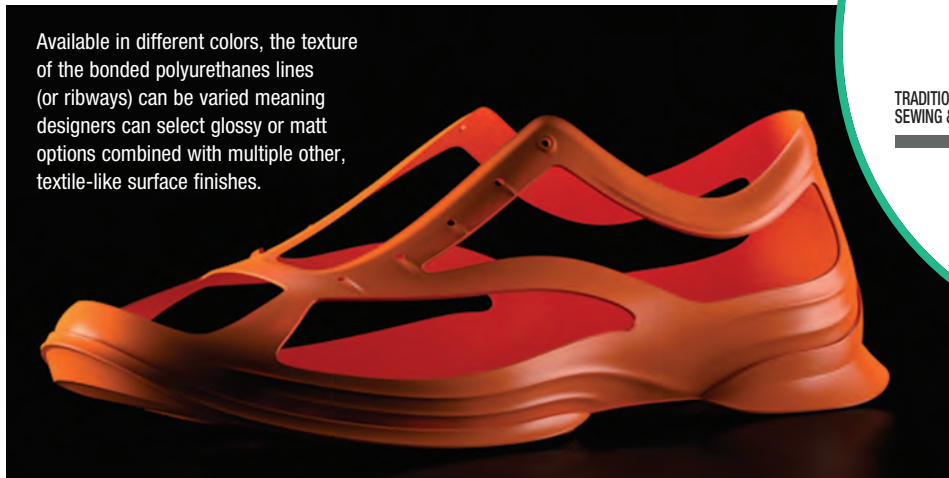
KEY STEPS IN THE SIMPLICITY WORKS PROCESS



polyurethane lines (or ribways) can be varied, meaning designers can select glossy or matt options combined with multiple other, textile-like surface finishes.

Suitable for creating all kinds of shoes, and compatible with different synthetic and natural materials, the 3D Bonding Technology can make shoe production outside of low labor cost countries far more cost competitive. With no seams to stitch, the overall production process is less labor intensive – reducing overheads. Material costs are also lower, as there are no overlapping areas and much less waste. From a consumer perspective there are additional benefits. With no knitting or stitching lines, and no doubling-up of material, shoes have less friction and pressure points, and behave more like a pair of socks. Shoes are also more waterproof, as there are no needle holes or permeable seam lines.

The launch of Simplicity Works' 3D Bonding process culminates six years of work for the three companies, who believe passionately in the technology's ability to disrupt conventional forms of footwear production.



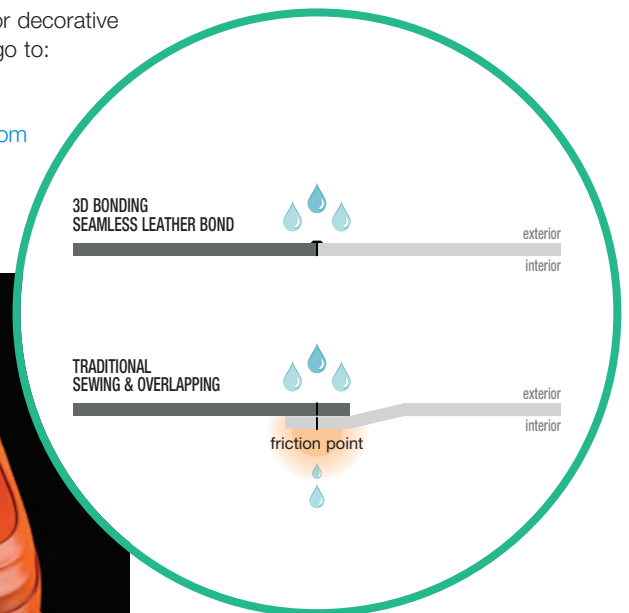
Available in different colors, the texture of the bonded polyurethanes lines (or ribways) can be varied meaning designers can select glossy or matt options combined with multiple other, textile-like surface finishes.

Adrian Hernandez, Simplicity Works CEO, said: "Six years ago, I realized there was a way to simplify footwear manufacturing. Keen to redress the geographical balance in the footwear industry in terms of labor costs, I came up with a radical new process that can make shoe production more cost effective, while also increasing comfort for consumers. With my concept patent-protected, I began looking for companies to make my vision a reality; which led me to DESMA and Huntsman. Working closely together over the last six years, our three teams have pooled their knowledge and expertise to create a process with the potential to shake up the shoe sector."



Simplicity Works' 3D Bonding Technology is flexible – meaning footwear manufacturers can choose to use it as the main joining technique or combine it with traditional stitching methods for functional or decorative purposes. For more information go to: www.3dbonding.com |

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With no doubling-up of material, shoes have less friction and pressure points and behave more like a pair of socks.

Enabling a greener future with non-wood particle boards

China has long been a country coping with the formidable challenges of deforestation and desertification. As a result of the Natural Forest Protection Program, which restricts timber production from natural forests, and a tree plantation program, the country has regained some forest cover in recent years – but the challenges it faces are still serious.



The Chinese building materials industry, and flooring manufacturers in particular, have traditionally been major consumers of timber. With growing awareness about the importance of forest protection, a large number of flooring solution providers in the region have shifted their attention to using timber substitutes for the manufacture of particle board. Huntsman is playing a major role in this effort, helping many different companies make the switch to non-timber materials.

In July 2017, with assistance from Huntsman, the Panjin Jijia Board Co., Ltd, a panel maker in Liaoning Province, China, launched the world's first production line of formaldehyde-free, reed-based, particle board – marking a major breakthrough in the flooring sector.

Enabling Panjin Jijia to kick off this pioneering project, Huntsman served as a strategic collaborator – helping the company bring formaldehyde-free, reed-based particle boards to the marketplace more rapidly. Joining the Panjin Jijia Reed Board Project team at a very early stage, Huntsman provided innovative solutions and technical support regarding the selection of adhesives and corollary equipment. Choosing the right adhesive is critical to the successful use of reed in particle board production. A resilient solution is needed to ensure a good bond with the smooth surface of the straw. The Huntsman team also assisted with the trial manufacture of prototypes and with performance tests and assessments.

Today, Huntsman continues to provide critical support to Panjin Jijia. With a close collaboration in research and development, Huntsman is supporting Panjin Jijia in a drive to reduce manufacturing costs and improve production efficiency. Huntsman's team is also delivering extra value by developing new products with specific performance criteria, suited to the utilization of reed.

Huntsman has a strong track record in the particle board industry and has been helping Chinese companies replace the use of wood since as far back as 1995 – forging strategic relationships with many leading players in the Chinese flooring sector. |

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Automotive experts from Huntsman have developed a new polyurethane technology for noise, vibration and harshness (NVH) applications that delivers outstanding acoustic performance – without compromising foam quality or line processing speeds.

New technology to enhance acoustic comfort in cars

ACOUSTIFLEX® HFI technology is the latest product in Huntsman's portfolio of ACOUSTIFLEX® polyurethane systems for automotive NVH applications. ACOUSTIFLEX® materials are known for offering distinct processing advantages over other acoustic materials, including significantly faster demold times, which means better part production rates can be achieved.

ACOUSTIFLEX® technologies also work well with water-based release agents, eliminating the need for solvents, and thereby satisfying EHS and sustainability concerns. Huntsman's ACOUSTIFLEX® technologies are available either as full systems or as an isocyanate for self-formulators.

Johan Peters, Global Account Manager Acoustics and NVH at Huntsman, said: "Huntsman is a global leader in polyurethane acoustic technologies for the automotive sector. Working closely with key industry players, we develop sound absorbing materials that can be used to deliver ultimate acoustic comfort to vehicle drivers and their passengers. ACOUSTIFLEX® HFI technology is the latest addition to a portfolio of acoustic products that are renowned for their performance, but also for the ease with which they can be integrated into existing production processes. This combination enables automotive original equipment manufacturers and their customers to benefit from a reduction in part production costs – without compromising performance." |

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Pursell Agri-Tech: Using Huntsman chemistry to help feed the world

The team at Huntsman has been working with Pursell Agri-Tech, an Alabama-based fertilizer company that coats next generation fertilizer pellets to improve their efficacy, increase crop yields and enhance human nutrition. In a move designed to advance the use of coated, slow-release, nutrient delivery systems, worldwide, the two companies have developed a new resin chemistry and a novel production process.



The patent-pending technology, which can coat urea capsules more quickly and efficiently, is designed to make the use of specialty fertilizer more accessible to farmers around the globe. Pursell Agri-Tech has been a leader in the North American fertilizer industry for more than a century. In that time, the business has earned a reputation for developing innovative, controlled-release fertilizer technologies that can improve soil growing conditions and boost the performance of broad-acre commodity crops, such as corn and wheat, plus other plants, grasses and trees.

Nick Adamchak, CEO at Pursell Agri-Tech, said: “Worldwide, urea pellets are widely used as a nitrogen fertilizer. Nitrogen is vital to the healthy development and physiology of plants, but it has one major downside; it is very soluble and easily washed out of soils. Coating urea fertilizer pellets can help overcome this problem – slowing down the rate at which nitrogen is released. With coated pellets breaking down more steadily, over time, the risk of nitrogen loss via leaching is dramatically reduced. From a farming perspective, this makes the use of fertilizers far more effective. With nutrients available over a longer period, plants perform better – increasing yields and farm profitability.”

The use of coated urea fertilizer pellets also has environmental benefits. Worldwide, nitrogen pollution is a big problem. Nitrogen that isn't absorbed by plants makes its way into streams and rivers. Too much nitrogen in our waterways causes algae to grow faster than ecosystems can handle, decreasing the

amount of oxygen available to fish and other aquatic wildlife. Algae blooms can also prove harmful to human health.

Continuing, Nick said: “Coated fertilizer pellets are widely considered more expensive than uncoated alternatives, despite their obvious commercial and environmental benefits – and this has slowed down the adoption of the technology. To improve this situation, we wanted to simplify our production process and create a smaller, more cost efficient, coatings plant from which to serve the North American and global farming sector. We also wanted to create a process technology that could be licensed to fertilizer producers in developing countries – where farming conditions are tough and the use of coated urea fertilizers can make a huge difference to how much food is grown. Currently, most coated fertilizer pellet systems are shipped to developing countries, which makes it cost prohibitive and uptake of the technology slow.”

To make its idea a reality, Pursell Agri-Tech reached out to Huntsman's Technology & Innovation (T&I) team for help in refining its production process. Using its knowledge of urethane chemistry and how it performs in coating applications, Huntsman's T&I team was able to help Pursell Agri-Tech cut out

Coating urea fertilizer pellets slows down the rate at which nitrogen is released. With nutrients available over a longer period, plants perform better – increasing yields and farm profitability.

several manufacturing steps and make the overall pellet coating process quicker and more cost competitive.

In March 2018, Pursell Agri-Tech opened a brand new \$8.4 million plant in Sylacauga, Alabama, which uses the new coating process and chemistry for the domestic farming sector. The new manufacturing method is also being made available to urea fertilizer producers outside of North America via a licensing arrangement with Stamicarbon, a market leader in urea production with licensing agreements with more than 250 urea fertilizer plants worldwide. Stamicarbon acquired a 20% stake in Pursell Agri-Tech in 2017.

Paul Mackey, Director of Innovation and Technology at Huntsman, said: “Our work with Pursell Agri-Tech is a great example of us working closely with a customer and using our knowledge and expertise to create an innovative product solution. Together, the system we have created has the potential to deliver far-reaching benefits to Pursell Agri-Tech; the farming sector; and ultimately, thousands of people worldwide, who are in need of better access to innovative farming techniques that enable the production of more food.” |

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New multilayer foam delivers advanced comfort in automotive seating

An international project, combining the very best of Huntsman's global polyurethanes and automotive expertise, has resulted in a major breakthrough in vehicle seating technology – which has been successfully adopted by two of the world's leading car manufacturers.

Working together, Huntsman Polyurethanes' global research team; European automotive team; and Asia Pacific product development team have developed a pioneering multilayer hardness foam. The new system enables automotive original equipment manufacturers (OEMs) to specify the comfort levels they want to deliver in seating applications and create cushions with different layers of hardness, according to specific manufacturing requirements.

Produced via a fast, one-shot process, the new seating foam technology is based on similar principles employed in the design and manufacture of footwear soles. Typically, shoes feature a soft, cushioning midsole, which comes into contact with the wearer's foot, plus a harder outer sole that touches the ground. Huntsman's new seating system follows a similar approach. A soft, comfortable top layer of foam is created, which the passenger sits on, while underneath, additional layers of a firmer foam provide structural support for the body. This offers protection against the vibrations caused by driving.

Forthcoming events and technical presentations

CPI 2018 Polyurethanes Technical Conference, Atlanta, Georgia (1-3 October)

IWCS, Providence, Rhode Island (14-17 October)

Foam Expo Europe, Hannover, Germany (16-18 October)

Feiplar Composites & Feipur 2018, São Paulo, Brazil (6-8 November)

SIMAC TANNING TECH 2019, Milan, Italy (20-22 February)

FIMEC 2019 (International Fair for Leather, Chemical Products, Components, Machines, and Equipment for Footwear and Tanneries), Novo Hamburgo, Brazil (26-28 February)

JEC World 2019, Paris, France (12-14 March)

European Coatings Show 2019, Nuremberg, Germany (19-21 March)

Foam Expo North America 2019, Novi, Michigan (26-28 March)

DOMOTEX asia/CHINAFLOOR 2019, Shanghai, China (26-28 March)

UTECH Las Americas 2019, Mexico City, Mexico (10-12 April)

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As well as bringing new levels of static, postural and dynamic comfort to car seats, Huntsman's new foam technology also has processing benefits. With a super soft foam at the top of the cushion, seating producers no longer have to add extra layers of TDI slab stock foam beneath a seat cover to improve comfort – resulting in a significant cost saving.

The only all-MDI system capable of delivering this kind of performance, Huntsman's new foam technology has already been adopted by two of Asia's leading automotive brands.

Commenting, Vincent Huang, Automotive & Flex Technical Manager at Huntsman, said: "For decades, Japanese and Korean car manufacturers have been trying to break into the high-end luxury car market. High comfort seat cushions constitute a key, but challenging element of this ambition. Our new foam system enables these companies to deliver new levels of comfort and demonstrates our commitment to technology differentiation. Two key vehicle producers are already using this technology, and we are actively looking to extend its use with other players in the market. As we roll out this novel foam system across the global automotive industry, we will continue to drive new polyurethane developments that can be used to create higher comfort foams, and which deliver real added value to car manufacturers worldwide." |

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HUNTSMAN

Enriching lives through innovation

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