

June 2021

Pureview

REPORTING THE WORLD OF POLYURETHANES FOR OUR CUSTOMERS

HUNTSMAN

Enriching lives through innovation

RIGID PU FOAM INSULATION: Essential cold chain solutions



**New manufacturing assets in Asia
Delivering greener insulation
Ensuring a smoother ride
Recyclable, sustainable footwear solutions**



The need to innovate is constant, whether in crisis or good times

Tony Hankins, President, Huntsman Polyurethanes

Since I last wrote to you in June 2020, COVID-19 has continued to affect our lives in unimaginable ways. Thanks to the focus, discipline and immense dedication of our associates, Huntsman has navigated the challenges of the pandemic and delivered a strong business performance. We were deeply honored to welcome Her Majesty Queen Maxima of The Netherlands to our Rotterdam MDI production facility in April (see page 3), during which she reviewed the unique COVID testing facilities that we've established at the site.

COVID has undoubtedly had a profound effect on the way we do business. But one of the things that remains constant, whether during crises or in good times, is the need to innovate. In this issue, we have stories which showcase how we're solving technical challenges in partnership with our customers. For example, you can read about the progress of Huntsman Building Solutions, our world-leading spray polyurethanes business; new developments in comfort seating for automotive; and new sustainable solutions for the footwear industry.

The main feature (pages 8 to 11) looks at the critical role of the cold chain, which is made possible by rigid polyurethane foam insulation. Enabling perishable goods to be transported and stored under temperature-controlled conditions, the technology helps reduce food waste and extend the life of vital products, en route to consumers. Today, polyurethane-based cold chain solutions are supporting the worldwide distribution of COVID vaccines, for which reliable refrigeration is essential.

I hope you find value in this issue and wish you a safe and healthy time, wherever you are in the world.

New downstream manufacturing assets come on stream in Asia Pacific

Huntsman significantly expanded its downstream polyurethanes capabilities in Asia Pacific in 2020 with major works progressing on two strategically important manufacturing assets.

In June last year, the business held a flag-raising ceremony at its new Tianjin polyurethanes systems house in Northern China, marking commissioning of the site. During Q4 2020, the business also completed work on its 22kT/year TEROL® polyester polyol plant at its Taiwan systems house in Kuan Yin. The sites represent a major step forward in Huntsman's downstream journey – with great synergies between the two facilities.

The Kuan Yin site is the first Huntsman plant outside of the Americas to employ the corporation's proprietary TEROL® technology. The site is now taking scrap PET (polyethylene terephthalate) and transforming it into a polyol that can be used to create polyurethane products for a wide range of applications. Each year the site is projected to use the equivalent of nearly half a billion 500ml PET bottles in its manufacturing process; materials that are saved from the



oceans, and from landfill and refuse facilities. The resulting polyols are then used to supply Huntsman's Tianjin systems plant, plus other assets in the region.



The Tianjin systems house is Huntsman's first plant in Northern China. Located in the Nangang Industrial Zone, annual capacity of the site is expected to reach 70,000 tons. Products produced on site – using TEROL® polyester polyols – will include polyurethane for PIR (polyisocyanurate) board stock systems and rigid foam applications; spray foam insulation; and pour-in-place polyurethane for use in cold chain units, refrigerators and freezers. The site will also utilize other sustainable processes – including cyclopentane-type blowing agents that do not damage the ozone layer. |

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Rotterdam site welcomes Queen Maxima

Employees at Huntsman's Rotterdam facility were treated to a special visit from Her Majesty Queen Maxima of The Netherlands in early April, in recognition of the success of a pilot program implemented to conduct rapid tests for COVID-19.

As part of a 40-day shutdown of the facility at the Port of Rotterdam for turnaround activities, nearly 1,000 external contractors have been on site, coordinating different tasks. In addition to existing protective measures already in place at the plant, an extra layer of protection was added to prevent the spread of infection. Coined "Operation Fastlane," Huntsman worked with the Dutch government to set up four test streets and became the only site in the Netherlands to administer breathalyzer tests around the clock for coronavirus. Through the program, personnel are screened every 48 hours and receive instant results from their breath tests, which has prevented outbreaks among staff and ensured a safe and healthy environment at the Rotterdam facility.

The breathalyzer device, developed by Dutch company Breathomix, functions like an electric nose and can quickly detect when users are not infected with the coronavirus. The device does not detect the virus itself, but instead captures changes in human breath when fighting infection. From start to finish, the testing process takes two to three minutes, creating an efficient and effective screen for illness in personnel entering the facility.

Kal Khogali, Rotterdam Site Director, said. "Our facility has been proactive in introducing systems for identifying and protecting the site from the threat of COVID-19 over the last year. To have the Queen recognize our efforts speaks to the tremendous work undertaken by the team to safeguard both health and our critical operations." |

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Turkish systems house rebuild underway

Huntsman has announced that it is rebuilding its polyurethanes systems house in Istanbul, Turkey, which was destroyed by a fire in September 2019. On the existing plot of land, which housed the original Huntsman EMA facility, Huntsman is creating a world-class systems house and technical center that will meet the highest standards for environment, health and safety (EHS), engineering and quality.

The new world-class systems house will include production capability for Huntsman's TEROL® polyester polyols, polyol blends, MDI prepolymers, spray polyurethane foam (SPF) and polyurea. Once operational, the proprietary TEROL® technology will use the equivalent of hundreds of millions of PET bottles per year in the production process – thereby enhancing the corporation's contribution to the circular economy and making it a sustainable investment.

The facility will also serve as a growth platform for Huntsman Building Solutions (HBS) in Turkey and the Middle East. HBS is one of the world's leading SPF providers and the fifth largest insulation manufacturer.

Steen Weien Hansen, Vice President – Europe, Africa, Middle East & India at Huntsman Polyurethanes, said: "This year, marks the 10-year anniversary since Huntsman acquired EMA. Reconstructing the systems house will enable us to continue the team's work at the heart of the Turkish polyurethanes industry. Turkey is the second largest MDI-based polyurethanes market in Europe and offers high growth and access to a multitude of industrial and consumer market segments, driven by attractive demographics and a sizeable manufacturing sector."

Gulum Kabil, Regional Managing Director for Huntsman Polyurethanes in Turkey & Middle East, said: "As work on the

construction of our new facility gets underway, we want to express our gratitude to the Turkish authorities for their ongoing support. I would also like to thank our customers for their understanding and the Huntsman EMA team. In the period since the fire, our associates have worked diligently to supply our products throughout the region through various interim supply solutions."

Construction of the new facility is targeted for completion by Q4 2021. |

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HEATLOK® Series is the first SPF product range certified to provide Radon protection



Spray polyurethane foam (SPF) is widely recognized as one of the most thermally-efficient forms of insulation available for both residential and commercial building projects. But, did you know it can also provide protection against radon – a colourless, odorless, radioactive gas that’s heavier than air and can accumulate in basements?

The HEATLOK® Series has become the first range of SPF products certified to deliver protection against radon – also known as soil gas. The certification was awarded following extensive tests conducted at the Czech Technical University in Prague.

Radon is a natural gas, found in the ground, which can infiltrate buildings through cracks and openings. Linked to lung cancer, radon has a tendency to build up in the basements of buildings, if they are not sealed properly.

Soil gas ingress into basements and cellars is typically managed in four steps:

1. By providing a gas collection layer under all ground contact floors;
2. By installing a piping system to extract the gas;
3. By sealing all seams, cracks and opening in basement floors, walls and roofs; and
4. By testing radon levels after the build is complete.



One of the most common methods for sealing cracks and joints in basement areas is to use polyethylene sheets and tape.

Concrete is then poured over the top of the material. While this method does work, it is virtually impossible to achieve a perfect soil gas barrier this way. Using SPF provides a much more effective solution and can dramatically increase the efficacy of soil gas control systems due to the high level of air tightness provided.

To determine the suitability of the HEATLOK® Series as a radon barrier, the materials were tested in a laboratory at the Faculty of Civil Engineering at the Czech Technical University. Applied at a thickness of just 1.25 inches, HEATLOK® HFO Pro was found to provide 65 times more resistance to radon diffusion than polyethylene sheeting.

SPF also has many other benefits. Using SPF to insulate and seal basements and cellars is faster and more cost effective than other methods. Surfaces can be sprayed quickly in a single step – with the foam expanding to 30 times its original volume in five seconds and penetrating crevices and cracks. Self-adhering to all sorts of building materials, the SPF seals itself around fixtures and fittings like plumbing pipes. It also creates a seamless barrier between floors, walls and ceilings.

Another major benefit is the material’s good compressive strength. At 31 psi, SPF can withstand the pouring of concrete when used as under-slab insulation – maintaining a continuous air barrier. Once the foam has



cured, construction workers can move about on it with wheelbarrows and equipment, without fear of damaging it. In addition, the final foam is resistant to water and fungi / mold – so is ideal for use in flood prone zones.

Maxime Duyzk, Director, Building Science and Engineering, Huntsman Building Solutions, said: “The benefits of using SPF to improve the energy efficiency of buildings are widely recognized – but there is now real interest in the technology’s radon protective properties. We are incredibly proud that the HEATLOK® Series is the first range of SPF products to be certified for use in this application. The International Residential Code, the National Building Code of Canada, as well as various provincial buildings codes, all stipulate the use of radon control measures in residential construction projects. As more regulations of this kind come into force, more and more contractors will be drawn to the benefits of SPF, which can keep occupants warm and comfortable in buildings – and also protect them from the harmful effects of radon.” |

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Delivering a greener future through HEATLOK® Soya HFO insulation

In support of today's green building standards and certification systems – and following the Montreal and Kyoto Protocols – Huntsman Building Solutions has committed to innovate products that are better for the environment. As a direct result, the business has eliminated the use of hydrofluorocarbon (HFC) blowing agents from its Canadian range of spray polyurethane foam (SPF) insulation products, effective from January 1, 2021.

Ahead of this milestone, the business launched HEATLOK® Soya HFO – a hydrofluoroolefin (HFO)-based spray foam solution, which contains a total of 22% recycled plastic and renewable soya oil. With ultra-low global warming potential (GWP) and superior spray-ability, adhesion and compressive strength, the product has a GWP rating of one, which is 99.9 per cent lower than comparable products that use traditional HFC blowing agents.

Doug Brady, Vice President of Global Innovation & Product Management at Huntsman Building Solutions, said: "Huntsman launched its first HFO system back in 2018. Since that time, the product has been selling steadily with a solid base of early adopters. The launch of HEATLOK® Soya HFO is the next big breakthrough in environmental terms. Suitable for use on all surfaces and shapes, this innovative product is making our spray foam insulation more environmentally-friendly than ever – coinciding with shifts in the legislative landscape. Containing a total of 22% recycled plastic and renewable soya oil content, just one polyol

drum of this product contains the equivalent of up to 3,000 plastic PET (polyethylene terephthalate) 500ml bottles; material that has been diverted from landfill. In addition, with the system sold in liquid form, in returnable or recyclable containers, the installation of HEATLOK® Soya HFO generates zero waste and zero trash on job sites."

In the run up to launching HEATLOK® Soya HFO, the Huntsman Building Solutions team has been educating insulation contractors and the architect community about the new product's efficiencies and overall benefits. In November, the business embarked on a "Coast to Coast" road show to re-introduce its innovative SPF solutions across Canada. The events were a chance for customers to test the product for themselves and see what it is capable of, as the industry focuses more and more on HFO-based systems.

Huntsman Building Solution's SPF insulation has a broad range of advantages, delivering better airtight building envelopes, stronger structural support, improved moisture control, and higher energy cost savings (more than



other forms of insulation). The product provides outstanding, high performance options for projects in the commercial and residential space. It has many other great properties and has been tested and certified as an exceptional air barrier, vapour retardant, water barrier and thermal insulator. The material is also flood resistant. |

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1 POLYOL DRUM CONTAINS THE EQUIVALENT OF UP TO

3,000

PLASTIC PET (POLYETHYLENE TEREPHTHALATE) 500ML BOTTLES





Launch of Huntsman Building Solutions University (HBSU)

Huntsman Building Solutions has launched its own education program, called Huntsman Building Solutions University (HBSU). Designed for construction industry professionals, HBSU is aimed at individuals who want to learn more about spray polyurethane foam (SPF) technology.

HBSU offers a variety of courses that insulation contractors, builders and architects can complete from anywhere in the world. The SPF course curriculum spans a broad range of topics from safety, product awareness, equipment selection and application best practice. There are also sections on how to sell SPF insulation.

Doug Brady, Vice President, Global Innovation and Product Management at Huntsman Building Solutions, said: "SPF technology is an increasingly important part of the insulation industry – not just in the Americas – but also worldwide. The aim of HBSU is to present our customers with a fun, but informative learning experience that increases understanding and adoption of a polyurethane technology that has far-reaching benefits. The courses we have put together are currently offered online – live or on-demand – and are designed to help our customers become experts in delivering energy efficient residential and commercial buildings. Once COVID-19 restrictions have eased, we'll also be offering training face-to-face."

Course content was created by the team at Huntsman Building Solutions, led by Vincent Kerr, Director of Technical Services, and Sean Collins, Brand Manager. Each course takes two to three days to complete and is divided into several modules. Care has been taken to ensure that the curriculum is fully aligned with SPF industry recommendations and standards on safety, equipment maintenance and spray foam application. Upon course completion, students take a test, and upon passing, they receive a diploma.

Vincent Kerr, said: "Benjamin Franklin famously said, 'An investment in knowledge pays the best interest.' At Huntsman Building Solutions, we agree with that statement and are committed to education and to assisting our customers. The multilingual global approach we are delivering via HBSU, demonstrates our dedication to furthering the safe, quality application of SPF systems."

HBSU courses are available in a range of different languages. For more information about what's available within HBSU, please contact: vkerr@huntsmanbuilds.com |

Meet Safety Sam

Safety Sam is HBSU's official mascot. One of HBSU's central learning objectives is safety. Reminding course attendees about the importance of always following best practice guidelines when using spray foam insulation, Safety Sam pops up throughout the course curriculum – alerting participants to the fact that safety-related information is being presented.



Automotive team celebrates supplier award from Toyota Boshoku

Huntsman's automotive polyurethane experts are celebrating after receiving another best performing supplier award from Toyota Boshoku Europe. Every year, Toyota Boshoku Europe gathers its top suppliers together to celebrate cooperation and collaboration. In 2020, because of COVID-19, the group's annual awards ceremony was cancelled, with winners notified by email.

For the second year running, Huntsman has been recognized as one of the most industrious and reliable companies within the automotive interior parts sector. For its efforts, it has once again received the prestigious Bronze Quality award for Superior Performance.

Christophe Ponce, Technical Leader for Automotive Seating at Huntsman Polyurethanes, said: "Huntsman has worked with the team at Toyota Boshoku Europe for almost 20 years – partnering to develop and manufacture a variety of seating components for the automotive industry that deliver improved comfort and reliability. As a business, we are continuously expanding our technology portfolio, taking further steps to ensure the quality, excellence and manufacturing expertise that is recognized by this important award." |

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Ensuring a smooth ride – from start to finish

Did you know that every fifth new car on the road has a Huntsman MDI-based formulation inside its seats? A lot goes into making the perfect car seat – quite literally. Typically, it takes up to 15kg or more of foam to deliver the levels of comfort, which vehicle owners have come to expect. However, with an increase in the number of technological innovations that are built into seats as standard, the amount of space available for foam is actually decreasing.

With car manufacturers integrating heating, air conditioning, lumbar support and airbag systems into seats, the challenge for polyurethane producers and original equipment manufacturers (OEMs) is to engineer ever thinner, ever-lighter foams that can deliver comparable comfort at a lower density.

To solve this issue, the automotive team at Huntsman has designed a range of RUBIFLEX® polyurethane-based products that are designed to deliver the ultimate comfort experience for drivers and their passengers. The range includes fully formulated systems, polyurethane components and prepolymers.

Used to produce high resiliency, flexible foam seat pads, as well as semi-flexible foam head restraints, armrests and center consoles, RUBIFLEX® polyurethane systems offer a robust processing window for a number of manufacturing methods such as cut-and-sew, foam-in-place, and cold-cure molding. In addition, these RUBIFLEX® solutions can help to improve indoor air quality in vehicles by reducing volatile organic compound (VOC) emissions and odour.



Light

Create thin, yet highly resilient seating solutions that provide more space with less weight.



Comfortable

Create soft-feeling seats that offer distinctive comfort levels and enhanced body support.



Circular & Clean

Create seats that contain greater levels of bio-content without compromising technical performance.

RUBIFLEX® polyurethane solutions include:

RUBIFLEX® HR AC

RUBIFLEX® HR AC (Advanced Comfort) polyurethane system: Designed to absorb the vibrations that can cause car sickness over medium to long distances, this material is used to create thin seats that have a high resilience response. This system opens up new possibilities when it comes to rethinking vehicle interiors in line with mobility trends, while also improving the comfort and durability of the seats.

RUBIFLEX® HR GH

RUBIFLEX® HR GH polyurethane system: An innovative product that can deliver a distinct difference in hardness between the top and middle layer of a foam, in one uniform piece. Used in car seating applications, the material provides good body support and pressure distribution, leading to maximum comfort across the vehicle's lifetime.

RUBIFLEX® HR VP

RUBIFLEX® HR VP (Vibration Performance) prepolymer: This special prepolymer is designed for self-formulators looking to develop comfortable, thin seating foams with a high resilience response and exceptional vibration performance.

Mazda achieves 'True Comfort' with RUBIFLEX® GH polyurethane system

Huntsman was recently selected as Mazda's supplier in its quest for the ideal seating systems. From seating covers and foam pads to springs and frames, Mazda needed multiple elements to work together seamlessly to support the body and deliver "true comfort." Meeting all of Mazda's comfort and pressure distribution requirements in a single foam, RUBIFLEX® HR Gradient Hardness (GH) polyurethane system requires no extra bonding and can contribute to keeping processing costs down. The material has subsequently been used in the new Mazda 3, which has received positive press reviews, including specific references to the comfort of the seats.



A cool solution that supports modern living



Rigid polyurethane foam has been absolutely integral to the successful operation of the global cold chain for many years. Enabling perishable goods to be transported and stored under temperature-controlled conditions, the technology helps reduce food waste and extend the life of vital products, en route to consumers. Now, polyurethane-based cold chain solutions are playing a major role in the COVID-19 pandemic – supporting the worldwide distribution of vaccines, all of which need refrigerating, but some of which need to be stored at sub-zero temperatures. *PU Review* spoke to Huntsman's global cold chain experts – John Hobdell, John Bebak and Jackey Cheung – to find out more.



John Hobdell
Global Technical Learning
and Development Director



John Bebak
Sales Manager, Americas



Jackey Cheung
Commercial Director &
Country Manager, China

PU Review (PU R): First and foremost, thanks for talking to us. Can you start by briefly summarizing Huntsman's role in the cold chain sector?

John Hobdell [JH]: No problem. In short, our MDI-based rigid polyurethane (PU) foam plays a critical part in all aspects of the cold chain sector – from end to end. Offering excellent thermal insulating properties, our products are widely used throughout the food industry; in refrigerated picking and processing plants and warehouses; in transport vehicles; in storage pods; in retailers' fridges and freezers, and even in the domestic appliances and cool boxes we use at home. Polyurethane is also essential in other areas of manufacturing, where temperature-controlled conditions are critical, for example, in the production of life-saving biologicals, vaccines, prescribed drugs and over-the-counter medicines. Here, as in the food and drink supply chain, the need is for thermally-efficient / insulated buildings, storage containers and transportation methods.

PU R: Am I right in thinking this is one of the only sectors where polyurethane touches every single part of the supply chain?

JH: Yes, and the benefits of the technology in this area of industry really can't be overstated. If you think about the journey that food takes, to reach your home, polyurethane is employed at every single stage from farm to fork. According to the Global Cold Chain Alliance, which represents all major industries engaged in temperature-controlled logistics, without insulated refrigeration of the kind produced using polyurethanes, an estimated one-third of the world's food would rot, before it reached the consumer.

John Bebak [JB]: When it comes to insulation, you can basically break the cold supply chain into two parts: commercial refrigeration and domestic appliances. To explain the difference, let's think about the journey that a bag of peas goes on to get to your house, and where it comes into contact with refrigeration based on polyurethane insulation.

“Without insulated refrigeration of the kind produced using polyurethanes, an estimated one-third of the world’s food would rot, before it reached the consumer.”

John Bebak



Once harvested, peas are quickly taken to a processing factory, where they are checked, cleaned and blanched. Within a few hours, they are frozen, bagged, packed into crates and stored at around -28°C. The buildings where this happens are normally made from insulated metal panels (IMPs). Invented around 40 years ago, IMPs are used to create the walls and roofs of commercial buildings. IMPs are composite structures. They are made from two steel skins, sandwiched around an insulating polyurethane foam core, which provides a strong thermal and moisture barrier, and bonds the two skins together, making the final panel rigid and durable. Produced using a continuous process, IMPs are vital to commercial refrigeration. They are quick to produce and erect, making it possible to construct thermally-efficient buildings, fast.

In the next step, the peas move from a factory to a retail distribution hub or warehouse – normally in a large refrigerated lorry / truck. Just like the factories and warehouses, these lorries / trucks are made with smaller composite panels – manufactured, typically,

via a discontinuous process. Upon arrival, the peas are stored in an industrial-sized freezer, before being transported to stores and supermarkets, where they are put into smaller freezer display cabinets. These types of freezers – like the domestic devices we use at home – are typically made from a rigid polyurethane foam that’s injected into the walls of the appliance. Again, the use of polyurethane provides excellent insulation, as well as structural rigidity – bonding the whole appliance case together.

PU R: Why is PU so well suited to cold storage?

JB: Polyurethane provides world-class insulation, which can last for years and years. Its popularity boils down to three key points. First and foremost, rigid polyurethane foam provides excellent insulation. In Europe, we state insulation effectiveness as a lambda value. This figure basically puts a number on the thermal conductivity of insulation over a given period of time. In the Americas, insulation performance is referred to as the R-value per inch. In short, a better lambda value indicates you can use less material to achieve the same insulating effect. Generally, polyurethane is around 40% better at insulating than other styrenic solutions. The second reason is the lightweight nature of polyurethane. Insulating foam made from polyurethane is typically used at around 40 kg per m³, which is 1/200th of the density of the steel used for the skin of IMPs and close to the density of feathers! The third element is the adhesive capabilities of polyurethane, which sticks the skins of the IMPs together – creating a really rigid, durable composite structure.

PU R: What competing technologies are there in this area?

JB: Polyurethane is definitely the dominant technology in the cold chain sector. It is estimated that more than 80% of the refrigerated solutions on the market today are based on PUR (polyurethane) or PIR (polyisocyanurate) systems – with the remainder made up of mineral wool, styrenic and vacuum panel solutions.

PU R: So, what’s the size of the cold chain market – globally and by region

JH: The global cold chain market size is estimated to be valued at \$233.8 billion (USD) in 2020 and is projected to reach \$340.3 billion by 2025, recording a CAGR of 7.8%*. This is fueled by our increasing reliance on perishable products and convenience foods. Globally, there is a trend towards healthier eating. A growing proportion of the world’s population wants access to fresh fruit and vegetables, which of course require refrigeration. At the same time, the busy nature of modern life leads many people to purchase pre-prepared ingredients and dishes, which are frozen. Globalization means we are also developing a taste for more exotic tastes and flavors. This in turn requires the transportation of goods from remote locations under temperature-controlled conditions.

JB: Regionally, North America has the biggest cold chain industry – accounting for around 33% of the market. In North America, we have observed a high growth rate for IMPs, especially in the last few years, and we expect this to continue. Next up is EMEA at about 30% and Asia Pacific at 20%.



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PU R: Are there any countries where there is major growth in the cold chain sector?

JH: Obviously, there are big differences from country to country. In regions like Europe and North America, the cold chain industry is really well established. However, in countries like India it's still growing. In 2008, the Indian government finalized a scheme to build 100 food mega parks nationwide. These are basically giant food processing centers, which span 20 to 60 acres of leased plots. On this scale, the potential demand for rigid foam insulation solutions will be huge. Initially, the scheme was slow to get off the ground, but momentum is building and there are now 37 parks at different phases of implementation across the entire country with 19 already operational.

Jackey Cheung [JC]: In Asia Pacific, there will be a continued demand in both healthcare and from food product suppliers. This is being fueled by three things: First, rising disposable incomes and ageing, which is increasing demand for temperature sensitive healthcare products such as vaccines, biopharmaceuticals, clinical trial materials, and so on. Secondly, the region is seeing a shift in dietary patterns, with an increased demand for premium produce – including meat, seafood, fruits, vegetables and dairy. Last but not least, in China, the government is investing heavily in modern agriculture – encouraging the creation of purpose-built farms and cold chain facilities in the 'first mile.' China's agricultural sector is currently dominated by the model of farming by small agricultural households.



Polyurethane-based panels will be central to this change and the construction of larger-scale farming units and warehouses. In 2018, the Chinese Government committed to building thousands of cold chain warehouses that will help store and preserve fresh farm produce in the 'first mile' of the supply chain. Last year, the country allocated around \$760 million (USD) to support the construction of some 14,000 buildings in 16 provincial regions**. These facilities, which will have a

combined capacity of around 6 million tonnes, are designed to reduce post-harvest losses of products by keeping goods at a suitable temperature in rural areas, before they begin their journey to consumers.

PU R: What impact has COVID-19 had on the cold chain?

JH: In the first wave of the pandemic, many ordinary aspects of life were quickly shut down. International borders closed and distribution networks across all industries were affected. With food supply chains hit hard, the cold chain came into its own. Refrigerated lorries / trucks and warehouses helped to keep perishable products fresh – in spite of serious delays and disruptions.

With supply chains operating normally again, the next big challenge relating to COVID-19 is how to distribute the COVID-19 vaccines that have been developed – once they are approved. It's been widely publicized that at least two of the vaccines are thermally sensitive and need to be stored at sub-zero temperatures. Here, there is a huge role for polyurethanes to play. At a local level, in every country around the world, vaccines will need to be delivered by refrigerated lorries / trucks, and then transported in freezers and cold boxes as part of a mammoth inoculation program.



At least two of the COVID-19 vaccines are thermally sensitive and need to be stored at sub-zero temperatures. Here, there is a huge role for polyurethanes to play.

“With food supply chains hit hard, the cold chain came into its own. Refrigerated lorries / trucks and warehouses helped to keep perishable products fresh – in spite of serious delays and disruptions.”

John Hobdell

This need will be the same everywhere – but will be more pronounced in developing countries, where electricity is harder to come by, and the weather is warmer. According to the World Health Organization, in parts of sub-Saharan Africa, only 28% of health facilities are estimated to have access to reliable electricity. Over the coming months, we expect to see higher demand for thermal insulation solutions from the pharmaceutical sector and will work with our customers to support their requirements.

PU R: What polyurethane products does Huntsman offer for this market?

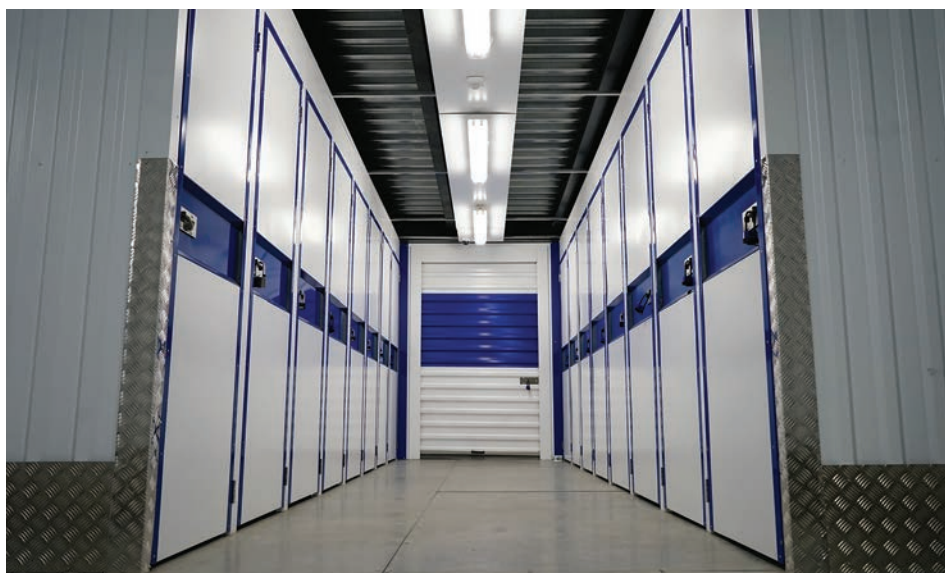
JB: For the production of IMPs, we have a range of fire-rated, PIR-based foam insulation systems and components, which are available under the RUBITHERM® brand. This special family of systems is based on Huntsman’s RUBINATE® and SUPRASEC® MDI and JEFFOL® and TEROL® polyols – the latter of which is based on recycled PET. The resulting products provide excellent thermal properties and deliver optimal fire and smoke properties, without compromising processing performance or durability. We also produce DaltoPIR® and DaltoPUR® insulation systems, which are also based on Huntsman MDI and polyols. For the production of domestic appliances, we produce DALTOFOAM® fully formulated polyol systems.

At Huntsman, we have the right technology and the right people in the field to ensure our continued success in this market. We are always driving our technology, looking for improvements in both R-value and other performance properties.

PU R: As I understand it, Huntsman also produces a number of other solutions utilized throughout the cold chain, can you elaborate?

JH: We do. We have a line of thermoplastic polyurethane (TPU) elastomers technologies that are regulated for water and food contact applications (European FCM and American FDA certifications). Our IROGRAN® FCM elastomers are used in the production of conveyor belts, dispensing hoses and tubes, and films and sheets used in food and drink and pharmaceutical manufacturing – with polyester and polyether-based solutions available, depending on requirements.

Our hot cast elastomers – available under the DALTOCAST® and TECNOTHANE®



brands – are also used to make wheels, castors and parts for equipment that has to operate in harsh environments.

Huntsman’s MDI technology is also used to create robust, chemically-resistant, antimicrobial polyurethane flooring systems for use in industrial kitchens and manufacturing environments. Using polyurethanes in this application, it’s possible to create floors that are quick to install and heat resistant up to 120° C – meaning they are easy to steam clean and sterilize.

PU R: I now understand why you said polyurethanes play such an integral role in the cold chain.

JH: Exactly. PU is a huge enabler of the cold chain globally and the impact it has on enriching day-to-day life is really tangible.

As the world’s population continues to look for ways to live and work more sustainably, and as we face global challenges like those experienced this year, its role will only grow in importance. |

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* Figures are according to the Global Cold Chain Market by Application (Fruits & Vegetables, Dairy & Frozen Desserts, Fish, Meat & Seafood, Bakery & Confectionery), Temperature Type (Frozen, Chilled), Type (Refrigerated Transport, Refrigerated Warehousing), and Region – Forecast to 2025, published by Research and Markets.

** http://www.xinhuanet.com/english/2020-12/13/c_139586583.htm

OESH® Shoes 3D prints 100% recyclable soles with TPU elastomers



OESH® Shoes (OESH), the U.S. footwear brand that makes women's shoes that are "healthy by design," has been evaluating how Huntsman's thermoplastic polyurethane (TPU) materials can be used to create a 100% recyclable shoe sole via 3D printing – with positive results.



Founded by Dr. Casey Kerrigan, a Harvard M.D., OESH® Shoes has been providing women with innovative, healthy footwear since 2011. As an internationally known researcher, who studied the effects of footwear on health, Dr. Kerrigan discovered that many common features of shoes can adversely affect posture and joints. She subsequently created OESH® Shoes to translate her research findings into the design of healthy shoes.

When OESH contacted Huntsman seeking advice about the ideal material to use for 3D printing soles, Huntsman's footwear team recommended thermoplastic polyurethane (TPU) materials with the specific comfort and performance properties OESH desired. Keen to offer environmentally-conscious customers a fully recyclable shoe, Dr. Kerrigan and Huntsman worked together to evaluate the material and determine whether it could be shredded at the end of the shoe's life cycle and recycled for re-use.

OESH put Huntsman's TPU to the test – producing a series of soles using OESH's unique 3D printing technique, which creates parts directly from pellets. The soles were then recycled into pellets and put back into the 3D manufacturing process. The next step was to test the new recycled sole against those made from virgin materials. Results showed that the recycled sole had the same

functionality as the original sole – with no drop-in performance properties.

Dr. Kerrigan said: "At OESH® Shoes, we are committed to making shoes that are not only the healthiest shoes on the planet, but also the healthiest shoes for the planet. We are constantly innovating and developing new technologies and manufacturing processes that minimize carbon emissions, toxins and waste. We are excited about our latest discovery – that by using Huntsman's TPU elastomers, OESH's signature soles are now not only 100% healthy, but 100% recyclable."

Jason Smith, Global Innovation Project Manager at Huntsman, said: "As a business, we are committed to helping our customers meet their sustainability ambitions – whether that's delivering products that require less energy to process or supplying materials that can be recycled back into new items at the end of their life. We are pleased to have worked with the team at OESH® Shoes – giving them the means to create a fully recyclable shoe, which can have a positive impact on the environment, as well as on the wearer's health."

For more information about OESH Shoes: www.oeshshoes.com |

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"We are excited about our latest discovery – that by using Huntsman's TPU elastomers, OESH's signature soles are now not only 100% healthy, but 100% recyclable."

DR. CASEY KERRIGAN
FOUNDER OF OESH® SHOES



Huntsman helps Blumaka create eco-soles for Sanuk®'s SustainaSole™ collection

For 50 years, Huntsman has been “Enriching lives through innovation,” using science and ingenuity to create products that enable more sustainable and comfortable lives for millions of people worldwide. A new project in the footwear industry demonstrates that commitment – delivering a first for the sector and proving that comfort and performance in shoe manufacturing does not have to come at the expense of the environment. *PU Review* found out more.

Huntsman has been working in close cooperation with BLUMAKA – an innovative supplier to the footwear industry – to develop an eco-friendly soling technology that has been incorporated into a new line of sustainable shoes produced by Sanuk®, part of Deckers Brands.

Used in Sanuk®'s SustainaSole™ collection, BLUMAKA's innovative soling technology, which includes a Huntsman IROGRAN® thermoplastic polyurethane (TPU) and a SUPRASEC® polyurethane (PU) system, delivers all the comfort and performance properties expected of a standard shoe sole, with 75 percent recycled foam content by volume and 35 percent recycled content by weight.

Sanuk® is a global lifestyle / surf brand. On a mission to clean up the planet, one shoe at a time, SustainaSole™ is Sanuk®'s most sustainable shoe collection ever. Reflecting the tag line, “Rubbish, reincarnated,”



SustainaSole™ shoes mix recycled and non-recycled materials together to create an eco-minded footwear range that delivers comfort and durability.

To create the soles for Sanuk®'s SustainaSole™ range, BLUMAKA grinds waste foam into granulated particles, and mixes them with Huntsman's SUPRASEC® polyurethane system to create a midsole. The midsole is then wrapped with a special IROGRAN® TPU film from Huntsman, which is incredibly versatile and ensures the finished product is fashionable and stylish, but also functional and high-performing.

BLUMAKA knew that finding the right TPU film was critical to the success of the project, so it approached Huntsman for help. After evaluating several options, the team opted to use a couple of different grades of IROGRAN® TPU products – one for the external skin of the sole; one for the outsole; and one as a hotmelt to bond with the upper. As well as providing the performance features required, BLUMAKA's technology greatly improves production efficiencies and significantly reduces tolling costs, two major manufacturing benefits intrinsically linked with the use of polyurethane materials.

Yi Li, Marketing Manager Footwear at Huntsman, said: “BLUMAKA's soling technology has game-changing possibilities for the footwear industry – enabling the creation of comfortable, stylish, eco-friendly soles. Working with the team at BLUMAKA was an incredibly rewarding experience. The company is very well respected and the vision and determination of their development team made the project with Sanuk® a real success. It is always fantastic to see a technology evolve from start-up to launch, and we are very proud that our PU and TPU materials are being used at the heart of BLUMAKA's soling system, within the new SustainaSole™ range.”



Stuart Jenkins, Founder of BLUMAKA, said: “Worldwide, consumers have come to expect the cushioned comfort that can, typically, only be achieved by using materials that are not easily recyclable. Our technology changes this, giving footwear manufacturers a more sustainable soling solution without compromising comfort or performance. Sanuk® is the first company to employ our soling technology and we are delighted with the end result, which we believe will help set a new standard for environmentally-friendly shoe soles.”

Sanuk® is part of Deckers Brands, which also owns iconic lifestyle footwear businesses, including UGG®, Teva® and HOKA ONE ONE®. |

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New PU system innovations take center stage at China Composites Expo



Two interesting industrial applications for polyurethanes were showcased at the China Composites Expo in September 2020 by the Huntsman team – highlighting the range of benefits the chemistry can deliver in transport and supply chain applications.

The first item displayed at the Huntsman booth was an innovative glass fiber-reinforced polyurethane (PU) pallet for the transportation of goods, including chemicals, food and drink products, pharmaceuticals and textiles. The pallet is designed to replace traditional wood, plastic and metal pallets in the logistics and transportation industry. Strong, durable and



free from styrene or peroxide substances, it was produced by the Shanghai Gaotie Electric Technology Company, using a PU pultrusion RIMLINE® system from Huntsman.

The second product, also produced by Shanghai Gaotie Electric Technology Company, was a graphene-reinforced polyurethane fishplate (a flat piece of metal), which is used in the railway sector to connect adjacent rails and improve safety. The fishplate is a new kind of pultrusion product that has been designed to improve safety on busy railway and subway networks.

Many railway lines are fitted with a device known as a 'red band.' This light display system indicates if there is a train on a section of track – informing train drivers if they are safe to proceed with their journey. The 'red band' relies on the railway track being insulated against any electrical interference to prevent a display fault that could have catastrophic consequences. The polyurethane-based fishplate acts as an insulation barrier, separating electrical circuits and ensuring that the system can work safely. The fishplate, which is made using a PU pultrusion RIMLINE® system, has – to date – been installed on track systems around transportation hubs in Zhengzhou, Guangzhou, Wuhan and Chengdu.

Commenting, Bingli Su, Commercial Director of Polyurethanes China at Huntsman, said: "The 2020 China Composites Expo was a valuable chance to showcase some of the most recent pultrusion, filament winding, spray and resin transfer molding (RTM) applications that our polyurethanes have been used in. It was great to be back at a face-to-face event, but equally good to connect with all the virtual visitors that attended the exhibition online because of COVID-19. Both sets of visitors showed a lot of interest in our PU materials, which are growing in popularity in the composite arena and are set to increase their market share over the next few years in China."

While most of the world continued to face restrictions on business events because of COVID-19, the China Composites Expo was able to go ahead in September as planned. With COVID-19 cases under control in China, the organizers decided it was safe to stage the event – while also live streaming elements of the exhibition for attendees that could not visit in person. |

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"PU materials are growing in popularity in the composite arena and are set to increase their market share over the next few years in China."

BINGLI SU, COMMERCIAL DIRECTOR OF POLYURETHANES CHINA AT HUNTSMAN.

Lintech to distribute hot cast systems and equipment in the United States



Huntsman's Elastomers team has signed an agreement with Lintech International LLC, to distribute its polyurethane-based DALTOCAST® hot cast elastomer systems. Lintech has been distributing Huntsman's coatings and adhesive systems and components for the past nine years.

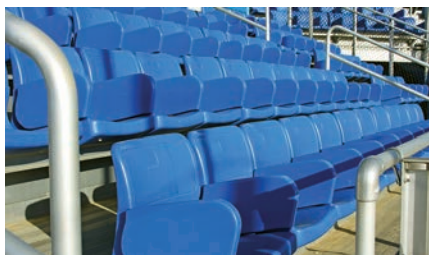
Under the terms of the agreement, Lintech, a leading national distributor of specialty chemicals, will now distribute Huntsman's hot cast systems in the Southern and Western regions of the United States.

Alex Ziev, Portfolio Manager of Huntsman's Elastomers business, said: "This agreement allows the Huntsman Elastomers team to leverage Lintech's 37+ years of chemical product distribution experience. Now, we will be able to tap into hot cast elastomers markets, which we may not have reached otherwise."

Jay Downs, Director – Marketing and Business Development at Lintech, said: "We are excited to strengthen our relationship with Huntsman. Combining Huntsman's hot cast technology with Lintech's strong distribution network in the U.S., we can strategically align our resources to expand and strengthen our customer reach and service to grow our target markets."

Huntsman DALTOCAST® MDI-based hot-cast elastomer systems are developed by Huntsman's Elastomers team in Modena, Italy and in Auburn Hills, Michigan. These systems are used in many applications, including bumper pads, coated conveyor belts, gears, rollers and wheels. Hot cast elastomers are used in the automotive, rail, oil and gas, mining and steel industries, among others. |

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Huntsman DALTOCAST® MDI-based hot-cast elastomer systems are used in many applications.



Forthcoming events and technical presentations

ExecutiveXchange – Park City, UT (25-28 July)
PU China, Shanghai, China (28-30 July)
International Roofing Expo (IRE) – Las Vegas NV (10-12 August)
Northwest Materials Show – Portland, Oregon (11-12 August)
Summer TecHome – Louisville, Kentucky (17-19 August)
DESMA, Achim, Germany (8-9 September)
Salon Expo Habitation, Quebec, Canada (16-19 September)
ICAA, San Antonio, Texas (23-25 September)
CPI, Denver, Colorado (5-7 October)
Western States Roofing Expo (WRE), Las Vegas, Nevada (21-23 September)
Buildex Vancouver, Vancouver, Canada (29-30 September)
PCBC, San Francisco, California (4-7 October)
ABAA, Reston, Virginia (20-21 October)
Salon Expo Habitation, Montreal, Canada (21-24 October)
MRCA – Milwaukee, Wisconsin (9-11 November)
EUROPUR, Amsterdam, The Netherlands (3-4 November)
UTECH, Maastricht, Belgium (16-18 November)
Construct Canada, Toronto, Canada (1-3 December)

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