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PU helps get coronavirus vaccines out



New life for old foam



From waste wheat to polyols

Front cover picture:
This issue we look at the environment and the PU industry's efforts in post-consumer mattress recycling. Picture: iStock



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Hip to be green

Post-consumer waste was not at the forefront of our thinking a couple of decades ago, with old furniture and mattresses largely sent to landfill – out of sight and out of mind. But it's now becoming clear this bulky waste might be transformed into a reliable new stream of raw materials for the polyurethane industry.

As you will see in this issue, a number of projects in the EU are starting to come to fruition. These are aimed at removing mattresses and furniture from municipal waste, and have the useful side-effect of stimulating a whole new field of endeavour for polyurethanes.

We have covered companies reworking in-process scrap before, but the challenge of post-consumer waste is significantly greater. It is complicated, and the waste is often very dirty, and one thing is clear – there is a lot of it. But, with proper treatment, it could become a good source of viable, consistent raw materials.

Away from the feature, the *annus horribilis* that was 2020 is now behind us. With luck, by the time you read this, the world will be steadily getting through the mass vaccination programmes that will allow us all to return to a more active state.

I hesitate to say 'normal', because that implies a return to the way we were before the coronavirus changed the world. One thing is certain, post-pandemic, things will be different. Fewer people will commute into offices, perhaps reducing the demand for cars. Cities may become less attractive places to live, offering opportunities to furnish homes in more rural settings or smaller towns.

It is not yet clear. But if things continue to improve, then at least the cycle of meetings, conferences and exhibitions can start again. There may be fewer handshakes, we may be wearing masks, and we may be trying to keep a couple of metres apart, but a return to some form of face-to-face contact will be invaluable for making those all-important business connections. See our announcements on pages 7 and 15.

I'm looking forward to reporting on a number of events in the second half of the year, and providing information and insights to help you run your business more effectively.



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LEADERSHIP

Chairman: Keith E Crain
Vice Chairman: Mary Kay Crain
President: K C Crain
Senior Executive Vice President: Chris Crain
Vice President and Publisher: Brennan Lafferty
Tel: +1 313 446 6768 Email: blafferty@crain.com

EDITORIAL STAFF

Editor: Simon Robinson
Tel: +44 (0)203 287 5979 Email: srobinson@crain.com

Associate Editor: Sarah Houlton
Email: sarah@owlmedia.co.uk

Art Director: Amy Steinhauser
Email: asteinhauser@crain.com

NORTH AMERICAN OFFICES (Editorial):
Don Loepp, Tel: +1 313 446 6767 Email: dloepp@crain.com

INTERNATIONAL CORRESPONDENTS:

CHINA: Jane Ho,
Tel: +86 189 3057 2271 Email: janeadios@gmail.com

KOREA: Choong-Ha Lee,
Tel: +82 (0)31 211 2073 Email: puworld@naver.com

INDIA: Satnam Singh
Email: Satnamsingh41@hotmail.com

TRADE SHOWS/EXHIBITONS
Director: Debbie Hershfield
Tel: +1 303 608 0231 Email: dhershfield@crain.com

NORTH / SOUTH AMERICA, UK, OPEN AREAS:
Advertising director: Ed Rich,
Tel: +1 330 869 0375 Email: erich@crain.com

NORTHERN EUROPE: Arthur Schavemaker,
Tel: +31 (0)547 275005, Fax: +31 (0)547 271831
Email: arthur@kenter.nl

SOUTHERN EUROPE: Fabio Potesta,
Tel/fax: +39 010 570 4948,
Fax: +39 010 553 0088 Email: info@mediapoints.it

CHINA: Winnie Song,
Tel: +86 13810 173625 Email: songwei@wkexpo.com

AFRICA, INDIA, MIDDLE EAST: Taher Patrawala,
Tel: +971 4 297 0512 Email: taher@mediafusionme.com

KOREA: Min Pyo
Tel: +82 (0) 31 211 2073 Email: minpyo@hotmail.com

Media services manager: Patrick Alfes
Tel: +1 313 446 0387 Email: palfes@crain.com

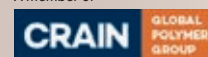
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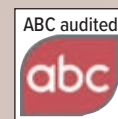
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ISOPA gets ready to address risks of OELs

Brussels, Belgium – Occupational exposure levels (OELs) are the next big regulatory challenge the polyurethane industry in the European Union will face in 2021, according to ISOPA secretary general Jorg Palmersheim.

‘We are right in the middle of the OEL process,’ Palmersheim said. ‘An impact assessment questionnaire will be sent to many, many companies by Risk Policy Analysts of the UK. Its findings will form the cornerstone of the data used to drive the impact assessment.’

ISOPA believes the best way to protect workers from exposure to diisocyanates is to use the EU’s REACH restriction, and its mandatory training. ‘When it provided its opinion on the restriction, the European Chemicals Agency (ECHA) concluded that it is the most effective and efficient measure to enhance occu-



Palmersheim: gearing up for OELs

pational health and safety,’ he said. ‘This would be much more effective than a very low OEL for an eight-hour time weighted average working day. The danger to health comes from spikes in exposure.’

ISOPA expects the impact assessment to be finished by the middle of 2021.

‘The REACH restriction introducing minimum training requirements for workers handling diisocyanates and mixtures containing diisocyanates is a done deal,’ he said. ‘We are in the transition phase to 24 August 2023, and it is up to the industry to ensure compliance by that date.’

He added that the association aims to get the training platform up and running by the middle of 2021. ‘We can then start the e-learning process in the big PU-using countries such as Germany, France, the Netherlands and Spain,’ he said. ‘We will then progressively roll the training out in additional countries.’

A website has been set up www.safeusediisocyanates.eu for interested parties.

An ISOPA/UTECH webinar about the process is also available at www.utech-polyurethane.com/events.

Stepan acquires Invista polyols

Northfield, Illinois – Invista’s aromatic polyester polyol business has been acquired by Stepan. No price has been given for the all-cash deal; the acquired business has global sales of about \$100m.

The polyols are sold under the Terate brand. They are used in the manufacture of flex-faced boardstock, metal-faced sandwich panels, spray foam, block foam. They also have a variety of CASE applications.

The acquisition gives Stepan two additional manufacturing sites, one in Wilmington, North Carolina, and the second in Vlissingen, Netherlands. Inventory, IP and working capital are also included.

The company believes the long-term prospects for rigid polyols in insulation remains strong in the light of energy conservation and increasingly stringent building codes.

UTECH Europe moves to November 2021

London – UTECH Europe has been rescheduled to 16-18 November.

The venue, MECC in Maas-tricht, Netherlands, is unchanged.

‘We are committed to a strong and vibrant UTECH Europe in 2021 to provide the polyurethanes industry with a much-needed platform to recapture lost opportunities, identify new business and re-engage with industry associates, friends and colleagues,’ said Debbie Hershfield, trade show director at Crain Communications,

the event’s organiser and publisher of *Urethanes Technology International*.

Hershfield added that, after consulting stakeholders, it felt right to take the early decision to postpone UTECH Europe until later in the year.

‘We believe the move will fill exhibitors, speakers and attendees with more confidence that they will see the UTECH Europe they have come to expect,’ Hershfield continued.

More details can be found at the event’s website, www.utecheurope.eu.

Celotex distances itself from responsibility for Grenfell

London, UK – Celotex, which made the PIR insulation used on the Grenfell Tower, issued a further statement in late December 2020. This distanced itself and its current management from the tragedy.

The company said in the statement that its PIR product RS5000 was marketed for use in rainscreen cladding systems for buildings above 18m high. However, the system used on the tower was ‘substantially different’ from the system it had tested.

‘Celotex does not design and install cladding systems, and did not do so at the Grenfell Tower,’ it said. ‘The design of the rainscreen cladding system on Grenfell Tower and the selection of the components were decisions made by construction industry professionals. The professionals

and contractors included parties which were contractually and professionally obliged to consider the fire safety for the building and its compliance with building regulations.’

Celotex said that an internal inquiry into the events leading up to the fire showed that there had been unacceptable conduct on the part of a number of former employees. ‘They should never have happened,’ it said. ‘Disciplinary proceedings were instituted as a result and six employees left the company (others having resigned previously).’

Celotex said that it has replaced its management, and reviewed and refreshed its factory process controls, quality management and approach to marketing to ensure these meet best practice.

The inquiry continues.

News in Brief

Sinomax returns to profit

Hong Kong – Sinomax expects to make an after-tax profit of HK\$50m (\$6.4m)

The Hong Kong-listed flexible foam company, has a number of plants in China and the US. It released the figures in a statement.

Tight polyurethane materials markets help Dow in Q4 2020

Midland, Michigan – Fourth quarter sales at Dow Chemical were up almost 5% compared with the same period in 2019, at \$10bn. The company's industrial intermediates & infrastructure business, which includes PU, contributed \$3.5bn.

In 2020, the company's overall sales were \$38.5bn, down 10.3% on the 2019 figure.

CEO Jim Fitterling said that in the final quarter, improved pricing and margins, particularly in polyethylene and polyurethane applications, delivered 5% revenue growth and higher operating EBIT year-over-year.

'As the global economy and market fundamentals continue to improve, demand drove volumes above or in line with pre-coronavirus levels across all operating segments,' he said. 'We captured strong durable goods in construction demand, we grew volumes in do-it-yourself architectural coatings and home care sectors.'

In Q4, sales in the industrial intermediates & infrastructure business grew by 7.6% from the previous year. This translated into a 33% increase in operating EBIT, which reached \$296m.

'Supply and demand funda-



Fitterling: gaining momentum

mentals in polyurethanes, as well as higher equity earnings from improved performance

at Sadara drove this result,' Fitterling said. Net sales in polyurethane grew by double digits from 2019 to 2020 and between Q3 and Q4 in 2020, he added.

Looking ahead to the first quarter of 2021, CFO Howard Ungerleider said sales should be between \$10.7-11.2bn because of the strength in polyurethanes. 'That segment will benefit from deurbanisation and strong demand for domestic appliances, and will be supported by the automotive and housing sectors,' he said. 'Industry supply limitations, and low inventories, should support pricing uplift.'

Greiner's consolidation plan for foam swings into action

Kremsmunster, Austria – Plastics and PU foam company Greiner has brought its Multifoam, Perform, Purtec, Uni-foam and EuroFoam businesses together into a new entity. The combined business will trade under the name Neveon in the next stage of the strategy outlined by the company in May 2019.

Neveon has 62 locations in 17 countries, and 3700 employees. The business is focusing on three areas: living & care, mobility, and specialities.

Oliver Bruns, who was CEO at Greiner Foam, is to be CEO



Bruns: a significant USP

of the new organisation. '[The new business can] offer everything relating foam production, from solution development to

implementation, and hence virtually any item that can be manufactured using this material,' he said. 'This represents a significant USP.'

It marks part of parent group Greiner's plan to become a global force in polyurethane. 'The move towards a leading global integrated foam group is wise,' said Greiner's CEO, Axel Kuhner.

As well as helping the company to compete in a consolidating flexible foam market, he said its economy of scale will make raw materials considerably less expensive.

Strong sales growth at Sheela despite raw materials

Noida, India – Sheela Foam, India's only listed flexible foam maker, generated sales of INR8.26bn (\$113.4m) in the third quarter of 2020, up 26% on the same period last year. EBITDA across the business rose by 21%, reaching INR1.1bn in the 2020 quarter.

Sheela said the results had been achieved in the face of significant raw material price rises. It said the price of TDI had risen by 63% between Q3 2019 and Q3 2020. Polyols were up 116%.

In the company's Indian business, sales rose by 17% between the third quarter of 2019 and the third quarter of 2020, to INR6050m. This compares with INR5180m in the equivalent period in 2019. EBITDA in the division rose by 39% to INR990m. In the third quarter of 2019, it was INR 710m.

Hauck takes the helm at cutting machinery company Albrecht Baumer

Freudenberg, Germany – Family-owned machinery manufacturer Albrecht Baumer has appointed Christoph Hauck as its new managing director. He will be the first person outside the family to hold the role.

Nina Patisson, the current managing director, will retire from operations on 1 February. 'We are confident that Christoph Hauck brings both the right education, experience and personality to this position,' Patisson said.

His background is in electrical engineering, and he has managed companies both at home in Germany and abroad.

He has spent the past couple of decades working in the engineering sector.



Mlily set to increase share of the US mattress market

Nantong, Jiangsu – Chinese mattress maker Mlily is expected to increase its US market share from 9% in 2020 to more than 20% in 2021, according to Great Wall Securities.

There will be a gap in the US market of 2.4 million units of memory foam mattresses in 2021 following the imposition of anti-dumping duties

on imports from south-east Asia. Countries in this region now account for 28% of US consumption, according to a report from the Chinese securities company.

Mlily will be able to help fill in the gap, as it already has manufacturing facilities in place in the US. These have CNY2.7bn (\$417m) of nameplate capacity.

The company's overseas plants purchase 55% of feedstock locally, which helps it counter price fluctuations from Chinese suppliers, and maintain stability in cost management, the report added.

Mlily is estimated to record CNY802m net profit in 2021, up 53% from 2020, with the additional help of domestic

expansion, the report said. Sales in 2021 will likely reach CNY9.4bn, a 49% jump from 2020.

Last year, the value of the domestic Chinese mattress market was CNY77bn, of which memory foam mattresses comprised less than 5%. This compares to a 50% share for foam mattresses in the US.

Lintech to sell Huntsman hot cast elastomers in southern US

The Woodlands, Texas – Lintech International is to distribute Huntsman's polyurethane-based Daltocast hot cast elastomer systems in the southern and western US. The company has already been distributing Huntsman coatings and adhesive systems for nearly a decade.

The MDI-based Daltocast systems, and the Castech processing machines they are used with, were developed by Huntsman's elastomers team in Modena, Italy and Auburn Hills, Michigan. Applications include bumper pads, coated conveyor belts, gears, rollers and wheels.

'We will be able to tap into hot cast elastomers markets, which we may not have reached otherwise,' said Alex Ziev, Americas sales manager at Huntsman Elastomers.

'By combining Huntsman's hot cast technology with Lintech's strong distribution network in the US, we can strategically align our resources to expand and strengthen our customer reach and service to grow our target markets,' said Jay Downs, director for marketing and business development at Lintech.

BASF completes phase 1 of Geismar MDI update

Geismar before the extra MDI is added



Geismar, Louisiana – BASF has replaced an older MDI reactor in Geismar as part of its plan to increase capacity from 300kT/year to 600kT/year by the middle of the decade.

The company said it had completed the \$150m first

phase, announced in April 2019.

BASF declined to specify the size of the unit replaced, or whether the work had changed the current size of the plant. A spokesman said: 'An older MDI synthesis unit is no longer in service. Although the instant capacity

addition is limited, the new MDI production unit sets the foundation for future growth.'

The second expansion phase is under way, and is expected to start up in the second half of 2021. In April 2019, the estimated cost was put at \$87m.

Technologic Systems adds PU conformal coating option

Fountain Hills, Arizona – Technologic Systems is now offering a PU conformal coating on some of its electronic components.

It is a 20–75µm thick protective coating that conforms to the circuit board's topology.

The aim is to provide additional protection for electronic circuits in environments with high humidity and varying

temperatures. It also creates a barrier to airborne contaminants such as salt spray.

The coating is made from HumiSeal 1A33. This is a single component PU conformal coating with no free isocyanates.

It fluoresces under UV light which helps when inspecting components.

'We know our customers

already install our embedded systems in harsh manufacturing environments, outdoor deployments, and demanding marine settings,' said Robert Miller, Technologic Systems' president.

'Adding conformal coating just enhances our already rugged portfolio and provides more protection for our customers.'

Massachusetts finally enacts FR ban

Boston, Massachusetts – The much-delayed flame retardant ban in Massachusetts has finally been signed into law by governor Charlie Baker. He had vetoed an earlier attempt to institute a ban, in January 2019, citing a conflict with federal legislation.

Companies in Massachusetts will be prevented from selling or importing various products into the state that contain more than 1000ppm of listed flame retardants in any of their component parts. Products covered include upholstered furniture, bedding, children's products and carpeting. The ban does not apply to inventory manufactured before 31 December 2021.

The banned list includes antimony trioxide, pentaBDE, octaBDE and chlorinated paraffins. Also covered are TSCPP, TCEP, HBCD, TBPH, TBB, TBB-PA and TCPP. The law instructs



Baker: finally signed the ban

DEP to work with the Toxics Use Reduction Institute at the University of Massachusetts Lowell to revisit the banned list at least every three years to determine whether any other FRs should be added.

The bill's passage concludes eight years of efforts by Massachusetts legislators to get a ban in place. The

state's department of environmental protection (DEP) may now implement a labelling programme for products that meet fire safety standards, but do not contain any of the banned FRs.

The legislation was backed by the Massachusetts firefighters union, which cited serious concerns about the FRs causing cancer among its members. 'This is a massive step forward in protecting our residents and first responders in Massachusetts from the dangers of these toxic chemicals associated with flame-retardant products,' union president Richard MacKinnon said.

'This has been a very long time in coming,' said Elizabeth Saunders, Massachusetts director of pressure group Clean Water Action. 'The first version of this bill was filed eight years ago. It passed the senate three times and the house twice.'

PPG buys polyurea company Versaflex

Kansas City, Kansas – PPG has agreed to buy Versaflex from DalFort Capital Partners. No price was disclosed, but the transaction is likely to complete in the first quarter.

Versaflex comprises four separate businesses, which employ 130 people. Its 2020 revenue is projected to be \$70m. DalFort put it together between 2017 and 2019, and includes Versaflex, Raven Lining Systems, Milamar Coatings and Specialty Products.

PPG's SVP for protective and marine coatings, Ram Vadlamannati, said Versaflex was attractive. '[It has] broad expertise and manufacturing capabilities in polyurea,' he said.



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Huntsman upgrades Q4 EBITDA outlook

The Woodlands, Texas – Huntsman has said that adjusted EBITDA in its polyurethanes business will be at least 20% better than its third quarter performance.

The company said in a trading statement that this was because of stronger than expected overall demand as well as higher MDI component margins, most notably in Asia.

Overall, Huntsman said it expects adjusted EBITDA in the fourth quarter to be 20-

25% better than the final quarter of 2019.

It added that the sale of its remaining stake in Venator Materials, a cyclical business focused on titanium dioxide, was on track, and that it plans to pay the outstanding €445m 5.125% bond that falls due next year at face value. It will do this from its available liquidity.

When the bonds were paid off or redeemed on 15 January the company's interest bill fell by about \$25m/year.

Growth in online sales drives Nike's H1 success

Beaverton, Oregon – Nike, the global footwear giant, generated sales of \$21.8bn in the first half of 2020. This is an increase of 4% on the same period last year.

EBIT across the business rose by 23.8% to \$4.27bn in the first half of 2020. Part of the growth in EBIT came because Nike is spending much less on promotion at sporting events because of lockdowns.

The growth in earnings continued momentum from the first quarter of the year, Nike said. CEO John Dona-

hoe claimed the growth was fuelled by compelling innovative product and global brand momentum.

Digital sales for Nike were up 84% in the second quarter, and offset temporary coronavirus shutdowns. The move to direct-to-consumer sales will speed up, according to CFO Matt Friend.

'We are focused on moving even faster against our strategic vision of Consumer Direct Acceleration and fuelling sustainable, long-term growth and profitability,' he said.

Johns Manville adds HFO-blown SPF

Denver, Colorado – Johns Manville has added a new spray polyurethane foam to its range of building insulation products. JM Corbond IV is a closed-cell SPF.

The fourth-generation insulation uses an HFO blowing agent, allowing it to meet increasingly stringent regulations prohibiting the use of materials with a high global warming potential. The new SPF was designed to offer similar performance to the company's older JM Corbond III product.

'JM Corbond IV not only has a lower GWP than JM Corbond III, but also performs competitively in terms of R-value, spray yield and cooling requirements when you compare it to the previous generation,' said Yusheng Zhao, senior research chemist at Johns Manville. 'The main difference between the two products is in the new HFO blowing agent.'

The product is already available for shipping within the US and it will soon be available in Canada, too.

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PU layer stops tunnels freezing

Beijing – Civil engineers at the North China University of Technology in Beijing have suggested that a PU–corrugated steel plate insulation lining could prevent railway tunnels being damaged by freezing conditions.

Guangyao Cui and Xuelai Wang explained that tunnel construction in cold regions is problematic, particularly in China where seasonal frozen soil accounts for more than half the land area, but railway tunnels are being built in large numbers. Without adequate

anti-freezing measures, the tunnels will gradually suffer damage, potentially affecting the railway's safe operation.

The Beijing team has developed an alternative lining solution. This comprises corrugated steel plates combined with a rigid polyurethane insulation layer, plus an additional waterproof layer to protect the PU layer. Using corrugated metal rather than flat sheets prevents buckling.

In a real-world test, the panels were applied to the inside of a 3.7km long, 10m high tun-

nel in northern China where there was already visible freezing damage. The panels were applied overnight, during the time when the train service was not in operation. The PU layer was 5cm thick.

Field temperature tests were made, with the outdoor temperature between -18°C and -22°C . The interface between the rock and the tunnel lining was above 0°C at all the points where temperature was measured, so there was no freezing damage.

'Compared to the conven-

tional anti-freezing technology that destroys the tunnel concrete or drainage system, the installation of polyurethane-corrugated steel plate insulation lining is a permanent reinforcement of the tunnel without destroying the existing lining structure and drainage system conditions,' they said. They also believe it could be used to treat damage such as cracking, back-voiding and frost-related water leaks.

The work has been published in the journal *Science Progress*.

PU improves the properties of fibre-reinforced composites

Shanghai, China – The use of fibre-reinforced epoxy plastic is limited by its brittleness and weak interlaminar properties.

A group at Tonji University's school of aerospace engineering and applied mechanics has been investigating the physical and mechanical properties of PU/epoxy interpenetration networks, and found that careful choice of PU can

greatly improve properties.

The group, led by Yiou Shen, used atomic force microscopy to show that even distribution of the appropriate amount of PU can improve the mechanical properties of the resin. This increases the strength and stiffness of the system. They also found that if 15% by weight of PU is added to the epoxy, the initial fracture

toughness of the composite is improved by 48%.

Their conclusion was that interpenetrating PU/epoxy networks have a positive effect on improving the interfacial and interlaminar properties of plant fibre-reinforced composite materials.

The work was published in the journal *Polymer Composites*.

Disulfide links give malleable, recyclable PU foam

Chongqing, China – A team at Southwest University in Chongqing has developed a polyurethane foam that is both malleable and thermally recyclable.

Jian-Bing Zeng and colleagues incorporated a dynamic disulfide bond into the PU. When heated, the disulfide exchange reaction enables the network topology of the PU foam to rearrange. The result is a foam that is malleable and can be thermally processed.

They claim that the disulfide-containing PU foams have similar appearance and physical properties to regular PU foams. They were fabricated using conventional foaming technology, with no need for modifications to the process.

It was also possible to recycle the foams into PU films via thermal compression moulding. The film could be further reprocessed several times.

'The recycled PU films show excellent and tunable mechanical properties, depending on the compositions of the original PU foams,' they said. The work was published in the journal *Green Chemistry*.

Stellar Q4 performance saves Wanhua 2020 earnings

Yantai, Shandong – Wanhua has estimated that its 2020 annual net profit will be CNY9.6bn to CNY10.1bn (\$1.48–1.56bn). This compares with CNY10.13bn net profit in 2019, and represents a year-on-year drop of up to 5%.

The company's net profit over the first three quarters of 2020 was CNY5.3bn, down 32% from a year ago.

'The global chemical industry's downstream demands picked up rapidly at the end of Q3 with strong growth for a few regions,' it said. 'The

company raised both sales volume and price for its main products, and net profit in Q4 grew at a rate between 91% and 113% from a year ago.'

Its MDI peaked in November and December 2020, by which time it was up 50% from the September figure.

Dramatic increase in Chinese refrigerator exports

Beijing – China exported 6.5m refrigerators and freezers in December 2020, up 59% compared with December 2019.

The value of these exports rose by 63% from a year ago, to \$828m, according to China's General Administration of Customs. This compares with a 99% year-on-year leap in export volume and a 91% leap in

value for November 2020.

Full-year 2020 numbers also rose. The 70m units exported in 2020 represents an increase of 36% compared with 2019. The value of 2020 exports was up by 30% from 2019, to \$8.2bn.

In December, China's production of refrigerators, excluding freezers, rose by 8%

from December 2019 to 8m units, according to the National Bureau of Statistics. Full-year production of refrigerators increased 8% from a year ago, to 90m units.

The country's freezer production has maintained strong momentum throughout 2020. Full-year freezer production was 30m units, up 50%.



BPCL polyol project in doubt

Kochi, Kerala – Planned expansions by Indian state-owned Bharat Petroleum Corporation Limited (BPCL) for PEG, MEG and polyols have been thrown into doubt as privatisation looms over the future of the specialty petrochemicals plant.

The project has been put on hold until the Indian government finds a new buyer for the refinery as part of strategic

disinvestment plan. It will be up to the buyer to decide the future of the project.

The company announced an initial investment of INR 111 bn (\$1.4bn) for the 170 acre (69ha) project.

It was scheduled to start production by 2024, in the second phase of BPCL's petrochemical project at Kochi.

However, India's Department of Investment and Public

Asset Management (DIPAM), which manages the government 53% stake in the company, has kicked off plans for privatisation.

Initially, DIPAM invited expressions of interest by 31 July 2020, but the pandemic has delayed the process.

While the disposal was getting underway in the middle of last year, chemical engineering specialist Fluor was

contracted to provide with the project management consultancy services.

The plan was to build six new process units, which would be integrated into the existing refinery. The units were set to produce propylene oxide, propylene glycol, polyols, ethylene oxide/mo-no-ethylene glycol, and cumene. There would also be an ethylene recovery unit.



Kool-ex: getting the vaccine out

Kool-ex PU reefers to distribute coronavirus vaccine in India

By Satnam Singh

Pune, Maharashtra – Polyurethane insulation is playing a key role in India's ambitious drive to immunise the whole population against coronavirus. The country aims to vaccinate 300 m people via the programme, which started in the middle of January.

The material will help keep doses at the required temperature on their journey from where they are manufactured to vaccination sites to all over the country.

Mumbai-headquartered

cold chain logistics business Kool-ex has been engaged to transport the vaccine.

The company has a specially designed fleet of 400 reefer trucks which are dedicated for the cold chain distribution of pharmaceuticals.

'We will handle the vaccine transportation from all four pharma firms, starting with Covidshield, developed by AstraZeneca and produced by Pune-based Serum Institute of India (SII),' said Kunal Aggarwal, a director at Kool-Ex Cold Chain. It will also be involve

in the distribution of other vaccines under development, including Covaxin from Bharat Biotech, ZyCoV-D from Zydus Cadilla, and the Russian Sputnik V vaccine.

'[The trucks] can operate at temperatures from -25°C to +25°C,' he said. 'All the vehicles are enabled in terms of GPS and temperature tracking to opening of the doors.'

Kool-ex claims to have the largest pharma-dedicated reefer fleet in India. Its national delivery network covers more than 800 cities.

PU leather maker Anli set to open Vietnamese plant

Binh Duong, Vietnam – Chinese PU faux leather company Anli expects to start partial operation in June 2021 at its new Vietnam plant. It was originally scheduled to go on stream in April.

The plant's infrastructure is largely complete, and the company has signed contracts for the fundamental machinery, as well as two of the facility's four production lines.

The machinery's delivery and installation has been on hold because of the coronavirus pandemic, Anli said.

The 12,000 km/year PU leather plant was first announced in 2017, with \$22m investment earmarked.

Ground was broken at the site in March 2019.

The facility is located in Binh Duong province's Vietnam Singapore Industrial Park in the south of the country, and covers nearly 26,000m². The plant will contain two dry and two wet production lines.

Anli also announced that it has become a supplier to Ikea. It will provide ultra-low VOC PU materials for the Swedish furniture giant's sofas, beds and chairs, the company said.

Brand new UTECH Southeast Asia set to debut 2022

Ho Chi Minh City, Vietnam – Crain Communications, the publisher of *Urethanes Technology International*, has announced the first UTECH Southeast Asia exhibition and conference.

It will be held 26-28 April 2022. The decision to hold the meeting was prompted by the rapidly expanding market for polyurethane products and systems in Southeast Asia, and Vietnam in particular.

‘Vietnam is the obvious place to expand the UTECH brand beyond our established markets in Europe, America, China and the Middle East/Africa,’ said UTECH trade show director Debbie Hershfield.

The event will be held at the Saigon Exhibition & Convention Center. A three-day conference will run alongside the exhibition.

Perma-Pipe uses PU in Indian pipeline insulation project

Spring, Texas – Perma-Pipe has been awarded a \$6.7m contract by Indian company JSIW Infrastructure to insulate a crude oil pipeline. It is part of the construction of a refinery and petrochemical complex in Pachpadra Tehsil, Rajasthan. The pipeline is being developed by HPCL Rajasthan Refinery, a joint venture between HPCL and the Rajasthani government.

Perma-Pipe will be applying its Trace-Therm insulation

system to the 30cm diameter, 74km long Mangla crude oil pipeline. The insulation itself is spray polyurethane foam, which is installed in conjunction with welded tracer tubes for heat tracing. It is jacketed with an HDPE casing.

Work was set to begin at Perma-Pipe’s facility in Gandhidham, Gujarat in the first quarter of 2021, with the first step being the application of an anti-corrosion coating on the tracer tubes and bends.



MPOB develops a palm oil polyol



Kuala Lumpur, Malaysia – The Malaysian Palm Oil Board has developed a palm oil-based polyol for floor coverings. It is designed to be used in both indoor and outdoor sports flooring applications.

Polyurethane manufactured from the polyol is used as a protective coating on the underside of stitched artificial grass. It also has good compressive strength, and gives a cushioning effect.

The technology has been approved by the government’s Minister of Plantation Industries and Commodities for commercialisation.

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Sales and plant additions boost Vitafoam Nigeria

Lagos – Vitafoam Nigeria, which makes flexible PU foam in west Africa, generated group sales of NGN23.4bn (\$5.9m) in 2020. This is up 5.41% on the previous financial year. Gross profit across the business increased by 25% to NGN11 bn in 2020.

The company's sales are almost exclusively within Nigeria. It has a large number of subsidiaries in the country, as well as one in Sierra Leone. It discontinued its operations in Ghana in 2019.

The company tried to sell the Sierra Leone business in 2019, but decided in September 2020 to keep making foam there. '[The plant is making] products of a high-quality standard with good margin,'

the company's annual report said. 'This subsidiary has commenced export of products to Guinea whilst strengthening collaboration with the government of Sierra Leone and other humanitarian agencies towards mass production and distribution of quality mattresses in Sierra Leone.'

Vitafoam Nigeria splits out the operating profit for its foam products business. In 2020, this increased to NGN6.5m from NGN4.5bn in 2019, a rise of 44%. It also disclosed that profit from non-Nigerian operations rose by 9%, rising from NGN563m to NGN615m between 2019 and 2020.

Also during the 2020 financial year, Vitapur, the company's rigid polyurethane subsidi-

ary, set up a systems house in Nigeria, with help from the United Nations Development Programme. The new systems house specialises in formulations based on methyl formate. It also supplies other group companies with non-flammable adhesives and pre-polymers on a just-in-time basis, and has developed hand sanitisers and handwash.

The Vitapur business, which has Saip machinery, also purchased a new mobile plant. It has stated that it wants to gain market share in a number of other industries.

Separately, Vitafoam Nigeria has set up Vitaparts Nigeria to make and sell oil filters. This is likely to begin operation in the second quarter of 2021.

Electrostatic face masks made with polyurethane

Singapore – Cori Inno-lab has crowdfunded a rechargeable facemask on Kickstarter. The mask uses PU foam in its filtering system.

The outer layer uses reticulated PU to slow particles by forcing them through 3D maze of channels. This removes 2.5µm-10µm particles.

Any particles that get through the foam are slowed and trapped in a mechanical/electrostatic filter. This is recharged by rubbing.

The two layers are rubbed together to recharge the electrostatic filter. The inventors claim the masks remove 96% of 0.3µm particles.



MAYSTA CHEMICAL A CREDIBLE SUPPLIER OF POLYURETHANE ADDITIVES

Maysta Chemical is a leading supplier of silicone surfactants in the China market and is currently expanding both the product line and geographical presence.

Maysta have recently added Polyurethane catalysts to the portfolio through the **MAYCAT™** brand and have also established **Maysta International Ltd** which will drive the company's global expansion.

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Bosnian producer to invest in new PU panel factory

Zivinice, Bosnia – Bosnian construction materials maker Disk Zivinice has announced plans to build a new plant for the manufacture of PU panels. It will invest about BAM15m (\$9.3m) in the project.

The factory will be located at the company's headquarters in Zivinice, a town with a population of 60,000 in the

north of the country. The site is within the town's Ciljuge 2 industrial zone.

It will create about 60 new manufacturing jobs. Construction is expected to be complete by the end of 2021, with manufacturing likely to start the following year, the company said.

Disk Zivinice was founded

1996, and makes roof and facade panels.

The investment will allow the company to diversify its product portfolio with the addition of PU panels. While most of its output is destined for the domestic market, the company also exports products, largely to western Europe.

Sika launches Purform PU technology

Dudingen, Switzerland – Sika has developed a new polyurethane technology which it will market under the Purform brand. The company, which specialises in adhesives and sealants for the building and automotive sectors, is initially integrating Purform into its Sikaflex product range. The technology is also being used in liquid applied membranes.

Purform prepolymers have ultra-low free monomeric diisocyanate content. The company claims the products have an improved performance profile. Products using the new technology can be extremely weather resistant, it said, and can withstand exposure to UV light outdoors for longer.

Sika has made investments in the associated production facilities at its Dudingen site. It added that the new products are in line with the upcoming stricter Reach regulations.

ISCC Plus certificate for Krefeld MDI

Krefeld, Germany – Covestro has won ISCC Plus certification for the MDI it produces at Krefeld using aniline made in its Antwerp plant. ISCC, or international sustainability and carbon certification, is an internationally recognised sustainability certificate for biomass and bioenergy.

Covestro received its first shipment of ISCC Plus-certified phenol from Borealis in October. This is manufactured using renewable hydrocarbons from Neste. Phenol is a precursor to many down-



Govil: smaller carbon footprint

stream chemical products, including the aniline that is used to manufacture MDI.

'With the gradual conversion of our production to renewable raw materials, we are getting closer to our vision of circularity,' said Klaus Schafer, Covestro's CTO.

Sucheta Govil, the company's chief commercial officer, said the development will help customers reduce their own carbon footprint.

Govil added that the product is a drop-in replacement for hydrocarbon-derived MDI that can be used in manufacturing processes without modifications.

Plixxent signs up as PU Europe member

Brussels – Plixxent, a European systems house, has joined PU Europe, the EU trade association for the PU/PIR insulation industry.

Juan Cirujeda, Plixxent's managing director, said his company was joining the association, 'because the PU industry will be facing challenges and also opportunities in the future'.

He said some of the opportunities for PU/PIR insulation will be reducing emissions through building and cold chain insulation.

Plixxent was formed from a number of systems houses that were spun out by Covestro in 2019.

Dow's Herman Motmans elected ISOPA president

Brussels – Herman Motmans has been elected as the new president of ISOPA, the European Diisocyanate & Polyol Producers' Association.

Motmans, senior product director at Dow Polyurethanes, succeeds Mike Fowles, who is vice president for global supply chain at Huntsman. Christopher Mets, VP of business management for isocyanates in Europe at BASF, is the new vice president.

Jorg Palmersheim, ISOPA/ALIPA secretary general, said: 'I am very pleased to welcome Herman as our new president, and Christopher as our new vice-president. They bring invaluable industry experience



Motmans takes the helm at ISOPA

and deep expertise to ISOPA's leadership team.'

Palmersheim and the membership thanked the outgoing Fowles for championing the organisation's work with its stakeholders to promote the highest standards.

News in Brief

Western Europe's car registrations plunge in January

Oxford, UK – Western European car registrations were down to 760,000 units in January 2021. This represents a 26% decline, compared with 1.02m sold in January 2020, according to data from LMC Automotive.

In Germany, sales were down 31.1% at 169,754 units. Sales were hit as a VAT reduction on new vehicle purchases in December 2020 ended.

In the UK, sales were down 39.5% year on year to 90,200 in January.

Lanxess launches energy-efficient PU elastomer

Cologne, Germany – Lanxess has developed a new Adiprene elastomer. The 95 Shore A hardness elastomer is said to show low heat build-up in rollers that move quickly and are highly stressed.

The material is made using Adiprene PP1095H, a polyester-based pre-polymer terminated with p-phenylene diisocyanate (pPDI), plus the

company's Vibracure A250 hardener. It claims that materials made with this combination of materials can maintain their properties over an outstanding temperature range.

'Our elastomers generate less heat when subjected to frequent, rapid deformation, therefore they do not overheat in continuous use,' said Ian Laskowitz, applications man-

ager at the Lanxess urethane systems business unit.

Because the polyurethane elastomers generate less heat when they are being used, it takes less energy to move them. These energy savings can feed directly into the machinery in which they are found, the company said, such as forklift trucks, lifts, escalators and other applications.

Perstorp acquires a new credit facility

Stockholm – Perstorp, which makes polyols for polyurethanes, has gained a SEK600m (\$73.6m) revolving credit facility. It is backed by Sweden's Export Credit Agency (EKN), which is guaranteeing 75% of the loan.

The arrangement will protect Perstorp from the current market environment, and provide liquidity to capture growth opportunities once conditions improve, the company said.

CEO Jan Secher said his company has, relative to its size, one of the best liquidity positions among European chemical companies.

Kingspan appoints head of compliance, director retires

Kingscourt, Ireland – Jim Carolan has been appointed as Kingspan's group head of compliance & certification. He will report directly to CEO Gene Murtagh.

'Carolan will be responsible for ensuring a rigorous approach to certification, testing and product compliance across all Group divisions,' the company said in a recent announcement.

Before taking the role, Carolan was operations director in the company's insulated panels division.

Another change to senior management was announced at the end of 2020 when Peter Wilson retired from his position as divisional managing director of the company's insulation boards business, and as a director of the company. He has been replaced at the helm of the business by Alan Lawlor, who was previously the division's CFO and managing director of Kingspan Insulation in southern Europe.

He will now have global responsibility for the insulation boards division.

BTC Europe to distribute BASF PU ingredients


Monheim am Rhein, Germany – BASF has announced BTC Europe as the new distributor for its aromatic isocyanates and polyurethanes for PU applications in Europe.

It covers the polyurethane ingredients sold under the Lupranat, Lupranol and Lupraphen brand names. All BASF's PU basic products will now be available from a single source in Europe.

'The new agreement enables us to react to the wish of our customers of providing the entire product portfolio from a single source,' said Oliver Peter, account manager for BASF's European isocyanate business. 'We see BTC as a strong partner to supply our customers in an optimal manner. BTC will join our direct customer support as a distributor for packaged goods.'


Part of the BASF group, BTC Europe is the company's European sales organisation. It supplies about 6000 products to SMEs from a network of 11 regional offices.

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Isocyanates supply improves, while polyol prices increase

The North American MDI market is still tight as 2021 gets underway. Crude and pure MDI are heard to be short, even though operators have started to increase production following months of disruption. Shortages of raw materials continue to be the cause of supply cuts.

In operations, BASF announced that the first phase of its new MDI plant in Geismar has been completed (see story on page 8). The first phase includes the construction of a new synthesis unit and the second phase, expansion of its upstream units, is now under construction and expected to be completed by the second half of 2021. The new plant is expected to produce 600 ktpa MDI, and to go online in about mid-2025.

Market stabilisation

European MDI markets ended the year in a better supply position than had been seen between September and November. Major supply disruptions meant prices increased significantly during those months, but the market stabilised somewhat in December and prices are seeing smaller upticks.

Demand remained healthy in December, even though the market usually slows down for the festive period. Offtake volumes usually tail off in the second half of December as many downstream factories shut down around this time. However, strong demand led to plants continuing to run at high levels. Some players suggested the increase in demand also came from the US, as supply has been tight there since September.

In China, the weak trend in the pure MDI market continued in December. Market activity was low, and factories focused on contract deliveries and bulk sales. Bearish sentiment in the market prompted traders to sell off material, causing prices to fall. Downstream industries entered their low season, and demand weakened. The Chinese domestic crude MDI market price saw some volatility but, on average, it declined as demand from some of the downstream markets was weak. Follow-

ing this, supply tightened after a number of turnarounds, and prices briefly picked back up.

The US TDI market did not change at the start of the new year. Supply has been short for the past few months, and it is likely to continue this way for a while. TDI is still understood to be under sales control because of tight availability. This means prices are rising once again. Producers have announced price increases for January business. BASF posted a 9¢/lb increase for TDI, effective 1 January. Dow increased its off-list prices by 10¢/lb on all grades and package types, also from 1 January 2021. Demand has bounced back over the past quarter after being muted since the first wave of Covid-19. Demand for furniture and bedding is at high levels. Automotive is also doing well, as producers try to build inventories following months of closures.

The European TDI market is not recovering as fast as MDI because of ongoing supply disruptions. Major supply problems plagued Q4, with December seeing some improvement, but supply was still short. The European market is also feeling the impact of the current production issues in the US, with some domestic producers exporting material to North America. Offtake volumes from the comfort industry in Europe were still doing exceptionally well in December.

Foam producers were reported to have operated at high levels, a rather unusual phenomenon during December, when they could source feedstock TDI. Supplies were as it was still tight.

Stable start

In China, the TDI market was fairly stable at the beginning of December, as downstream users had sufficient stocks and there was little business taking place. By mid-December, Covestro Shanghai adjusted its list price by CNY500/ton in an attempt to push prices up, but there was strong resistance from buyers. Towards the end of the month, BASF Shanghai resumed production, and supply lengthened. Prices were mostly offered at lev-

els closer to the bottom end of the range. Downstream markets were in their low season and had sufficient stocks, so transactions were limited.

Polyether polyol prices are rising, as supply continues to be disrupted and demand healthy. Given the current supply tightness, producers are announcing price hikes for January. BASF announced polyols increases of 9¢/lb effective 1 January 2021. Dow also increased its off-list prices by 8¢/lb on all grades and package types from 1 January 2021. Dow also announced its polyether polyols will go up by 7¢/lb from 1 February 2021. Demand was expected to slow down because of seasonality and not pick up again until next spring, but so far good volumes are being seen.

Tighter polyols

European polyols buyers and sellers still report problems with availability and supply continues to be tight. Some polyols producers have better availability, and most of the issues are reported to involve polyols that serve the automotive sector. Upstream, propylene oxide availability is heard to be tight after production issues. Downstream demand was still strong in December, and this is expected to continue even though it is now the off-peak season. Construction will not pick up again until February/March time, depending on the weather, but demand has still been above previous years.

In China, higher raw material prices and good demand caused polyol prices to rise in the Chinese domestic market. In December, the market followed the same trend as its key raw material, propylene oxide, and weakened significantly. The price recovered later as buyers started to purchase in bulk volumes increased. In mid-December, Shandong Province carried out environmental protective measures, and there were difficulties with transportation, meaning feedstock PO supply was short. This led to tightness in polyol supply, and without sufficient imports to make up for supply shortages, prices continued to increase.





New life for old foam

Mattresses and furniture represent a huge potential source of polyurethane that could be recycled, but they are complex products comprising many different materials alongside PU. As we move into 2021, changing rules and extended producer responsibility are starting to focus the minds of EU-based recyclers

Extended producer responsibility makes manufacturers responsible for the waste created by their products at the end of their useful life. It is proving to be a powerful motivator of innovation within the EU. It is now common to see the formation of consortia of companies and organisations to determine the best way to deal with the tsunami of end-of-life mattresses that the EU generates every year.

Describing it as a tsunami is not hyperbole – the volume is staggering. Marcel Moeller, global marketing & sustainability director at Dow Polyurethanes, explained the situation to participants at EuroPUR's virtual conference in late November last year. 'Within the EU, 30m mattresses on average are discarded every single year,' he said. 'Most of these go into landfill or are incinerated. If they were piled up, they

would be approximately 680 times the height of Everest.'

Bert Haeltermann, corporate manager for sustainable innovation at Recticel, told the meeting that the latest EuroPUR figures for end-of-life mattresses indicate that the EU generates about 200kT/year of polyurethane which is available for recycling. Currently, about half of this ends up in landfill, with 45% being incinerated with energy recovery. Just 5% is mechanically recovered.

Scrap it

But that is only volume from end-of-life mattresses. The volume of scrap resulting from the manufacture of mattresses and upholstered furniture is larger, and the scrap from that furniture once it is discarded even greater. 'The bed, furniture and mattress makers generate about 310kT/

year trim foam, all of which is mechanically recycled,' Haelterman said. 'But the really big volumes are in end-of-life furniture upholstery. EU processors generate around 660kT/year of this and about 50% is incinerated and 50% is landfilled. In contrast, the automotive sector produces about 130kT/year of PU foam scrap, which is mechanically recycled, 50% incinerated and the rest landfilled.'

If all of those figures are totted up, it amounts to a pool of 1.3mT/year of waste PU foam in the EU that requires processing. That's a huge volumetric problem. 'I estimate that if all the mattress foam were 100% landfilled, then Europe would need twice the volume of the pyramid of Cheops in Egypt,' Haelterman said. This equates to about 2.6m m³ being buried in the EU each year.

Dow's Moeller explained that attacks

on several fronts will be required if the problem is to be solved. While it is important to look at the technology, there an ecosystem of companies and organisations to support the circular economy also needs to be in place. But compared to linear value chains, circular chains are much more complex.

‘We need to start creating those circular loops,’ he said. ‘We need to step up to that challenge collectively. Today, pressure is building on PU because it is perceived as being non-recyclable. We are all in this together – it is an industry problem.’

A problem shared

Yet it is not a problem solely for the foam makers, and some big guns in the downstream furniture manufacturing sector are taking it very seriously. For example, in December 2019 Ikea said its goal was to become climate positive and circular by 2030. ‘[We want to reduce] greenhouse gases emissions by more than the total Ikea value chain emits, while growing our business,’ the company said. ‘We will not rely on carbon offsetting, and we will work within our value chain to reach reductions.’

Moeller described the EU’s waste recycling targets as very ambitious. ‘Different countries are at different stages of progress,’ he said. ‘France, for example, is among the front runners.’

The EU’s Green Deal foresees that by 2050 the EU will be ‘a fair and prosperous society, with modern, resource efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and economic growth is decoupled from resource use’.

But this target for 2050 is not an isolated aspiration: there are also ambitious interim targets. By 2030, the EU wants to cut greenhouse gasses by 50% of the 1990 level, and by the middle of 2021, it may extend the emissions trading system into a number of additional sectors, and price carbon effectively throughout the economy.

High profile

Recycling large, easily identifiable products such as mattresses will help to meet those targets, and the stakes are high. The PU industry is actively working to meet these standards, as several speakers at the EuroPUR meeting explained.

For example, Haeltermann said that Recticel is working with the French recycling coordination organisation EcoMobilier and automotive seating products company Tesca on the ValPUMat project. This programme is designed to extract value from end-of-life-life mattresses by using mechanical recycling processes to develop foam-based products, cars and acoustic building insulation. The project started

Foam properties with different levels of recycled polyol (%)					
Property	Unit	PIW 20	PCW 20	PCW 30	PCW 50
Density	Kg/m ³	28.1	27.1	26.8	27.2
Resilience	%	43.3	41.8	43.1	33.8
Compression set	%	3.9	4.5	3.9	5.4
Hardness	N	164.0	158.6	143.4	130.5
Support factor		2.5	2.3	2.3	2.8
Tensile strength	kPa	129.0	131.0	130.0	190.0
Elongation at break	%	175.0	195.0	224.0	257.0

Note: PIW = Post-Industrial Waste, PCW = Post-Consumer Waste
Source: Ikano

in 2018, and will last for a total of three years. During that time, it is expected to generate 10 new applications for foam from end-of-life mattresses.

One of the project’s successes has been to make acoustic foam for buildings, generators and compressors, as well as the passenger compartment of cars. Conventional techniques shred the foam, turning it into a fleece that is bonded by isocyanate and steam. ValPUMat has developed a new material: a fleece bonded by fibres in a continuous process. This has gone into commercial operation at a Recticel plant at Agners, France. There is also a pilot plant at Wetteren, Belgium

A second development from the project is SilentWall. This is an 80kg/m³ foam bonded to plasterboard, designed to help insulate rooms from noise.

Got to be smart

Recticel is also part of the Puresmart consortium, which is funded by the EU’s Horizon 2020 programme. This was set up in early 2018 with the goal of developing a complete circular life cycle for polyurethane, turning it into a sustainable material. As well as reducing the amount of waste generated, the Puresmart programme should also help to generate 20 full time jobs for every 6kT/year of PU recycled.

Its core goals are to divert up to 220 kT/year PU waste from landfill, and reduce the carbon intensity of PU foam by at least 30%. It fits with the EU’s goal that member states should reuse and recycle 55% of municipal waste, including mattresses and furniture, by 2025. The EU also wants to reduce the amount of municipal waste going to landfill to 10% by 2030. Once again, large, bulky objects like mattresses are good targets for recycling.

The Puresmart programme has three pillars: smart design, smart sorting and smart chemolysis. The design pillar is based on developing new polyurethanes with a greater thermoplastic character that could be easier to recycle than con-

ventional fully thermoset materials. By the end of 2020, Haelterman said, a number of candidates based on triazolinedione were being studied. These can be used as co-monomers with polyols in formulations to create covalent adaptable polyurethane (CAPU).

The manufacture of these raw materials will be scaled up by Weylchem Innotec, and then used by Recticel in its range of products. This foam should retain the mechanical properties of conventional polyurethane foam while being much easier to recycle because of their thermoplastic nature, according to project information.

As we reported in our June/July 2020 issue, the consortium is developing a smart sorting process with Austrian company Redwave. The aim is to fractionate post-consumer polyurethane waste from bedding and furniture, and this will be fed into chemical recycling processes developed by academic groups at the KU Leuven and the University of Castile La Mancha. The separation technique uses machine learning algorithms. Haelterman described it as a breakthrough for polyurethane foam recycling.

Patents in progress

The consortium has three patent applications for processes in its smart chemolysis pillar. The programme members have built on a laboratory method chemolysis that gives high purity polyols at a high yield after screening a number of agents and separation methods. The group is investigating the most effective way to scale this up to a semi-industrial process. This will enable larger volumes of foams which will generate both polyols and amines which can be converted into diisocyanates.

Dow is part of another consortium that has made high-profile advances recently, winning an award from *Chemical Week* magazine on the way. Moeller explained the company’s plans to sell Renuva brand polyols made from post-consumer mattress waste collected under France’s

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Mattress waste ready for recycling at RetourMatras

► Continued from page 23

Eco-Mobilier scheme. They will be generated at Orrion Chemicals' Orgafoam site in France, using technology developed by German company H&S.

Turning the value chain from the straight line of produce–sell–scrap into a circle where the scrap is used in the raw materials for the production phase will have an immediate impact on the waste problem, Moeller claimed. 'Only one industrial scale plant will recycle around 200,000 mattresses/year,' he said. 'The Renuva system is scalable and decentralised, with huge potential,' he said. 'It is a demonstration that PU can be recycled and that recovered polyols have value.'

The chemical recycling process converts waste PU into polyols with up to 50% recycled content. 'This polyol will be used as a high-value constituent in new flexible foam for mattresses, and it could be used in rigid foams for thermal insulation,' he said. 'It is important here to understand that the value stays very high so the properties remain in place.'

Any PU foam will do

There is no need to segregate PU foam types, he said, and any kind of PU foam can be recycled, as long as it is clean and dry. The first plant is under construction and should be operational by the middle of 2021.

Applications are already in the pipeline, with Vita announcing in October 2020 that it plans to use polyols from the project in its foams. At the time, Vita's CEO Ian Robb said: 'We are committed to being pioneers in the development of a circular economy within our industry, where post-consumer flexible PU foams will be recycled into new raw materials for use in our manufacturing process to produce new, quality foams.'

Vita expected to start using polyols at its ICOA plant in Crancey, France in early 2021. It also intends to work with mattress brands in France and across Europe to promote the use of foam made with recycled polyols in the new mattress market. It also plans to look for other applications for the material.

Don't scrap the scrap

Poland-based flexible foamer Dendro's recycling activities first came to prominence in 2013, when it announced it was working with H&S to recycle in-process scrap at its facility in Rogozno, about 350km west of Warsaw.

Dendro now trades as Ikano Industry, and is still a key supplier to Ikea, being owned by the Kamprad family which controls the Swedish furniture giant. It supplies about 2.5m mattresses to Ikea, according to Michal Soltsinski, Ikano's head of PU foam production.

The company started looking at post-industrial waste in 2015. 'We invested,' Soltsinski said. 'It took three years from the feasibility study while we searched for the best available technique with a focus on chemical recycling.'

The company now has a 7m³ reactor that makes polyol from cut offs and waste foam from industrial production. These include both HR and conventional foam, he said, and the waste is free from fillers, melamine and other flame retardants, colorants and pigments, he said. As the demand for this recycled polyol, which Dendro calls repolyol is growing, the company is now investing in a 15m³ reactor.

The only criteria for foam to be recycled are that it must be both clean and dry. 'It needs good preparation before we use it,' he said. 'Otherwise, if something sticks to the foam it will be found in the reactor. We use a range of different polyols in dif-

ferent formulations. These include standard, visco, repolyol, natural oil and CO₂ based polyols. They can all be recycled. The manufacturing cost of the repolyol is about 50% of the cost of standard polyol, based on a market price of €1.5/kg.'

Soltsinski estimates that since 2015 when the project started, Ikano has generated 12.5kT of repolyol, equivalent to the capacity of 500 road tankers, and consumed 5.5kT of trim foam. That represents, he said, about 250 truckloads.

Ikano is making repolyol with a specification very similar to standard polyol in terms of hydroxide number and water content. 'Its viscosity is higher, and we worried about that at the start, but it works well in production,' he said.

Repolyol can substitute for between 20% and 40% of virgin polyol. Ikano has also tried it at 100% and made a 50m long block. That foam had lower physical properties, but he believes it will still have applications.

Recycle and recycle again

Initially, there were concerns that some of the polyol would be reused many, many times, and that this could have an effect on finished properties. However, Soltsinski explained, at an addition level of 20 – 40%, this does not seem to be a problem.

Ikano decided on that upper addition level of 40% because the foam had to meet Ikea's demanding compression set specifications. 'Ikea sells many of its mattresses pressed and rolled with the volume reduced, so the rolled height of the foam is 10% of the original height,' he said. 'For low density foam of about 25kg/m³ the maximum would be about 25%.'

After 2017, the company began to look at the possibility of using post-consumer waste, too. 'Post-consumer waste has some biological content, and this could



be hard to sell into the flexible foam market where there can be a lot of near personal contact with flexible foam products,' Soltinski said. 'To get around this, we looked at glycolysis as a method of producing polyols for rigid foams.' The company has already successfully used the polyols to make rigid sandwich panels.

'In parallel, we tried acidolysis,' he added. 'We did not think that this would be as promising, but today it is the main process we use with material from the post-consumer waste stream.'

More demanding

Of course, biological content is not the only factor that makes post-consumer waste much more demanding to reprocess than post-industrial waste.

The composition is far more unpredictable, perhaps because the foam has been combustion modified in some way, he said. As well as flame retardants and other additives, it can incorporate materials such as glue, textiles and latex. 'This is very different to post-industrial waste, where we know exactly what is in our foam,' Soltinski said.

Ikano has already scaled this work up from the lab into a 700kg reactor, which is sufficiently large to make quantities for testing on processing machines. The physical properties of foams made with different addition levels of post-consumer and post-industrial waste are shown in the table on page 23.

'The foam parameters are OK,' he said. 'There is a drop in resilience and hardness, but tensile strength and extension at break increase.'

As well as physical properties, Ikano tested the foam from a consumer safety perspective at a number of external institutes. The foams were also tested against Ikea IOS-MAT 0010,0054, which covers the migration of flame retardants, lead, organotin compounds, phthalates, TDA, MDA and other products. Foams were also tested for microbial growth on the foam to ensure they would be safe for sale to consumers.

The need for a continuous source of post-consumer waste led to the team making other discoveries, Soltinski said. They were given some mattresses that had been returned to Ikea as faulty prod-

ucts, giving them the opportunity to look at the dismantling process, which proved challenging.

'We realised that this needed a lot of knowledge,' he said. 'It also made us realise that there must be some kind of future design for recycling. It should be much easier than it is now, and we have started looking at that with Ikea.'

Don't mix and match

Their work on dismantling highlighted several factors that would make the process simpler. 'You should not mix PU with latex, for example,' he said. 'There should be 100% polyurethane foam or 100% latex to help with the separation.' Foam should not be attached to the cover, either, as this is difficult to separate effectively.

Armed with that knowledge, Ikano is now cooperating with RetourMatras, a Netherlands-based mattress recycling company. It has the collection, dismantling and logistical expertise that will be required for Ikano to make repolyol from post-consumer waste into an important input stream of material for the manufacture of future consumer products.

Mattress recycling is a mixed bag

In the US, the picture for mattress recycling is complicated. There is no federal mandate for mattress recycling to take place; instead, the activity is delegated to the states to set their own rules.

A handful have formal programmes and legislation in place, but in the vast majority, it's down to individual cities and counties to organise mattress recycling. Availability of recycling is all too often very patchy.

Wave goodbye

Three states, California, Connecticut and Rhode Island, work under auspices of the Mattress Recycling Council's Bye Bye Mattress programme.

The scheme kicked off in Connecticut in 2015, and since then, more than 775,000 mattresses have been collected free of charge from consumers in the state. There are also three drop-off locations, and 136 communities offer access to the programme via waste transfer stations and public works yards, or by collection events and curbside pick-ups. Two recycling facilities are located within the state.

Next door in Rhode Island, the programme started a year later. About a third of a million mattresses have been collected in that time, via drop-off loca-

tions, events and curb-side pick-ups, plus two public drop-off locations.

In California, more than five million mattresses have been collected since the programme started there in 2016. State-wide, there are more than 200 permanent drop-off locations. In total 90% of the population living within 15 miles of one of the sites.

Retailer take-back programmes and curb-side collections are also in place to make life easier for the consumer, along with at least 100 drop-off events held around the state every year.

Online retailers selling to Californian consumers now have to offer to pick-up old mattresses, bringing them into line with brick-and-mortar stores. At least 140 more public and private entities are involved in the state's recycling efforts, including various high-volume businesses such as mattress retailers, hotels and universities.

Keeping it local

Outside these three states, the picture is far more fragmented. For the most part, there is no state legislation mandating recycling, and it is left to local municipalities to set their own rules and programmes. Some have tried and failed to set state laws; Oregon, for example, has

already had two unsuccessful attempts at legislation.

On the other side of the country in Maine, a bill was passed back in 2017, which was vetoed by the governor. MRC is hoping to start a pilot programme there in the next couple of years, although the geography makes state-wide activities like this extremely challenging. About half of the state's 1.3 million residents live in the Portland area, leaving very low population density across most of the rest of the state's 35 million square miles (91 million km²).

In 2020, New York governor Andrew Cuomo attempted to include mattress stewardship rules in the 2021 budget, but in the light of the pandemic, this was put on the backburner, and it remains to be seen whether something similar will be introduced this year. Other states contemplating legislation include Maryland, Minnesota and Florida, plus the District of Columbia.

In Massachusetts, a proposed landfill ban on mattresses has received push-back, not least from MRC, who believe a formal recycling programme should be instituted first. Insufficient recycling facilities within state itself would also lead to it exporting its mattress problem to neighbouring states.



Wheat waste transformed into PU foam

Cordoba, Spain – Wheat straw has been identified as a potential source of polyols by a team at the University of Cordoba. Working in collaboration with Chile's Advanced Polymers Research Centre, they managed to transform it into polyols for polyurethanes.

Nearly 740m tons of this agricultural waste is produced worldwide every year, they said, but there is no well-defined use for the cheap material. Although there are potential applications such as bioethanol production, it is usually discarded.

An alternative strategy would be to convert the biomass into liquid fuels without the usual gasification step. While thermochemical conversion mechanisms such as this have potential, the Cordoba group said that to date the ideal has been neglected because the process is complex and expensive, and therefore difficult to scale up.

Recent advances have led to increased

yields of products such as polyols by using organic solvents at atmospheric pressure and low temperature. The method used by the Cordoba team used glycerol as solvent, and catalytic amounts of sulfuric acid. The resulting polyol had a hydroxyl number of 604 mg KOH/g. This compares to about 200 for petrochemical-derived polyols, and 408 for castor oil.

'[The straw-derived polyol] does not offer complete hardness and dryness once exposed to air,' according to chemist Esther Rincon. This is necessary for the proper formation of foam, she said, and is in contrast with the behaviour of castor oil polyols, which fail to cross-link completely because of an insufficiency of double bonds in the molecules.

The polyols were then used to make PU foam, using different proportions of straw-derived polyols and castor oil. It worked with both TDI and MDI, but increasing the proportion of straw polyol

above 50% did not give a stable foam. The team suggested the optimal mix was 40% straw polyol and proportion for the straw polyol was 40%, and 60% castor oil. The characteristics of the resulting foam resembled those of foam made using petroleum-derived polyols.

'We were able to obtain very desirable parameters in the manufacturing of foam, converting 96% of the wheat used with an almost maximum performance,' Rincon said. An additional benefit was an increase in biodegradability.

The team now plan to use the PU foams in plant nurseries to help with plant growth. 'Instead of watering the plant, and with the aim of dealing with drought problems and preventing overwatering, we would inject the water into the foam so that the plant can consume it as needed,' she said.

The work has been published in the journal *Polymers*.

Belgium's mattress recycling system gets under way

Brussels – The scheduled start of Belgium's solution to the extended producer responsibility for mattresses in waste streams was 1 January.

Three Belgian trade bodies have formed Valumat as an organisation to facilitate collecting and reprocessing all the discarded mattresses in the country cost-efficiently and process them sustainably into a number of raw material streams.

Valumat charges participating importers and mattress-makers in Belgium a

fee based on the number of mattresses made in or imported into the country. This pays for the costs of collection, storage, processing and recycling. A portion of the fee is used to fund research into eco-design so that in the long term all the materials from discarded mattresses can be reused.

Participating companies fulfil their legal requirements under extended producer responsibility in Belgium.

Valumat will ensure that there are enough mattress-

es to recycle in a number of ways. First, consumers can take their old mattresses to the local dump. Valumat will pay the recycling centre to collect, store, transport or process the mattress.

Alternatively, consumers will be able to return their old mattress to a store when they buy a new one. Once again, Valumat will pay the owner. If the store does not want to take old mattresses, it must give clear instructions about how consumers can dispose of them.

In total, 37 companies including foamers Recticel, Polypreen, and retailers, Aldi, Ikea, Lidle and Tempuras well as bedding manufacturers were either signed up to the Valumat at the end of December 2020.

Valumat was formed by: Fedustria, which represents textile, wood and furniture industry companies; Comeos, for trade services, and Navem; the furniture trade association plus three bedding makers Recticel, Veldeman and LS Bedding.

Reactive amines for reduced emissions

When creating foam for challenging applications such as bed-in-a-box mattresses, reducing emissions and retaining properties is the name of the game, and the choice of catalysts has a huge bearing on results. **Sarah Houlton** reports on the new reactive amine catalysts presented by Tosoh and Evonik at PFA's online Fall 2020 meeting.

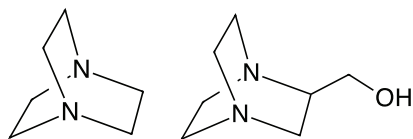
The rapid market growth of bed-in-a-box mattresses has sharpened the focus on the catalysts used to make the foam for these demanding applications. Largely sold on line, they are vacuum-compressed into a relatively small box, making them far easier to ship than a bulky traditional mattress. But customers expect that when the mattress is unrolled in the bedroom, it will quickly expand to the correct size and shape. This is only possible if the foam has high durability and appropriate compression set performance.

As well as these physical demands, another concern is the emission of VOCs and odour from the mattresses. Odour is a particular issue for consumers. If the foam is made using reactive catalysts, emissions can be reduced because the catalysts are incorporated into the structure of the polyurethane, so they cannot subsequently be volatilised from the foam.

However, it can be difficult to create a foam with a sufficiently low compression set using reactive amine catalysts. This is because the low gelling activity means a large catalyst dosage is necessary. A second downside is that with such large amounts of catalyst, polymer growth is far more likely to be inhibited by the catalyst reacting with the isocyanate monomers.

Low set, low dosage

A reactive amine catalyst that gives a low compression set at a low dosage while also reducing VOCs would be particularly useful for the bed-in-a-box industry. One such product has been developed by Tosoh Specialty Chemicals, and was described in a presentation by the company's Yusuke Morioka.



DABCO, also known as TEDA (left) and Tosoh's new catalyst Rzeta-HD (right) which is more reactive

Tertiary amine catalysts are generally used for urethane foaming, he said, and the new catalyst, Rzeta-HD, was designed specifically to address the performance challenges posed by bed-in-a-box mattresses. Non-reactive amine catalysts such as the widely used TEDA (triethyl diamine, more correctly named 1,4-diazabicyclo[2.2.2]octane, or DABCO) are not incorporated into the polymer network and, therefore, after foaming can contribute to odour. In contrast, the reactive hydroxyl group on the TEDA derivative Rzeta-HD enables it to be incorporated into the network via reaction with isocyanate groups, rendering it unable to volatilise.

The nature of the catalyst can also have an impact on foam durability. The steric hindrance at the nitrogen atoms in TEDA is relatively small, giving it high reactivity and, therefore, low dosage requirements. In contrast, many of the commercially available reactive amine catalysts have a large steric hindrance, giving lower catalytic activity. With the higher dosage, residual catalyst in the polymer network can cause the physical properties to deteriorate and, therefore, reduce the foam's durability.

As a non-reactive catalyst, TEDA is easily emitted from the foam, and therefore contributes to odour. Currently available reactive catalysts are less likely to be emitted from the foam, he said, but may remain partially unreacted after foaming. This is particularly the case if the reactive group is a secondary hydroxyl. In contrast, if the reactive catalyst contained a primary hydroxyl group, it would be more reactive and, therefore, even less likely to be emitted from the foam.

Rzeta-HD was designed to retain the positive aspects of each of these catalysts, while improving the negative, Morioka said. Structurally, it closely resembles TEDA, with the addition of a hydroxymethyl moiety, giving the catalyst a primary hydroxy reactive site. As a result, it has high catalytic activity with a lower required dosage, and can produce foams

with improved durability as well as reduced odour. Indeed, the amine emission from the foam is below the limits of detection.

Morioka's team made test batches of slabstock foam using a tri-functional polyether polyol, TDI, and a small amount of tin catalyst in addition to an amine cata-



It is a very suitable catalyst for bed-in-a-box applications"

Yusuke Morioka, Tosoh

lyst. A range of amine catalysts were studied, including the new Rzeta-HD catalyst, TEDA, and four currently available reactive amine catalysts. While slightly more Rzeta-HD was needed than TEDA, substantially less was required than for any of the other four reactive catalysts because of its stronger curing activity.

The durability of the foams was then evaluated. Rzeta-HD gave comparable compression results to TEDA, and better compression than all of the four other reactive catalysts. The new catalyst also had good stability at any of the evaluated doses of the tin catalyst. It performs as well as TEDA in long-term compression tests, and better than the other reactive catalysts.

Amine emissions were evaluated using the CertiPUR method. In contrast to foam made using TEDA, from which 2.7mg/m³ of amine was emitted, the amount measured from the foam made with Rzeta-HD was below the detection limit. Morioka said this was because of its strong incorporation into the polymer network.

The new catalyst also performed better in subjective human panel tests, he added. In another test looking at odour

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changes over time, foam made with the Rzeta-HD catalyst changes very little over time in contrast to TEDA and the tested existing reactive catalyst. Aldehyde emission measurements from the Rzeta-HD foam were much better, too.

'Rzeta-HD has excellent durability compared to others, and shows less foam odour and less aldehydes than other reactive catalysts,' Morioka said. 'It is a very suitable catalyst for bed-in-a-box applications.'

An alternative option

Another alternative to TEDA was presented by Evonik's Jane Kniss. The traditional industry standard TEDA is very efficient at low use levels, Kniss said, and for a long time this was the only important factor. But with the recent increased focus on emissions from foam, this is changing. Also growing are concerns about other issues such as VOCs, foam odour, fogging of car windscreens and PVC staining. Foam production safety and worker exposure are also in the spotlight. While amine catalysts are a common focus for emissions, in reality they are not the only component of the foam that may be responsible, she said.

There are, Kniss explained, two main ways in which the amine catalyst can be locked in to the foam: either by making it very large, or by adding a reactive hydrogen site that will react with isocyanate groups. Both strategies have pros and cons. A high molecular weight catalyst is less likely to cause chain termination in the absence of an active site, but it will increase viscosity, and this higher viscosity can prove problematic for pumping. At the same time, reaction efficiency is often reduced in comparison to smaller catalyst molecules.

A reactive hydrogen can enable the catalyst to be incorporated into the foam, and multiple linkages may enhance the properties of the foam, but additional synthetic steps are often required. Slight foam softening and humid ageing instability can result, but the biggest obstacle to date has been the use level.

Evonik introduced its DABCO NE 500 reactive catalyst for slabstock foam about 20 years ago. However, the biggest problems of the first non-emissive gel catalysts were the higher loadings required at higher foam densities, particularly for visco foams. More recent developments have led to the introduction of improved catalysts, Kniss said, including DABCO NE 740 and 750. These offer similar efficiency to industry-standard TEDA-based gel catalysts in a variety of foam grades, including visco, she said.

Lab studies have been carried out to demonstrate the improvements in foam properties these new catalysts can give. First, using a standard 1lb/ft³ (16kg/m³) 30

IFD conventional foam, the rise profiles were assessed, between formulations containing the non-reactive catalyst DABCO 33LV, and the non-emissive DABCO NE 500.

To achieve similar foam rise times and height as foams made with 500 or 33LV, between 25 and 35% less of the new 740 and 750 catalysts were needed to produce fine, regularly celled foam. Further physical properties of the foams were reasonably comparable at equivalent densities in the lab-scale tests.

Kniss explained that the most stringent application for non-emissive catalysts is in a higher density visco foam compo-



Kniss: Increased focus on emissions from foam

sition, such as a 3.5lb/ft³ (56kg/m³) TDI visco foam grade. Tests showed that at the same use level, 740 rise time was comparable to the 33LV control, and 750 was slightly faster. In contrast, 500 was significantly slower. Airflows were similar for foams made with all four catalysts at equivalent use levels. However, all three non-emissive catalysts had slower recovery times than 33LV. 'More study is required to determine if the longer time is a result of pneumatic effects, adhesive effects or polymer relaxation effects,' Kniss said.

The force to crush values for the foams were also tested and compared. This gives an evaluation of catalyst efficiency, ability to cure, and helps to determine how quickly a foam can be demoulded without risk of tearing.

This work showed that the 33LV catalyst produces the firmest foam with the highest initial force to crush value. The two new catalysts produce less firm foam, and the force to crush value levels off more quickly, settling at 10% lower than 33LV. The initial figure is similar for the 500 control, but it takes longer to level off to a foam that is noticeably softer, by about 30%.

This parameter was also evaluated with

an alternative 3lb/ft³ (48kg/m³) MDI visco formulation. Again, 33LV gives the firmest foam at the outset; the slightly softer foams made with 740 and 750 are only 10–20% lower than the final 33LV crush cycle, she said. Both 500 and another non-emissive gel control, DABCO NE 1082, gave a softer foam at the outset, and also after the crushes.

Foam recovery times were also evaluated in this foam. As anticipated, Kniss said, airflow is still very low for all the reactive catalysts, but the recovery times are mixed. By far the fastest to recover is 740, along with the two reactive controls; in contrast, 750 is significantly slower. 'More investigation would be necessary to identify the mechanism for the range of recovery times,' she said.

To ensure the catalysts do not contribute to foam emissions, VOC testing was also carried out, on a 1.8lb/ft³ (29kg/m³) conventional foam and a 3.6lb/ft³ (58kg/m³) TDI visco foam. 'As expected, amine emissions are only evident in the fugitive control foam made with 33LV and no gel amine emissions appear in the three non-emissive catalyst foams,' Kniss said. Other emissions are similar across all foams; overall, VOCs from the non-emissive foams were about a third lower than those from the 33LV control for the conventional foam, and 70% lower in the visco foam.

Production trials

In addition to lab-scale testing, a pair of full-scale line trial tests were carried out in two different foam grades. Kniss gave a brief outline of these tests, although most details were confidential.

The first of the trials was carried out in a 3.2lb/ft³ (51kg/m³) high-resilience foam. A 25% lower use level of 740 produced foam very close in properties to the control low-emission catalyst.

In a second trial in a 3lb/ft³ (48kg/m³) 10 IFD MDI viscoelastic foam, 740 required a 15% lower use level. Most of the two foams' physical properties were similar, but the 740 foam block a squarer top shoulder, helping to increase yield during subsequent fabrication.

Overall, Kniss said, the two new catalysts, 740 and 750, offer several benefits to a wide range of flexible slabstock foam grades. Both show significant improvements in gel reaction efficiency compared to earlier non-emissive gel amine catalysts. They are very similar to the long-time industry standard TEDA-based materials when used in higher density visco foam grades, Kniss said. 'They contribute no amine emissions, supporting CertipurUS and other certifications,' she said. 'Full-scale production testing carried out with 740 and 750 demonstrates similar processing when compared to TEDA-based control catalysts.'

EU foam growth heads eastward

The year 2019 may now seem like the distant past, but it is the last time that PU foam production was normal. Chemical industry consultant **Clint Raine** ran through the numbers at the recent virtual EuroPUR meeting

There was a lot of consistency in the European flexible polyurethane production figures between 2018 and 2019, the most recent year for which figures are available, Clint Raine of Belvedere & Partner told the online EuroPUR annual meeting in late November 2020. He used two markets as illustrations: mattresses and cars.

'Looking at mattresses, there was little change between 2018 and 2019, with just a small decline in production,' he said, quoting provisional data from consultants CSIL. However, he added that online sales are growing significantly, and more expensive raw materials were forcing mattress makers to look at cheaper alternatives.

In the automotive sector, the production downturn had already begun in 2018, Raine said, despite growing car sales in Europe. The biggest fall in automotive production in 2019 was the UK which produced 13.6m units or 14.1% fewer cars than in 2018. Italy was down by 11.2% at 9.3m.

Production fell in Germany to 4.9m units, down by 8.3%. In France, production dropped 5.9% to 21.5m units in 2019. Overall, if Turkey and Russia are excluded, European automotive production was down 4.5% in 2019.

Outside Europe, the situation was bleaker still. In the US, it was down 10%, while there was an 11% decline in China, allied to a growth in the second-hand car market. In Europe, exports, which mostly came from Germany, fell by 13%.

Despite these pressures, flexible foam producers in the EU 28 plus Norway, Switzerland, Turkey and Russia ended 2019 with 1.3m tonne of polyether foam production, representing an increase of 3.6% on the previous year. In total, a further 70 kT of polyester block foam was also made. Turnover of €5.3bn supported 159 continuous block plants and a little more than 27,000 full-time equivalent jobs, he said.

A total of 45kT more slabstock was exported in 2019 than was imported into the EU trading bloc. 'The main export destinations for Europe-made flexible foam are the US, China and Serbia,' Raine said. 'There was a spike in demand from the Yemen, but this is probably linked to the conflict there.'

EuroPUR's regular market survey confirmed that the centre of gravity of the industry is moving further east. Indeed, the majority of the regions where production growth was registered between 2018 and 2019 were in the east of the continent.

The biggest relative gains came in the Balkans, Greece and Cyprus, which was up by 44% year on year, albeit from a low start of 29.4kT in 2018. Polyether slabstock production in Turkey grew by 12.8% to 162kT/year. Romanian and Bulgarian production increased by 4.6% to 62.7kT. The combined production of Hungary, Croatia, Czech and Slovak Republics

and Slovenia also grew by 4.6%, to 52kT.

Growth in Russia, Kazakhstan, Belarus and Ukraine grew by 3.8% to 136kT. Among the western European countries, the ones where production grew between 2018 and 2019 were Scandinavia and the Baltics, up 3.2% to 77kT, and France, where it was up 2.8% to 33kT. Overall, those countries where production was up added about 50kT in 2019. In contrast, the UK and Ireland was the biggest loser, with production down by 4kT. Elsewhere, the decline was less than 1%.

Looking at the net production figures between 2017 and 2019, production in Turkey increased by 27kT, Poland by 17.9kT, and the Balkans, Greece and Cyprus by a total 16.9kT. The biggest falls were seen in Germany, Austria and Switzerland, where 10.5kT less PU was produced over the three-year period. In France, production was down by 9.9kT, and in the UK and Ireland, it declined by 4.5kT.

'The market was tough in 2019, and there were structural changes,' Raine said. 'There was a trend towards lower density foams. That has continued, and may have led to lower levels of HR and polyether foams being produced.'

This trend was amplified by higher raw material prices in the second half of 2019. This has resulted in downstream users trying to replace flexible polyurethane foam with other materials where they can, or to use less of it.

'End-users are getting clever at reducing the amount of foam in their products,' Raine said.

European flexible foam snapshot 2018 vs 2019

	UNIT	2018	2019	% CHANGE
Polyether slabstock	kT	1243.0	1302.0	4.7
Polyester slabstock	kT	75.0	69.0	-8.0
Full-time Employees		27649.0	27349.0	-1.1
Number plants		158.0	159.0	0.6
Estimated turnover	€ bn	4.5	5.3.0	17.8
Total	kT	1315.0	1371.0	4.3

Source: Labyrinth Research and Markets/Belvedere & Partner

Mattress production (m units)			
REGION	2018	2019	% CHANGE
Belgium + Netherlands	3.5	3.4	-2.9
Denmark	2.2	2.0	-9.1
Finland + Norway	1.0	1.0	0
France	3.6	3.6	0
Germany + Austria	5.7	4.9	-14.0
Greece	0.6	0.5	-16.7
Italy	4.8	4.6	-4.2
Portugal	1.5	1.5	0
Spain	4.1	4.1	0
Sweden	1.7	1.6	-5.9
Switzerland	1.4	1.3	-7.1
UK + Ireland	5.7	5.7	0
Bulgaria + Romania	1.7	1.7	0
Czech Republic	0.4	0.5	25.0
Poland	12.9	13.1	1.6
Total	50.8	49.5	

Source: CSIL World Mattress Report 2019 (provisional data)



Diary

Readers are strongly advised to confirm details with event organisers before making travel arrangements.

2-4 March

Postponed until 1-3 March 2022

Futurebuild

ExCel, London

Web: www.futurebuild.co.uk

3-4 March 2021

ISPA Industry Conference

Vinoy Renaissance Resort & Golf Club

St Petersburg, Florida

Contact: Kerri Bellias

Tel: +1 336 945 0265

4-7 May 2021

Interzum 2021

Cologne Messe

Email: interzum@visitor.koelnmesse.de

Tel: +49 1806 077 050

26-27 May

PFA

Vinoy Renaissance Hotel

St Petersburg, Florida

Contact: Kay Wright

Tel: +1 865 657 9661

1-3 June

JEC World 2021

Villepinte/France

Email: hotline@jeccomposites.com

Web: www.jec-world.events

22-25 June 2021

Plast

Milan Rho Fairgrounds

Milan, Italy

Email: info@promaplast.org

Web: www.plastonline.org

10-12 August

Feipur

Sao Paulo Expo

Tel: +55 11 2899 6363

Email: consultoria@artsim.com.br

10-12 August

International Roofing Expo

Mandalay Bay Convention Center

Las Vegas, Nevada

Tel: +1 972 536 6415

Email: info@theroofingexpo.com

28-30 September

PU Tech 2021

India Expo Center

Greater Noida, India

Email: reena@unitechexpo.com

Web: www.putechindia.com

4-6 October

CPI Polyurethanes Technical Conference

Denver, Colorado

Contact: Mary Novack

Email: mary@novackmanagement.com

3-4 November

PFA Fall Meeting

Omni King Edward

Toronto, Canada

Contact: Kay Wright

Tel: +1 865 657 9661

25-27 November

PUTech Eurasia 2021

Istanbul Expo Center

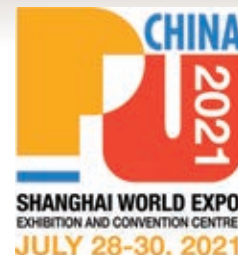
Istanbul, Turkey

Contact: Demet Sarikas

Tel: +90 212 324 00 00

Email: demet.sarikas@artkim.com.tr


Key Events



Contact: Debbie Hershfield


Tel: +1 330 608 0231

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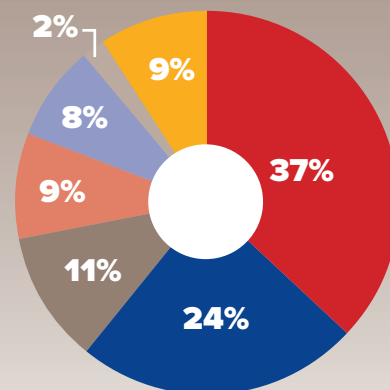
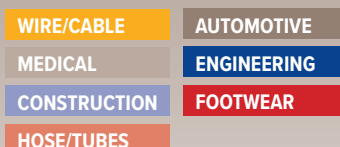


- TPU (Thermoplastic Polyurethane)
- TPU Hot Melt Adhesive
- TPU Adhesives (granules, powder)
- PU Adhesives for Shoes
- CPU (Casting Prepolymers)
- PUR (R-HM) Adhesives
- WPU Adhesives (Water-based)
- MOCA, Hardener Additives

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TPU CONSUMPTION BY END USE 2020



SOURCE: IAL CONSULTANTS

The world produced 704kT of thermoplastic polyurethane in 2020, down about 6% because of coronavirus, according to a new report from IAL Consultants.

The Asia Pacific region accounts for 69% of consumption, the report said.

The materials have been enjoying one of the fastest growth rates among polyurethane businesses, and the impact of coronavirus on this sector was less severe than in others. IAL estimates that

in 2020 PU production fell by 10.9%, because of coronavirus and high raw material prices.

TPU has grown because it is increasingly substituting for other polymers such as PVC, and its sustainability credentials are helping in a world that increasingly appreciates the use of polymers that can be easily recycled.

Footwear and textiles are mainly focused on Asia, where it is used in high-quality products for

both local consumption and for exports. The demand for TPU is driven by population growth in the region, as well as greater disposable income.

Another market for TPU that is set to grow is 3D printing, as it could allow smaller companies to make parts that are expensive to make conventionally. This information comes from IAL's Global Overview of the Thermoplastic Polyurethanes Market, published in January 2021.

INTERNATIONAL UTECH EVENTS

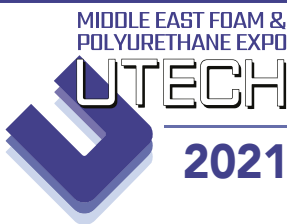
100% Polyurethanes In All Corners of the World



JULY 28-30, 2021

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CONVENTION CENTER, SHANGHAI, CHINA

PUCHINA.EU



26-28 OCTOBER 2021

DUBAI WORLD TRADE CENTRE,
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MEFPU.COM



16-18 NOVEMBER 2021

MECC, MAASTRICHT,
NETHERLANDS

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APRIL 26-28, 2022

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