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Autumn 2024
Volume 33, Number 3

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In the Editor's opinion

Techtextil, co-located with *Texprocess* in Frankfurt, Germany, on 21–24 April 2024, was once again a great success. One couldn't help but notice, however, that the mood on the show floor was somewhat muted. This has much to do with the current economic climate. Geopolitical uncertainty, coupled with inflation, has created an environment where many are reluctant to invest. The German Mechanical Engineering Industry Association (VDMA) Textile Machinery Association, for instance, reports that orders for machinery remained very weak in the first quarter of 2024. Demand from the large-volume markets – China, India, Turkey and the USA – remained low. German exports of textile machinery and accessories in January and February 2024 were 19% lower than in the same period of 2023. Deliveries to China were 20% lower than at the beginning of 2023, while exports to India and Southeast Asia almost halved.

There are reasons for optimism, however. The downturn is likely cyclical. Further, on the show floor, many of the smaller companies with specialised, high-value products – the bulk of companies serving the technical textiles market, in fact – reported better fortunes. Further, the outlook for the technical textiles industry is very positive. Fortune Business Insights, for instance, says that the global market in 2023 was valued at US$225.99 billion and forecasts an increase to US$346.67 billion by 2030. Similarly, Allied Market Research expect an increase to US$331.8 billion by 2032.

The impact that the manufacture of technical textiles has on the environment was, of course, a big talking point at the show. Starting on page 9, Adrian Wilson, lays out the ways in which drylaid process for the production of nonwovens could increase the use of natural and recycled fibres, and how bio-based resins are being used in spunmelt processes.

Another topic of conversation at the show was the need to switch to fluorocarbon-free treatments, which is proving to be a big challenge for garment manufacturers and is likely to be even more problematic for the manufacturers of technical textiles. The situation is muddied by the complexity of regulations on perfluoroalkyl and polyfluoroalkyl substances (PFAS) around the world. In the first instalment of a two-part feature (starting on page 19), we have put together a concise overview of the current regulatory landscape. In the next issue, we will delve into the technologies being developed to eliminate the need for PFAS in the finishing of textiles.

Finally, as this issue goes to press, Messe Frankfurt USA is in the process of making its final preparations for *Techtextil North America*, which takes place in Raleigh, North Carolina, USA, on 20–22 August 2024. North America serves as a hotbed of innovation in technical textiles. Aluula Composites, for instance, is the Canadian developer of a co-polymer bonding process that enables it to fuse fabrics and films together to create laminates without using adhesives, and was initially founded to manufacture strong, lightweight fabrics for the production of kites used in watersports. As John McCurry finds-out (starting on page 15), however, the company is now finding a variety of new and interesting markets for its products.

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On the cover:

The Reifenhäuser Reicofil technology centre houses a seven-beam spunmelt line for trialling new products. Adrian Wilson explores this and other technologies for the manufacture of drylaid and spunmelt nonwovens, starting on page 9.

Aluula Composites was initially founded to manufacture strong, lightweight fabrics for the production of kites used in watersports. As John McCurry finds out (starting on page 15), however, the company is now finding a variety of new and interesting markets for its products.

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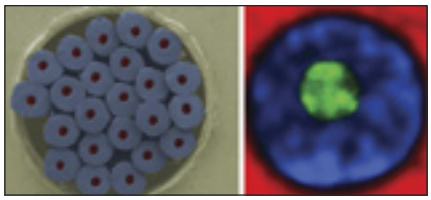
Core-sheath fibres could eanble sutures for controlled drug delivery



Novel polymer fibres with a liquid core can deliver drugs in a targeted manner. The image shows a fibre bundle of approximately one millimetre in width at 80x magnification (left: electron microscopy, coloured; right: Raman microscopy).

Core-sheath fibres that could be used to create sutures, wound dressings and textile implants capable of administering substances into the human body precisely, locally and over extended periods of time are being developed by researchers at Empa in St. Gallen, Switzerland.

The team, at Empa's Advanced Fibers laboratory, say the fibres could also be used to deliver patient-specific dosages of a given liquid substance, including painkillers, antibiotics and insulin. The fibres comprise a sheath of biodegradable and biocompatible polycaprolactone (PCL) that encloses the liquid substance and releases it over time. The stable, flexible fibres are produced using a meltspinning process that the Empa team, working with a Swiss industrial partner, has shown will work on an industrial scale.

The parameters that influence how the fibres release an enclosed agent have been investigated using fluorescent model substances and then with various drugs. Empa researcher Edith Perret says: "Small molecules such as the painkiller ibuprofen, move gradually through the structure of the outer sheath". Larger molecules, by contrast, are released at the two ends of the fibres. Perret adds: "Thanks to a variety of parameters, the properties of the medical fibres can be precisely controlled."

After extensive analyses using fluorescence spectroscopy, X-ray technology and electron microscopy, the researchers have demonstrated, for instance, the influence that the thickness of the sheath and the crystal structure of the material used for its production have on the release rate of drugs from the liquid cores.

Depending on the active ingredient, the manufacturing process can also be adapted. Active ingredients that are insensitive to the high temperatures generated during meltspinning can be integrated directly into the core of the fibres in a continuous process. For temperature-sensitive drugs, the team was able to optimise the process so that a placeholder initially fills the liquid core, before it is replaced by the active ingredient.

The fibres can release active ingredients from a reservoir over extended periods of time. With diameters of 50-200 µm, the fibres are large enough to be woven or knitted into robust textiles, for example, and could also be inserted into the body to deliver hormones such as insulin. Further, the fibres can be refilled and the range of active ingredients that can be administered easily, conveniently and precisely using them is wide.

The researchers now want to use the fibre to make an antimicrobial suture.

See also: *Polymer, Volume 298, Drug delivery with melt-spun liquid-core fibers*, https://doi.org/10.1016/j.polymer.2024.126885

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Multifunctional yarn spun from fibres with novel cross-sections

A spun polyester (PES) yarn that has a soft, gentle feel, fluffiness, is light in weight, absorbs moisture and retains heat has been developed by Teijin Frontier, of Osaka, Japan, for the production of sportswear and outerwear.

Called Octa sf, the yarn is based on an ultra-fine staple variant of Teijin Frontier's Octa PES fibre(1), the cross-section of which consists of eight projections (fins) in a radial pattern around a hollow centre. The fibre can rapidly absorb moisture, such as sweat, as well as providing bulk, and thermal shielding and insulation. The hollow centre helps absorb moisture, keeping the wearer dry, and makes the fibre about half the weight of a solid one of a similar thickness.

The gaps created by the fibre's eight-fin cross-section, combined with the softness of the extremely fine-spun yarn, provide a gentle feel and warmth. The shape of their cross-section, and the large gaps between them, also make it easy to for the staple fibres to be blended with natural fibres, such as wool, and with synthetic fibres, such as lyocell.

Until now, Teijin Frontier says that it has been difficult to develop ultra-fine staple fibre that maintains its hollow eight-fin cross-sectional shape, but it claims to have overcome this problem using a novel spinneret, and by optimising the crimp characteristics and the cut-length of the fibre, and the oils applied to it.

Teijin Frontier will begin selling textiles made from Octa sf yarn for outdoor wear and sportswear in the latter part of 2025. Subsequently, the company will look to expand the application of the yarn in conventional apparel, aiming for sales of 100 000 m in its fiscal year for 2025 and 500 000 m by fiscal 2028.

Electron microscopy of the cross-section of Teijin Frontier's Octa sf blended yarn.

Teijin Frontier is a subsidiary of the Teijin Group of Tokyo, Japan.

See also: (1)*Introducing the Octopus,* https://www.technical-textiles.net/node/49661

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Autoneum launches recyclable monomaterial boot trim element

An easily recyclable, sound-absorbing polyester (PES) side-trim element for the boots (trunks) of vehicles has been launched by Autoneum of Winterthur, Switzerland.

The company says that the side-trim element, based its Propylat PET nonwoven, is stiff, can be produced a wide variety of geometries and has appealing aesthetics. The nonwoven contains 50%-by-weight recycled material. Further, Autoneum claims that the part will help its customers comply with new automotive regulations, such as the revised End-of-Life Vehicles Directive in Europe, as its monomaterial construction should make it simple to recycle. The part can be converted into granules and spun into new fibres.

Off-cuts of material generated during the production of the side-trim element can be reclaimed, processed and reused.

The side-trim element is also available under the Autoneum's Blue brand. Blue products contain at least 30%-by weight recycled polyethylene terephthalate (PET) that is collected from coastal areas.

Autoneum says that this sound-absorbing polyester side-trim element for the boots (trunks) of vehicles is easily recyclable.

Propylat-based boot trim elements are lightweight and sound-absorbing, contributing to the attenuation of tyre and rear electric-motor noise. They are available in Europe, North America and China.

Propylat was originally developed by Bocholt, Germany-based Borgers Automotive, which was acquired by Autoneum in April 2023[1].

See also: [1]*Autoneum completes purchase of Borgers' automotive business*, https://www.technical-textiles.net/node/77118

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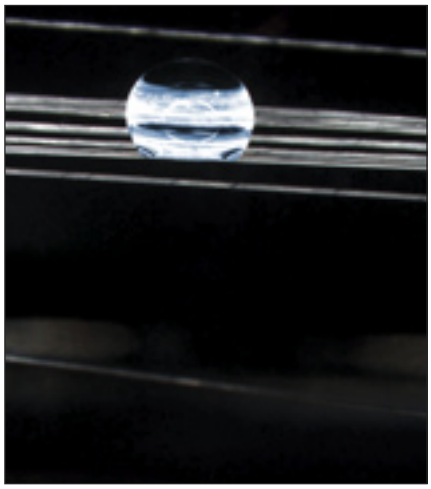
Non-toxic, siloxane-based plasma coating renders fibres hydrophobic



Even when stretched, the plasma-coated fibres, shown here at 30x magnification, repel a water droplet (blue).

A plasma-coating process that can be used to render fibres water-repellent, eliminating the need for perfluoroalkyl and polyfluoroalkyl substances (PFAS), is being developed by researchers in St Gallen, Switzerland.

The researchers report that, in initial laboratory testing, textiles made from the coated fibres absorb less water and dry faster than conventional PFAS-finished fabrics. Further, while the performance of conventional PFAS-based finishes on textiles declines considerably after repeated laundering, the plasma-coated fibres retain their water-repellent properties.

One of the lead researchers on the project at Empa's Advanced Fibers laboratory, Dirk Hegemann[(1)], says: "We use so-called highly cross-linked siloxanes, which create silicone-like layers and – unlike fluorine-containing PFAS – are harmless". Using a plasma-coating system, the siloxanes are atomised and activated in a reactive gas so that they envelop fibres to create a coating of approximately 30 nm in thickness. The resulting fibres can be converted into textiles that are uniformly and consistently hydrophobic. Hegemen says: "We have even succeeded in permanently impregnating more demanding, elastic fibres with the new process, which was previously not possible."

In partnership with Swiss companies Lothos KLG, beag Bäumlin & Ernst AG and AG Cilander (which recently announced its intention to close[(2)]), Hegemann and his team are now working on scaling-up their laboratory process into efficient and economic industrial processes.

The Chief Executive Officer (CEO) of Wattwil-based beag Bäumlin & Ernst, Bernd Schäfer, concludes: "The technology is environmentally friendly and also has interesting economic potential."

See also: [(1)]*Resource-saving reel-to-reel plasma processing of textiles,* https://www.technical-textiles.net/node/338

[(2)]*AG Cilander announces intention to close*, https://www.technical-textiles.net/node/77409

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Non-contact process for applying polyurethane to textiles

A non-contact process that will allow the digital application of polyurethane (PU) to fabrics is to be developed by Alchemie and JSRTEX Group through a UK government-funded project.

The two companies, of Cambridge, UK, and Taipei, Taiwan[(1),] respectively, have received a £742 254 grant from Innovate UK for the project and are looking to eliminate the need for textile-lamination processes. The global laminated-textiles market was worth US$4 billion in 2021 and is forecast to reach US$6.3 billion by 2030.

Alchemie recently launched its Endeavour waterless dyeing system and claims that garment manufacturers who use it can dye their textiles without producing contaminated wastewater, reduce energy consumption by 85% and cut costs by 50% compared with traditional dyeing technologies. The system features digitally controlled piezoelectric nozzles that enable dyes to be applied to fabrics with a high degree of precision. Alchemie recently opened a facility for the demonstration of Endeavour in Nantou, Taiwan[(2)].

Alchemie Technology recently opened a facility for the demonstration of its Endeavour waterless dyeing system, shown here, in Nantou, Taiwan.

See also: [(1)]*Waterless dyeing technology to be demonstrated in Asia*, https://www.technical-textiles.net/node/76611

[(2)]*Demonstration facility for waterless dyeing technology opened in Taiwan*, https://www.technical-textiles.net/node/77446

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Breathable polyester fabric blocks ultraviolet radiation

Teijin Frontier says that this fabric is permeable to air while acting as a barrier to ultraviolet radiation.

A polyester (PES) fabric that is permeable to air while acting as a barrier to ultraviolet (UV) radiation has been developed by Teijin Frontier of Osaka, Japan.

The company says that, until now, these two properties – acting as a barrier to UV radiation and allowing the passage of air – were considered to be mutually exclusive in fabrics.

Inspired by the structure of a traditional Japanese Sudare blind (bamboo blind), which allows wind to pass through it while blocking-out sunlight, the company created a fabric with slit-shaped, highly breathable areas in either its warp or weft directions. These three-dimensional gaps, like those in the bamboo blind, enable the fabric to demonstrate an air-permeability of 50 $cm^{-3}.cm^{-2}.s^{-1}$ while blocking 85% of the UV radiation exposed to its surface.

The fabric is made in part from recycled PES. Its structure and the use of elastic fibres enable it to stretch, while its uneven surface caused by differences in thread shrinkage and its structure help to prevent it from sticking to damp skin.

Teijin Frontier will begin promoting the product for the 2025 spring and summer fashion and casual clothing collections in Japan, and is aiming for sales of 250 000 m in its fiscal year for 2024 and 750 000 m in its fiscal year for 2027.

Teijin Frontier is part of the Teijin Group of Tokyo, Japan.

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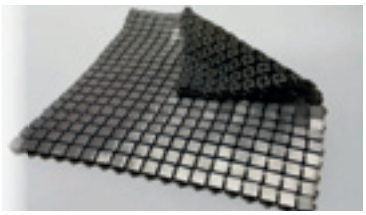
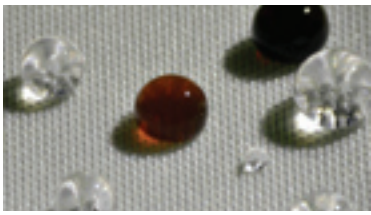

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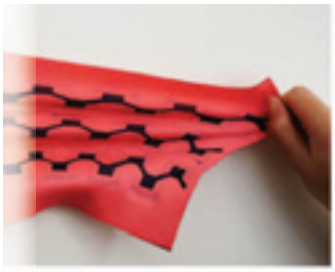


Advances in Textiles technology

February 2022

An international newsletter on textiles technology edited by: James Bakewell

Fibres, filaments and yarns

Artificial silk door-pulls feature on Mercedes-Benz concept car

Novel, sustainable door-pulls made from artificial silk fibre are being used by Mercedes-Benz of Stuttgart, Germany, in its latest concept car, the Vision EQXX.

The carmaker has designed Vision EQXX to highlight ways in which luxury vehicles can be produced using technologies that are more environmentally sustainable than conventional approaches.

The artificial silk fibre is called Biosteel and is produced by AMSilk of Planegg, Germany. The company says that the fibres are biodegradable and recyclable, and no waste is generated during their manufacture. It adds that Biosteel demonstrates mechanical properties

The door pulls for the Vision EQXX concept car from Mercedes-Benz are made from Biosteel artificial silk fibres.

Highlights this month: full contents listing on page 2...

Methods for determining the effects of strains and stresses on carbon nanotube fibres are being developed by researchers at Rice University 2

A single vented tumble dryer can discharge up to 120 million microfibres into the air each year, according to a pilot study 5

A range of durable fabrics made from pre-consumer recycled polyamide (PA) 66 fibres has been launched by Invista through its Cordura brand 3

A fibre-laying process that enables the efficient production of composite footplates and toe caps for use in footwear has been launched by Coats 7

A dual-action thermoregulating finish that reduces the temperature of surfaces to which it is applied by up to 3°C has been launched by HeiQ 4

A long, fibre-based lithium-ion battery that could be woven into fabrics is being developed by researchers at the Massachusetts Institute of Technology 10

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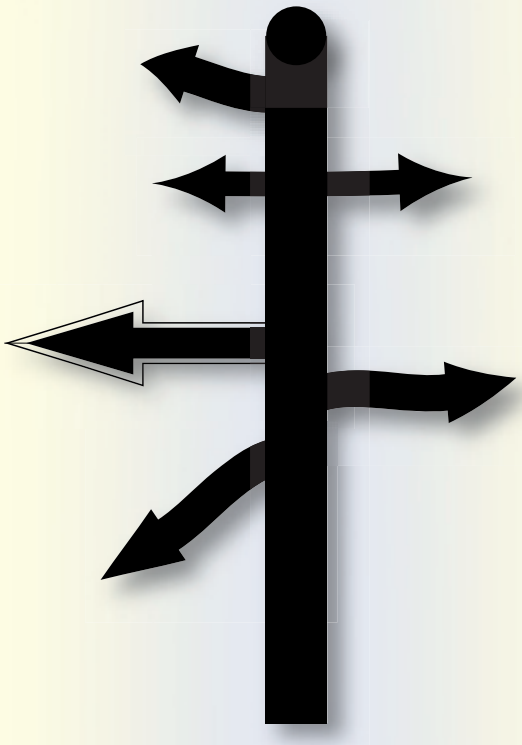

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