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WSA

PERFORMANCE & SPORTS MATERIALS



Chemicals complicate textile waste

Joined-up thinking on smart textiles

Pandemic propels progress on sustainability

Dialogue: Cindy McNaull on recycled nylon

THE INTERNATIONAL MAGAZINE FOR PERFORMANCE & SPORTS MATERIALS

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Slovenian brand Elan — one of a number of European companies that worked hard in the build-up to the 2022 Winter Olympics to establish themselves in China's winter sports market.
IMAGE: ELAN SKIS

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Global news

Belgium European textiles industry association Euratex has called on the European Commission and member states to urgently support the industry to avoid company closures due to energy price rises. As there are few alternatives to gas in manufacturing, production costs are increasing sharply. Euratex has presented requirements to Kadri Simson, European Commissioner for Energy.

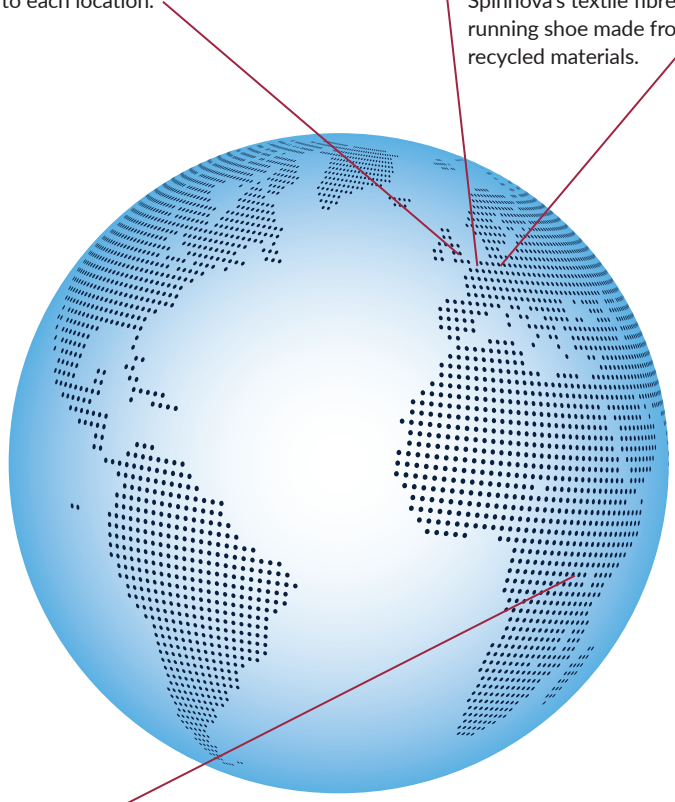
Switzerland Geneva-based Better Cotton (BC), which campaigns for increased production and consumption of more sustainable or "better cotton", has launched a new strategy, setting a target of reducing by 50% the greenhouse gas emissions of better cotton by 2030. Further targets will address pesticide use, women's empowerment, soil health and the livelihoods of people in small rural communities.

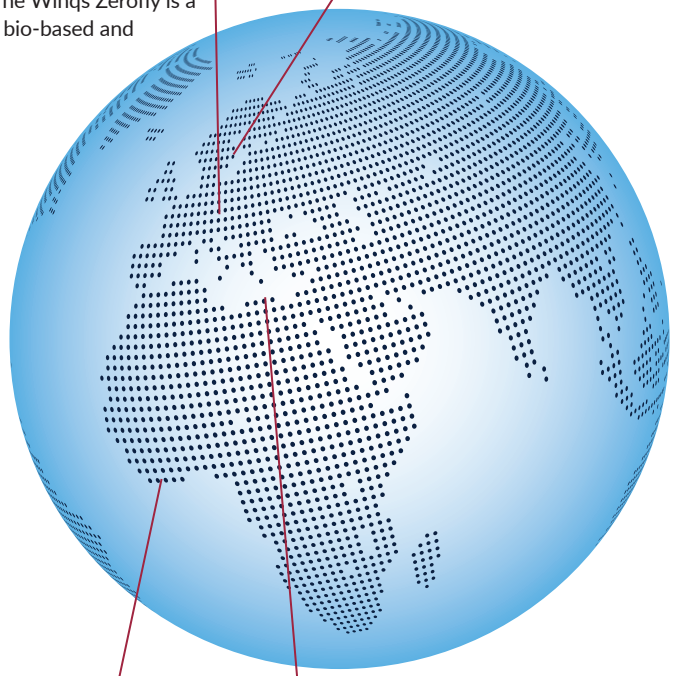
• The European Outdoor Group (EOG) has said the fact that brands use mutual suppliers is helping its Supply Chain Decarbonisation Project (SCDP) as it reduces the number of facility audits. After auditing, companies – including Amer Sports, Burton, Deuter, Fenix Outdoor, Gore-Tex, Haglöfs - will jointly financing facility improvements.

UK New Zealand-based traceability technology provider Oritain has agreed a partnership with British Wool, a collective owned by around 35,000 sheep farmers across the UK. Oritain's method combines forensic science to detect naturally occurring elements in fibres, including wool. Soil composition and other environmental factors give the fibre an inherent 'fingerprint' specific to each location.

Germany The first winners of the ISPO Award have been announced, as part of a new concept. From now on, the sports industry award will be decided and presented year round. Patagonia used the first PFC-free Gore-Tex membrane for its Storm Shift Jacket. Scott Sports processed the frames of old goggles into new frames. The Loska Spinnova ski by PUSU reinforces a solid wood core with Spinnova's textile fibre. The Winqs Zerofly is a running shoe made from bio-based and recycled materials.

Sweden Antimicrobial maker Polygiene is launching 100% natural technology derived from Swedish sand. OdorCrunch is being adopted by brands including Diesel, Mos Mosh and Everbasics. It contains silica, the main ingredient in sand. The technology encapsulates the odour molecules and cracks them, removing the odour, the company stated.





Egypt Applied DNA Sciences, a provider of DNA-based tracking for fibres, has announced "forensic proof of cotton authenticity and provenance specifically related to regional cotton varietal". The programme has identified a biomarker specific to Giza 94, the largest planted Egyptian cotton varietal. It is working to bring the same level of fidelity to cotton from the US, India, Australia and China.

Rwanda A Rwandan shoe company that uses recycled car tyres as a raw material has been chosen as a winner of the third Tommy Hilfiger Fashion Frontier Challenge. More than 430 start-ups and small companies from 22 countries submitted their ideas. The winners will share a prize fund and receive a year-long mentorship with experts from Tommy Hilfiger and from graduate business school INSEAD. Shoe company Uzuri K&Y was awarded €100,000.

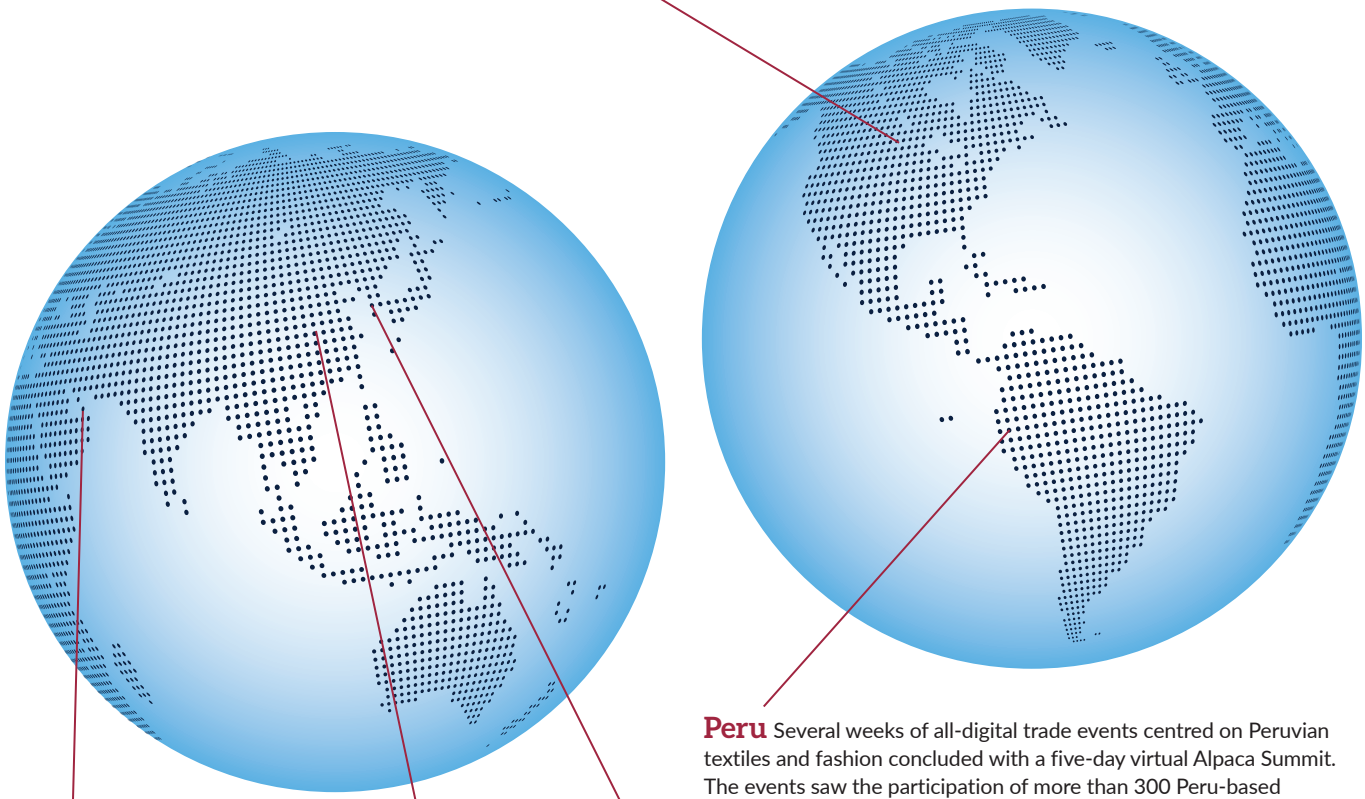
Africa Due to the evolving nature of the 10-year partnership between Aid by Trade Foundation, the Hamburg-based body which administers the Cotton made in Africa (CmiA) standard, and Better Cotton (formerly known as the Better Cotton Initiative or BCI), the sale of CmiA-verified cotton as Better Cotton will end at the close of this year. The parties said the "new form of cooperation" would create space for greater flexibility and result in joint projects for smallholder farmers in Africa.

Ghana The not-for-profit organisation Biomimicry Institute has been awarded €2.5 million to lead a multi-year initiative called Design for Decomposition. Together with Laudes Foundation, Hong Kong Research Institute of Textiles and Apparel (HKRITA), Yale Center for Green Chemistry and Green Engineering, Metabolic Institute, The OR Foundation, and Celery Design, the Biomimicry Institute will pilot technologies that convert wasted clothes and textiles into biocompatible raw materials. It will host pilots in Western Europe and Ghana.

US The US-based Conservation Alliance and Outdoor Alliance have expressed disappointment in the Utah state governor's litigation to undermine Grand Staircase Escalante and Bears Ears National Monuments. In 2017, the twice-yearly Outdoor Retailer left Utah in protest against demands by Utah's officials to roll back the National Monument designations. With the show's contract in Denver set to expire in 2022, organisers have been considering moving back to Salt Lake City. However, industry leaders learned that Governor Cox and other Utah officials are planning to challenge the monument designations, which were reinstated by President Biden in October 2021.

• US-based brand Gore-Tex has moved into rental at 15 mountain resort and retail locations across North America. Conceptualised as "on-demand" outerwear, Gore said its rental experience would help all winter sports enthusiasts take to the mountain "in the best possible, highest performing gear".

• Clothing brand Ralph Lauren has unveiled an insulation that adapts to cooler temperatures by expanding and creating a layer of insulation and was used by Team USA for the Olympics Winter Games opening ceremonies. The Intelligent Insulation uses two materials that expand or contract at different rates. The technology was developed by Portland-based textile start-up Skyscrape.



Peru Several weeks of all-digital trade events centred on Peruvian textiles and fashion concluded with a five-day virtual Alpaca Summit. The events saw the participation of more than 300 Peru-based enterprises dealing in footwear and apparel, plus cotton and alpaca fibres. Buyers from Speedo and Christian Dior were reportedly among those in attendance.

Dubai Athletic footwear brand Asics launched a special edition of its Gel-Kayanotm running shoe to mark the fifth edition of an event called the Dubai Fitness Challenge. Asics said it hoped the the shoe would help the city's authorities in their bid to encourage its residents to become more active. Specifically, they have asked all citizens to complete 30 minutes of physical activity every day.

South Korea South Korean multinational Samsung is working with outdoor brand Patagonia on a new kind of washing machine to address the perceived need to stem the tide of microplastics. Patagonia's director of philosophy, Vincent Stanley, highlighted microplastics shed from the brand's fleece jackets as a particular area of concern.

• South Korean lifestyle brand Jaju has secured an exclusive supply of Cotton made in Africa (CmiA), effectively becoming the fibre's sole Asian licensee. Reports said that Jaju plans to replace more than 70% of its lines with "sustainable" products by 2025 through gradually increasing its use of more environmentally friendly, recycled and deadstock fabrics.

China The Chinese government has published another five-year development plan for accelerating several industries' "green upgrades", inclusive of textiles. Highlights include promoting the recycling of renewable resources such as textile waste, strengthening water-saving standards and establishing an industrial water-saving model. The plan proposes the implementation of low-liquor ratio dyeing, non-polyvinyl alcohol (PVA) sizing in weaving, green pulping of regenerated cellulose fibres and supercritical carbon dioxide ($scCO_2$) dyeing.

• Chinese apparel manufacturer Fengcheng Ruiwo'Er Garment has developed its own line of "high-end" ski suits under the brand name River. Beyond the use of unspecified "lightweight, wear-resistant, tear-resistant and high-tech fabrics", the range is differentiated by the company's use of natural tussah silk for the articles' lining and filler.

People

TNF names global brand successor


CREDIT: THE NORTH FACE

Outdoor brand The North Face (TNF) has named **Nicole Otto** as its global brand president; she will take up the role in June.

Ms Otto will join from Nike, where she had worked for 16 years before leaving last May.

Steve Rendle, CEO of TNF's parent group VF Corporation, said: "Nicole is the right leader who brings the right capabilities to The North Face brand at the right time.

"Her global industry experience and deep understanding of consumer engagement strategies – through physical retail and digital commerce – make her ideally suited to take the helm of this iconic brand and accelerate growth through even more compelling direct connections with consumers worldwide."

She will succeed **Steve Murray**, who is retiring. Mr Murray became global brand president of TNF in September 2020, having previously been executive vice-president and group president for VF's Americas region and, earlier, president of the group's action sports coalition and global brand president of Vans.

Changes to the team running ISPO events

Exhibition organiser Messe München has announced a reorganisation of the team that runs the ISPO group of events.

It announced towards the end of last year that, from now on, ISPO Munich will run in November each year, with OutDoor by ISPO running at the end of May or beginning of June.

It has now said that **Tobias Gröber**, who used to be a director of the ISPO Group but moved to become head of Messe München's consumer goods business unit, will return as head of the ISPO Group. He will run the ISPO shows in parallel with his corporate role.

Lena Haushofer will work with him as project director. Ms Haushofer has worked at Messe München since 2011 but said that, as a keen ultra-trail runner, she looked forward to contributing her passion for sport as well as her professional experience.

"We have laid the foundation for realigning ISPO and hence for a successful future," said Messe München's chief executive, **Klaus Dittrich**.

Garmon Chemicals names new president

San Marino-headquartered Garmon Chemicals, a fashion-focused chemicals manufacturer owned by Kemin Textile Auxiliaries, has appointed **Valter Dompè** as president.

Mr Dompè has been serving in his new role since January 1, when he replaced **Kimberly Nelson**, a third-generation member of the Nelson family. The Nelsons founded Kemin Textile Auxiliaries' parent, Kemin Industries, in the mid-twentieth century and it remains a family owned and operated business.

He has joined Garmon Chemicals after moving over from Kemin Food Technologies (Europe, Middle East and Africa), where he had worked since 2015 following around 25 years in sales, marketing, operations, personnel and finance management for L'Oréal.

"I'm ready and excited for this new challenge in textile auxiliaries, which merges strong technical requirements with a great attention to the fashion and style side," Mr Dompè said. "Thanks to the experience achieved in both areas during my career, I'm ready to contribute to reaching Kemin Textile Auxiliaries' ambitious goals."

350m Chinese engaged in winter sports

According to China's National Bureau of Statistics (NBS), the country's efforts to encourage its population of 1.4 billion people to participate in winter sports have been a success.

More than 346 million Chinese people have now engaged in winter sporting activities since Beijing was chosen in 2015 to host the 2022 Winter Olympics, NBS said, soaring well past the government's initial target of 300 million people. Around 37.3% of winter sports participants were aged between 18 and 30.

According to NBS' data, the vast majority of the 346 million people who said that they had engaged in these activities were from east China (143 million individuals), followed by residents of west China (84 million), central China (68 million) and, lastly, north-easterners (51 million).
The number of ski resorts (indoor and outdoor) in the country also increased from 568 in 2015 to 803 today.

Staff shuffles at Nilit

Nylon 6.6 maker Nilit has announced **Sagee Aran** will lead product development and commercialisation and **Michelle Lea** has joined the company to head marketing. **Ilan Melamed**, general manager of Nilit, said: "With this new management structure, Nilit will more rapidly develop and implement sustainable premium nylon innovations that appeal to today's growing segment of conscious apparel consumers." The Israeli company is working on a nylon that integrates renewable non-fossil biomaterials made from post-consumer waste and is working with several brands to introduce the development.

Inov-8 hires for France

UK-based footwear brand inov-8 has set big growth ambitions for France after adding the country to its portfolio of European direct markets. The brand has appointed **Emmanuel Fedon**, known as Manu, as its sales manager for the country. Mr Fedon lives in Annecy and brings two decades of sports industry experience to the role. He previously worked for Asics and most recently enjoyed a hugely successful five years as commercial director for On Running in France

Wake-up call on textile skills challenge

A total of 118 organisations have signed a new Pact for Skills that Europe's main representative bodies for textiles, clothing, leather and footwear have drawn up.

As part of an initiative promoted by the European Commission and by the umbrella organisations for textiles, clothing, leather and footwear in Europe, the pact calls for recognition of a "skills challenge" in these industries, and for a commitment to addressing this.

Industry bodies involved are EURATEX for textiles and clothing, COTANCE for leather and CEC for footwear. They want companies throughout Europe to address the issue by investing in reskilling and upskilling workers, integrating green and digital skills and improving the attractiveness of their industries to potential new employees.

Employers, social partners, national and regional authorities, plus education and training providers will all be involved in fulfilling these ambitions. Benefits that signatories to the pact will receive include networking, guidance and resources offered by the European Commission; this assistance should become available in the early part of this year.

"EURATEX is proud to coordinate this initiative" said the organisation's president, **Alberto Paccanelli**. "Our companies' success is based on finding the right people with the right set of skills. This is becoming increasingly difficult, so this pact is a wake-up call to work together and develop a forward-looking strategy that puts people at the heart of our sector."

Teijin promotes for top role

High-performance materials developer Teijin has announced CEO **Jun Suzuki** will leave the role on April 1 to become chairman. He will assume the role of chairman of the group. The new chief executive will be **Akimoto Uchikawa**, who is currently president of the group's materials business. Mr Uchikawa joined the group in 1990 and worked in senior roles in the high-performance fibres business unit before becoming the general manager of its composites business unit in 2020 and president of its materials business in April 2021.

Puma combines US workforce

Germany-based sportswear brand Puma has brought together 450 employees from two former offices in Boston and Westford, Massachusetts, in a new location in Somerville. The new US headquarters features 150,000 square feet of office space, a roof deck, art installations and a fitness centre. **Bob Philion**, president of Puma North America, said: "We focused on creating a space that reflects our 'Forever Faster' mentality. We put creativity and innovation at the forefront, bringing together our entire North American team to collaborate and propel our brand forward."

Haglöfs makes HR appointment

Swedish outdoor brand Haglöfs has appointed **Frida Vingård** as its new human resources director. Haglöfs said it is "on an expansion journey" and is experiencing strong growth in the global market. It has made investments in product development, brand, design, and sustainability over the last couple of years to adapt to a changing consumer landscape. It currently has a team of more than 200.

brrr°

brrr° Introduces Cationic Dyed Polyester Heathered Yarn

Cooling yarn innovator brrr°® has developed a new cationic dyed (CD) polyester yarn that can be single dyed or double dyed to achieve a true heathered and/or solid look for increased flexibility in designing fabrics made with brrr° yarns. brrr°'s new CD polyester yarn can be piece dyed or yarn dyed in any color to get a genuine cationic dyed heathered appearance or a solid color look in the finished product.

As with all brrr° products, the new brrr° CD polyester yarn has been independently lab tested by globally recognized third parties to prove that it outperforms other cooling brands in the market.

brrr° offers brrr° polyester and brrr° nylon yarns, as well as a library of fabrics with an array of natural rich blends and synthetic rich compositions such as cotton, wool, nylon and other materials used to achieve specific attributes in textiles.

To learn more you can email licensing@brrr.com

brrr.com

Industry & Innovation

Gore promises more recycled laminates



CREDIT: W L GORE

The Gore Fabrics Division has gained Global Recycled Standard (GRS) certification in both of its manufacturing sites, in Shenzhen, China and Putzbrunn, Germany.

GRS is an international standard that sets requirements for third-party certification of recycled content, social and environmental practices, chemical restrictions and chain of custody.

It describes the certification as a milestone in its efforts to reduce the environmental footprint of providing high performance products.

Originally the GRS was developed by Control Union Certifications in 2008 and ownership was passed to Textile Exchange in 2011. The GRS is intended for use with any product that contains at least 20% GRS certified recycled material; final products carrying the GRS logo must contain at least 50% GRS certified recycled material.

Thomas Kiebler, global application engineer leader at W. L. Gore & Associates, said: "After having successfully obtained the GRS certification, we are now embedding the processes and requirements into our existing management system to ensure we maintain the certification and will continuously improve our performance."

Gore adapted its production and warehouse set-up which allows the separation of GRS from non-GRS certified goods as required by the standard.

By mid-2022, Gore plans to introduce GRS certified laminates to its customers on both the consumer business side and in the Gore-Tex Professional Workwear business. Adaptations of the IT systems will be needed to allow Gore to issue product-related certifications, known as 'transaction certificates,' to customers and buyers.

Mr Kiebler added: "We will introduce a more holistic portfolio management for our GRS certified laminates so that we can continually expand our offering to customers and buyers. We will initially start with a small number of laminates of our Gore Fabrics portfolio, but we will work with our suppliers and manufacturing sites to certify all laminates with recycled textiles according to GRS in the future."

Black pigments from waste tested for dope dyeing

A pilot programme seeks to further develop and scale waste-derived black pigments for the dope dyeing of manmade cellulosic fibres (MMCFs) and recycled polyethylene terephthalate (rPET) yarns.

Bringing together global partners such as supply chain initiative Fashion for Good, fashion groups Kering and PVH, plus MMCF producer Birla Cellulose, manufacturer Paradise Textiles and eco-minded disruptors Graviky Labs, Living Ink and Nature Coatings, the project will focus on testing black pigments from industrial carbon emissions, waste algae and wood waste.

The three latter firms' technologies, which have previously achieved black pigments from waste feedstocks, have thus far only been harnessed for printing applications, Fashion for Good said. Birla and Paradise will support these start-ups with their respective technical expertise relating to dope dyed MMCFs and both "sustainable" and performance fabrics, it continued. (Paradise will focus on rPET yarns.)

The first phase of the pilot is scheduled to run until mid-2022, during which time the collaborators will have the opportunity to evaluate the viability of the pigments' performance, colour fastness, wearability and impact, following Birla and Paradise's dope-dyeing of the fibres and yarns for which they will respectively be responsible.

Water-soluble threads

UK threadmaker Coats has launched EcoCycle, a circularity-minded line of water-soluble threads designed to dissolve at 95°C in an industrial washing machine. The idea is that washed articles may then be disassembled more speedily by simply being pulled apart before being sorted for recycling. It highlighted the need for brands to "build in the right threads" at the beginning of the design stage, if they are serious about helping to facilitate a circular economy.

Partially plant-based

Textiles chemicals group Archroma has developed a textile softener with one-third plant-based active content. The Earth Soft system is based on Siligen EH1, joining plant-based innovations EarthColors dyes and Appretan NTR binders, for manufacturers and brands looking to reduce the use of fossil fuel-based ingredients. The Earth Soft system, which also includes its Hydroperm wicking agent to boost hydrophilic properties on synthetic and blended fibres, can be applied on natural and synthetic textile fibres, woven or knitted.

Fulgar offers recycled nylon 6.6

Q-Cycle, a post-consumer recycled polyamide 6.6 yarn, is the result of a tie-up between German chemicals group BASF – specifically, its ChemCycling recycling initiative – and Italian fibre producer Fulgar, which will sell the product. The latter party said the new yarn offers buyers functional and aesthetic benefits (such as lightness, strength and resistance) equal to those of conventional polyamide, "but in a greener form". It added that Q-Cycle has "excellent" moisture absorption properties and that fabrics made with the yarn demonstrate a similar solidity level as virgin polyamide when processed with conventional dyeing and production methods.

Toray's plant-based nylon

Toray has developed a nylon 510 (N510) fibre that incorporates 100% biobased synthetic polymer content. It will add the N510 fibre to its Ecodear range. The Japanese group said fabrics for sports and outdoor would be the primary applications for the product. It will be able to make 3 tonnes of this fabric per month by March 2024.

After this, all successful formulations will be trialled in larger production runs where fabrics will be dyed, Fashion for Good added. Notably, test variables including affinity, colour and light fastness, as well as the tensile strength of the fibres and yarns, will be measured against dope dyeing with industry standard synthetic yarns at this stage.

Passed formulations will then be progressed from pilot to textile production, with the partners' long-term objective being to have all successful technologies reach a commercially ready scale for ultimate integration in the textile and apparel value chain.

Katrin Ley, managing director at Fashion for Good, commented: "We are very excited to be able to support this first-of-its-kind collaborative pilot aiming to validate three technologies that will enable the industry to switch to more sustainable (black) dye chemistry."

Green Machine able to separate blends

A consortium of international partners has joined hands to investigate the industrial scale feasibility of what is being called The Green Machine, a recycling technology with proven capability to separate cotton from polyester in blended fabrics, in Cambodia.

Led by German development agency GIZ, other named partners include the Hong Kong Research Institute of Textiles and Apparel (HKRITA), VF Corporation, H&M Foundation, joint Thai-Cambodian construction venture Chip Mong Insee and Hong Kong automation company Dakota Industrial. The HKRITA-developed machine's technological achievements were described by VF as world leading.

Essentially a hydrothermal treatment method which uses only heat, water and biodegradable chemicals (kept to less than 15% of the total recipe), the technology is able to selectively separate cotton from polyester, the group states, while still maintaining the quality of the polyester fibres. This is intended to enable fibre-to-fibre recycling, which will in turn generate a closed recycling loop as a result, effectively "eliminating" waste.

VF-owned brand The North Face (TNF) will test the machine this year.

Bio-HMDA for nylon 6.6

Biobased chemicals firm Genomatica, in collaboration with polymer producer Covestro, has announced a plant-based version of the chemical raw material hexamethylenediamine (HMDA). Typically made from extractive fossil feedstocks, HMDA is a key ingredient in the manufacturing of nylon 6.6. Both parties said they were the first to have produced the so-called bio-HMDA in significant volumes, adding that their version is "of high purity and quality".

Recyclable TPU

Specialty chemicals developer Huntsman has announced a thermoplastic polyurethane (TPU) that is fully recyclable. The new product, a special grade of its Irogran TPU, is also UV-protected and can be extruded into a film for expansion into foamed sheets. Huntsman worked on the project with the Shincell New Material Company, a specialist developer of lightweight, high-performance polymer foams, set up in 2019 in China's Jiangsu province. Shincell will use the new material to create foam sheets for use in insole, midsole and forepart insert applications.



Backtrack

Limitations on space make it impossible for us to run more than a carefully selected sample of industry news in *WSA*. However, we publish hundreds more stories on www.sportstextiles.com, one of the most comprehensive archives of news anywhere on the web for textiles, apparel, footwear and equipment for sports and outdoor. Below are just some of the headlines that have appeared on the site in recent weeks.

10.02.2022

ISPO provides push for innovation, 3M states

Competitors collaborate to boost avalanche safety

Gore-Tex makes mountain gear rental strides

09.02.2022

Fruit-based textiles take a new turn

08.02.2022

Fabric makers seize chance to shine at Premiere Vision

OR names Innovation Awards winners

07.02.2022

Record figures for Columbia Sportswear in 2021

Further move into lingerie for Calida

Down jackets make a splash at Beijing 2022

04.02.2022

GTT's water repellent finishes classed PFOA/PFOS-free

Ventile's plastic-free performance key for Mover

03.02.2022

Award worth €5000 up for grabs from Lenzing

Vaude harnesses 3D printing for recyclable mono-material pack

Adidas launches 'biggest commitment to women'

02.02.2022

Two outdoor companies move into employee ownership

Regenerative agriculture report offers 'toolkit' for brands

01.02.2022

Nike outlines operating updates

Technical textiles steal the show in Ternua's Protech line

31.01.2022

WFSGI emerges strongly from 2021

Thousands of new jobs at adidas

Andar launches premium line in South Korea

28.01.2022

Sneakers with plant-based soles set for big launch

Cordura cleans up at textiles awards

VF's third-quarter revenues rise 22%

27.01.2022

HD Wool supplies ISPO winner's 'from farm to Finisterre' ID

Tencel celebrates 30 years of fibre innovation

26.01.2022

Catch-up in textile machinery demand, Rieter says

Companies call for international treaty on plastic pollution

25.01.2022

Supply chain certification offers peace of mind, Unifi says

Chinese supplier launches tussah silk ski line

24.01.2022

Innovations on show from Huntsman in Medellín

Used sports shoes wanted

Footwear group announces investment plan

21.01.2022

Grants available to let start-ups take part in ITMA 2023

Ralph Lauren selects Intelligent Insulation for athletes

Osprey focuses on materials for. reduced impact

20.01.2022

Lycra celebrates Foshan's Higg score

Skims heads to Beijing with Team USA

19.01.2022

Carbios factory announcement only weeks away

Children's focus groups inspire Nike strategy

Cifra boosts green commitment

18.01.2022

Eastman to build $1bn plastics recycling facility

Wet-to-dry project aims to slash emissions and water use

Säntis: 'step change' in recycled fibre demand

17.01.2022

UN Global Compact a natural step for Spinnova

Stores remain core for Arc'teryx

NexTex offers Outdoor Retailer preview

Goldwin opens first Chinese flagship

14.01.2022

Hohenstein partners Texbase to improve workflow

Ralph Lauren unveils first polo with NFW technology

13.01.2022

Cordura launches recycled nylon 6.6 as part of new platform

Footwear group creates impact 'guide' role

Coats offers increased precision for shoe components

Anta picks Donghua as latest research partner

12.01.2022

Biodegradability attracts Pressio to Biofuze yarn

ITC endorses US Cotton Trust Protocol

Origin and Mitsui aim to 'industrialise' carbon negative materials.

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Hazardous chemicals in textile waste has slipped under the radar for many promoters of a circular economy. A study into this issue finds risk to be low, but real. It brings to light the need for more research and increased traceability, but also brings into question the evolution of standards, and may introduce a new snag in the possibility of closing the loop.



Unwanted legacy: chemicals in textile waste

There are known barriers to closed-loop recycling of fibres into fibres. There is, for one, the low cost of virgin raw materials. Secondly, there is a lack of infrastructure for large-scale sorting and pre-processing of textile waste, despite progress in mechanical recycling. A third stumbling block is the possible presence of hazardous chemicals in material intended for a second life.

This known unknown inspired H&M Group and Ikea to launch a study on the presence of hazardous chemicals in used textiles. This is a necessary step if they are to meet their stated goal to use 100% recycled or sustainably sourced materials by 2030. The findings of this research project, begun in 2019 and expanded in 2020 with a new set of industry partners, will be used to create a databank that will be shared within the industry and with legislators.

The study tested three fibres, cotton, wool and polyester, from samples collected in Europe, the US and Asia. For the most part, the thousands of tests conducted showed that no regulated substances were found to exceed accepted limits, based on the restricted substances list (RSL) of the Apparel and Footwear International RSL Management (AFIRM) group, a widely recognised resource. Of the 172 cotton samples, 99.97% passed and in 98.23% of the samples, no restricted substances were detected. Harmful chemicals were found to be above accepted limits in eight instances out of a total of 24,700 analyses.

For polyester, 99.3% of 169 samples passed. For this fibre, 85 substances were found to be above accepted RSL limits. Of 154 wool samples, 98.5% passed. Here, however, 216 tests found levels to be above accepted limits. In 145 instances, NPEOs (Nonylphenol and Nonylphenol ethoxylate) were found to exceed RSL limits. "Although the overall fail rate was low, the failures were spread over many samples," say Negin Farhadi, H&M's project manager for recycled textiles, and Mirjam Luc, project leader for recycled textiles at IKEA.

At first glance, these results could be considered reassuring. In the vast majority of samples, no restricted substance was detected, and any that were present remained under

Textile waste was first shredded before undergoing tests in the H&M and Ikea project

CREDIT: IKEA SWEDEN

accepted limits. However, the report confirms that textile waste can be tainted by chemicals of concern. Formaldehyde showed up in many wool samples, the APEO is a group of surfactants (covering NPEOs and OPEOs) and heavy metals were found across all three types of fibre. The enduring presence of APEOs, used in detergents, scouring or wetting agents, dye-dispersing agents and spinning oils, could be problematic. "Nonylphenol ethoxylates, or NPEs, pose no risk to consumers of apparel and footwear, but they degrade into nonylphenol (NP) in wastewater systems and in the environment," says AFIRM's director Nathaniel Sponsler. NP is considered persistent in the aquatic environment, moderately bio-accumulative, and extremely toxic to aquatic organisms. Legislation around the world restricts the presence of APEOs in finished goods.

How and why they turn up is an open question. Their presence may not be intentional. The precise formulation of chemicals used in the textile and apparel industry is not always known. A harmless substance may become harmful in some conditions. It is also possible that the textile waste comes from clothes made at a time when there were fewer restrictions.

The H&M and Ikea project confirms that this issue needs to be addressed. "Any chemicals hampering recycling and material recovery should be restricted," insist the study leads. The findings, they say, will be used to establish "an acknowledged and harmonised hazard assessment methodology for chemicals used in production".

Few companies have the means to conduct tests on the scale of the H&M and Ikea study. French sports retailer Decathlon spends €10 million every year to check that its products are safe for consumers, workers and the environment, said Maxence Dubus, chemical safety manager, at a recent conference, organised by the French National Institute for Industrial Environment and Risks (Ineris), on hazardous chemicals in textiles. The retailer says it now uses BHive, a chemical scanning tool and app developed by GoBlu International, to monitor the presence of chemicals in its goods.

Safety, an ever-evolving notion

Among its findings, the study brings to light the evolution of chemicals regulation policies. "The number of restrictions for chemicals has grown from only one in 2014 to over 5,000 in 2022," said Carole Mislin, Archroma's head of global product stewardship, speaking at the same Ineris conference.

The definition of what is safe keeps changing, says AFIRM group director Nathaniel Sponsler. "A substance that was perfectly legal a few years ago may become illegal at a later date, or the residual amount allowed in a product may be substantially decreased by new regulation. This means that a material manufactured today may face stricter rules later that would not allow its use in new products."

The EU is in the process of potentially adding over 1,000 new restrictions, of which 20% are thought to be relevant to the apparel and footwear industries, says Mr Sponsler. "Some of the new guidelines bring allowed levels down to parts per *billion* (ppb)." These difficult-to-detect trace amounts could have an impact on the recyclability of used textiles.



A collaborative study led by H&M and Ikea on the presence of harmful chemicals in textile waste has revived an issue that some recyclers have been flagging for years.

CREDIT: IKEA SWEDEN

> **"Any chemicals hampering recycling and material recovery should be restricted"**
>
> NEGIN FARHADI, H&M, AND MIRJAM LUC, IKEA

As new data emerges on the presence of hazardous chemicals in used textiles, new questions will emerge. "It may be possible to wash out some of the unwanted, or now illegal, chemicals. But that may require a lot of water, energy and additional chemicals, and may not be sustainable," says Mr Sponsler. This situation raises another set of questions. "Should specific rules be set for recycled content? A separate RSL could be developed for recycled materials, but would it meet basic market requirements?" he asks.

Textiles are not the only source of concern, as polyester recycled from post-consumer PET bottles has been found to contain trace amounts of Bisphenol A (BPA). "All possible sources are being investigated, but early indications are that it could come from polycarbonate bottles mixed in with PET plastics," says Mr Sponsler. If that were the case, it would be necessary to implement finer sorting processes to keep polycarbonate bottles out of PET feedstock or treat the solution to filter out the BPA. "We are learning as we go," he says.

Chemsec, like AFIRM, was consulted by the Ikea and H&M research team. "Chemsec reviewed the findings, and we commend it as a great example of collaboration for good. There is a huge lack of information on recycled textiles, and this is an attempt to fill that gap," says Chemsec senior policy advisor, Theresa Kjell. The environmental NGO, based in Sweden, advocates for the removal of hazardous substances from consumer goods.



A collecting and sorting facility for post-consumer textile waste run by Le Relais, a French charity.

CREDIT: LE RELAIS

"I was surprised that the results were so good for cotton. This issue of chemicals in waste textiles is not problem-free, but slightly better than expected," she says. Azo dyes, for instance, did not show up. "This confirms that regulations have an impact."

> **"This issue of chemicals in waste textiles is not problem-free, but slightly better than expected"**
>
> THERESA KJELL, CHEMSEC

Tracing chemicals

The data provided by H&M and Ikea makes clear the need for more information on chemicals used in the textile industry. In addition to providing recyclers with the go-ahead to recycle identified waste, it could also increase the value of used textiles, says Ms Kjell.

Traceability systems currently tend to focus on tracking fibres throughout the supply chain. Few include data on chemicals.

Toxnot, a company founded in 2016 and based in Fort Collins, Colorado, has chosen to include chemicals in its software platform. It compiles data to create a material passport for the textiles used in apparel, furniture and architecture for companies seeking to address compliance, sustainability and circularity goals. The advantage of software over a paper-trail is that "there is no limit to the possibilities of software, whereas there is only so much room on a paper trail," says Peter Girard, CEO and founder of Toxnot. "Brands try to do good, and we are working with them to achieve this. But the industry does not have the tools to screen chemicals used to make their products. We are filling a gap," he says.

In circularity, he says, there has been a lot of focus on recycling and not much on chemistry. To support the addition of sensitive data to its traceability platform, Toxnot allows companies to make 'blind' information they do not want to share if they feel this is necessary to protect intellectual property. They can decide what data will be made available to whom. Recyclers may be given access to information on chemicals that would otherwise be restricted.

How toxic is textile waste?

For those engaged in promoting circularity and mechanical recycling of textile waste, the presence of hazardous chemicals is, unsurprisingly, a cause for concern. But so are the escalating quantities of unwanted clothes, which have possibly been worn and washed for years before being discarded. "This is clearly an important issue. Yet, we need to recognise that we collectively produce a tremendous amount of post-consumer material. In my mind, it is better to recycle it than send it to landfill," says Accelerating Circularity founder Karla Magruder. This point of view may well be shared by the many companies specialising in the reuse, resale or rental of secondhand clothes. These are not known to be subject to chemical testing or to any specific standards.

"The Ikea and H&M study shows that the risk profile is not so high for post-consumer cotton textile waste as maybe originally thought," says Helene Smits, chief sustainability officer for Recover. A global producer of mechanically recycled cotton, Recover was founded by 70-year-old Spanish spinner Hilaturas Ferré and spun off as an independent entity that US private equity firm Story3 acquired in late 2020.

The company recycles cotton textile waste into fibres that it sells to spinners, who most often blend the recycled material with other sustainable fibres. "Our products are all certified Oekotex 100 class 1. We test them at 100% concentration level, meaning 100% recycled content, to guarantee they do not exceed accepted levels of detection," says Ms Smits.

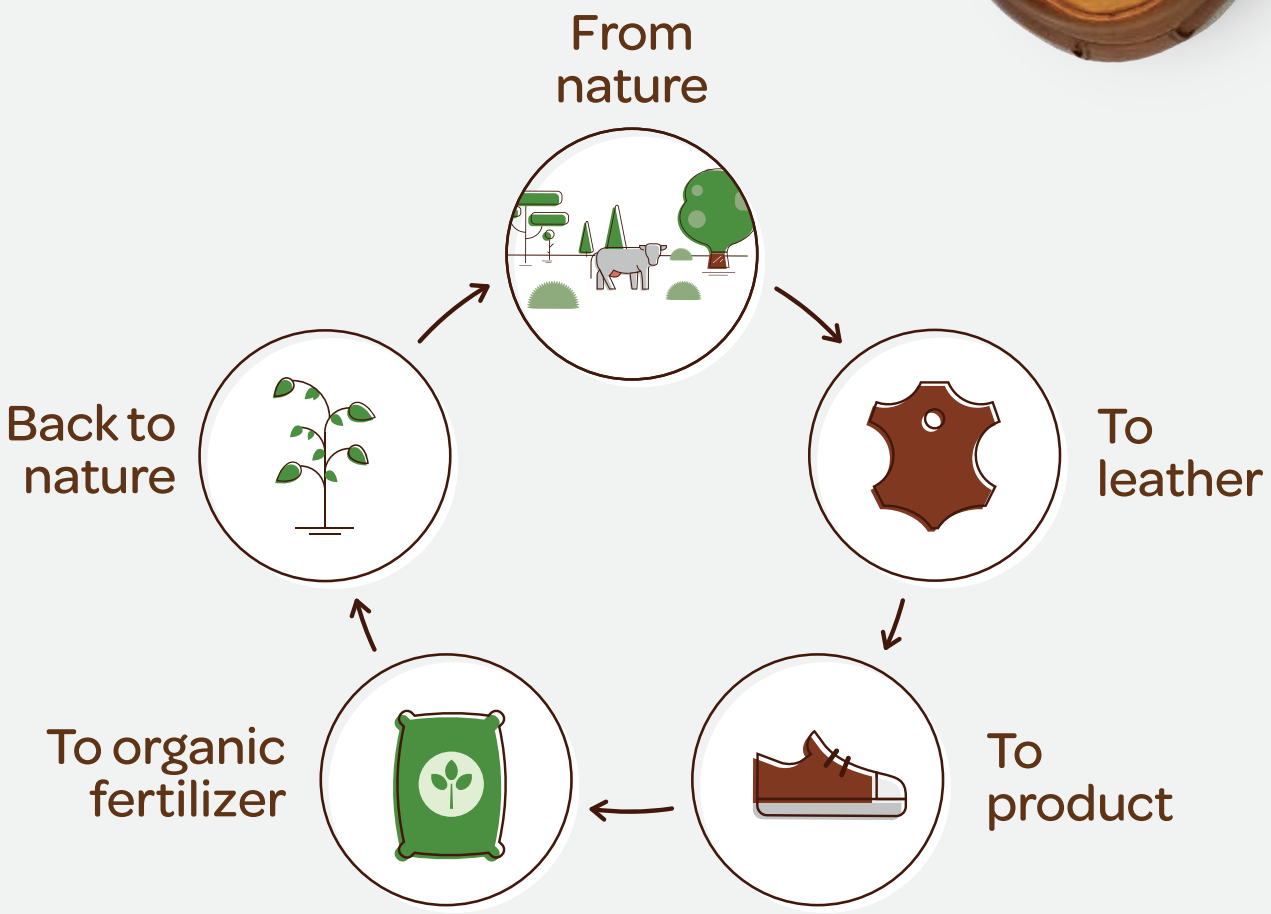


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Recover currently processes post-industrial waste for some 95% of its business, which Ms Smits says is expected to be REACH compliant, whether produced in Europe or elsewhere. The remaining 5% of its production is cotton recycled from post-consumer jeans.

In both cases, the material processed by Recover comes from various sources and is never the same. As testing feedstocks once a year will not give a true picture, it tests random samples twice monthly "to uphold our certification," says Ms Smits. The company has started to test every lot for specific chemicals on top of that. For post-consumer fibres, it takes samples from multiple places in one lot and mixes them to get a good average sample. "If we sampled from a single area, we could be lucky or unlucky," she says. This raises the question of whether post-consumer waste, heterogenous by nature, should require different testing protocols. "We need standards that ensure safety and that allow us to keep costs manageable," she says.

Stripping out chemicals

Chemical recycling is often cited as a possible solution to avoid finding toxic chemicals in textile waste, as feedstock is dissolved and problematic substances could then be filtered out. But the Technological Readiness Level (TRL) of chemical recycling processes is low, from three to six, on a scale of nine, says Jeanne Meillier, project manager at French material innovation and sustainability cluster Euramaterials. "Mechanical recycling is much more advanced, and has greater economic potential," she says. She also notes that mattress recyclers sanitise used goods to neutralise pollutants before recycling.

The presence of commonly used and legal dyestuffs has been found to adulterate mechanical recycling processes. The EU-funded Retex recycling programme that Euramaterials led met one such hurdle in its polyester textile value chain. "During the compounding process, which uses heat and pressure, colours were found to sublimate," says Ms Meillier. An orange shirt would turn khaki green once compounded, and sometimes blue and yellow combined to produce green. "This is not something that can be controlled," she says, as many different chemicals are applied to polyester clothing, including sizing agents, surface treatments and dyes.

Various methods to strip away dyes from waste, using supercritical CO2 or ozone, could be an option for removing unwanted substances, and increasing the value of recycled feedstock. But these, says Ms Meillier, can be energy-intensive. Lei Yao, director of product development at Hong Kong-based textile research centre (HKRITA), agrees that supercritical water could be a solution for handling harmful chemicals removed from textile waste. "It is a very powerful and efficient technology, but there are lower-cost methods," she says.



Jeans make up most of Recover's post-consumer recycled cotton fibres. This feedstock is relatively easy to sort out, and the vertically integrated supply chain may possibly make materials and chemicals tracing easier.

CREDIT: RECOVER

HKRITA has recently finalised a study on the decolouring of polyester textiles. It has found that a combination of high temperature, high pressure and water "makes the polyester fibre swell and release its colour," Lei Yao tells *WSA*. Activated carbon is then used to absorb the discharged dyes. "This process does not affect fibre quality, and it is not very expensive," she says. Though it sounds simple enough, Ms Yao admits there are some challenges. "The system works well on some dyes and not on others. We need more comprehensive studies of different dye families."

This circles the issue back to the initial question that the H&M and Ikea project was looking to answer: what chemicals remain lurking in a random bale of discarded, no longer wearable clothes? The chemical experts consulted tend to insist that legal limits are legal limits and, to be put onto the market, any recycled product must be guaranteed to be safe.

But they also intimate that as regulations become ever more stringent, it may become near impossible to find feedstock suitable for mechanical recycling. "It will be challenging to tackle the issue of legacy chemicals, but developing closed waste streams is one way to decrease the problem, as open ones could be too contaminated," says Theresa Kjell, at Chemsec.

For those that promote mechanical recycling, as Karla Magruder at Accelerating Circularity does, it is commercially viable and should be encouraged. "It will support the development of sorting and pre-processing technologies. A recycler should be able to say, I need this and don't want that, and be able to place an order that meets its standards," she says.

The two camps agree on one matter: the need to phase out hazardous chemicals from the start instead of having to remove them afterwards.

Two accelerator and innovation programmes, SmartX and SmartEEs, believe collaboration is key to unlocking opportunities in smart textiles. Promising projects selected by these platforms have access to a network of research centres, consultants in textiles and electronics, along with potential business partners and investors.

New momentum for smart textiles

The global market for smart textiles is expected to reach $3 billion by 2024. This positive outlook draws on a 2021 smart fabrics industry report by Grand View Research. Yet the large and small companies operating in this field in Europe face obstacles in the development and scaling up of their innovative and connected products. This is what SmartX and SmartEEs, two incubator and accelerator programmes for smart textiles, have been focusing on throughout their three-year mission as part of the European Commission's Horizon 2020 fund.

"Independent research firms believe the smart textile market will grow 80 times faster than the traditional textile and apparel industry," says Lutz Walter, SmartX coordinator and secretary general of the European Technology Platform for the Future of Textiles and Clothing (ETP). "But the greatest challenge this sector faces and the reason why many prototypes do not reach the market is a lack of a strong value chain." Filling the gaps in the supply chain is precisely what SmartX has sought to address by supporting the SMEs that have the know-how "to fill the gaps". In this way, it aims to enable Europe to be a world leader in smart textiles. SmartX estimates that the development of these new value chains could represent a market opportunity of €5.5 billion in 2026, if a viable industrial ecosystem is developed to meet potential market demand for smart textile-based solutions.

The two programmes share a similar mission and vision. "SmartX funds smart textiles projects that are based on a real manufacturing supply chain, have been tested in a real environment, have a solid business model, and, ideally, are textile-based. These are all necessary for the creation of a viable supply chain in Europe," says Mr Walter. SmartX was given a budget of €2.4 million that it distributed to 40 smart textile projects. Each one received up to €60,000, including access to coaching sessions. For its part, SmartEEs had a budget of €8 million to support



Developed by Footfalls and Heartbeats, KiTT monitors joint movement in real time, providing useful data to athletes and physiotherapists.

CREDIT: FOOTFALLS & HEARTBEATS (UK) LTD

companies developing flexible and wearable electronics. As its second three-year mission has come to a close, it has set up a new structure in Belgium, the European Flexible and Wearable Electronics Association, to keep the programme dynamics going. "The two are quite complementary, with very few overlaps," Jérôme Gavillet, head of the SmartEEs project tells *WSA*.

Both programmes enlisted a wide range of research centres to provide the start-ups with technical support. These include Centexbel in Belgium, Citeve in Portugal, the Smart Textiles science park of the University of Borås in Sweden, the Deutsche Institute für Textil in Germany, to name just a few.

To foster interaction and collaboration, SmartX organised a series of events, workshops and hackathons throughout Europe. The two accelerator programmes joined forces to present their final round of funded projects at the Institut Français de la Mode (IFM) in Paris in late November. The event was an opportunity to discover a selection of ongoing projects for sports applications and provides a picture of the state of next generation smart textiles developed in Europe. The final event for SmartX will be held in Brussels, on April 20 and 21, if conditions allow, in conjunction with the ETP's annual conference.

Promising projects

Originally based in New Zealand, and now headquartered in the UK in Nottingham, Footfalls & Heartbeats specialises in knitted textile-based sensors. Within the SmartX programme, the company focused on optimising its motion-tracking knee sleeve, KiTT, specifically improving the sensor response and removing anomalies in data collection. It was able to work with Ioetec, a data security specialist based in Sheffield, and with Revolve, a Katowice software company in Poland.

Three types of sensors, knitted directly into the smart sleeve, measure pressure and strain, and collect bioelectric measurements such as heart rate, electrocardiogram (ECG) and electro-myography (EMG) data. "The knitted structure itself is the sensor, it is a unique technology," says Dr Andrew Garland, Footfalls & Heartbeats CEO. "The sleeve measures joint movement directly; we do not infer data. This allows us to capture high-accuracy gait count and to monitor parameters that indicate a state of fatigue or help optimise performance." The smart textile technology has already been used and validated in mattresses, car seats and socks, which can have up to 12 different sensors, he says. "Sports shoes now often have knitted uppers, we could knit in sensors to measure users' gait cycles," he says.

Sweat monitoring

Swemax is a sweat-monitoring smart top and an evolution of a previous project known as Biometrica, first developed by a research consortium with the University of Padua in Italy.



Pikku Active is "a trainable textile AI-based system for exercise recognition," says its developer Blautic. It collects movement and muscle activity, and users define what parameters they want to measure using a smartphone app.

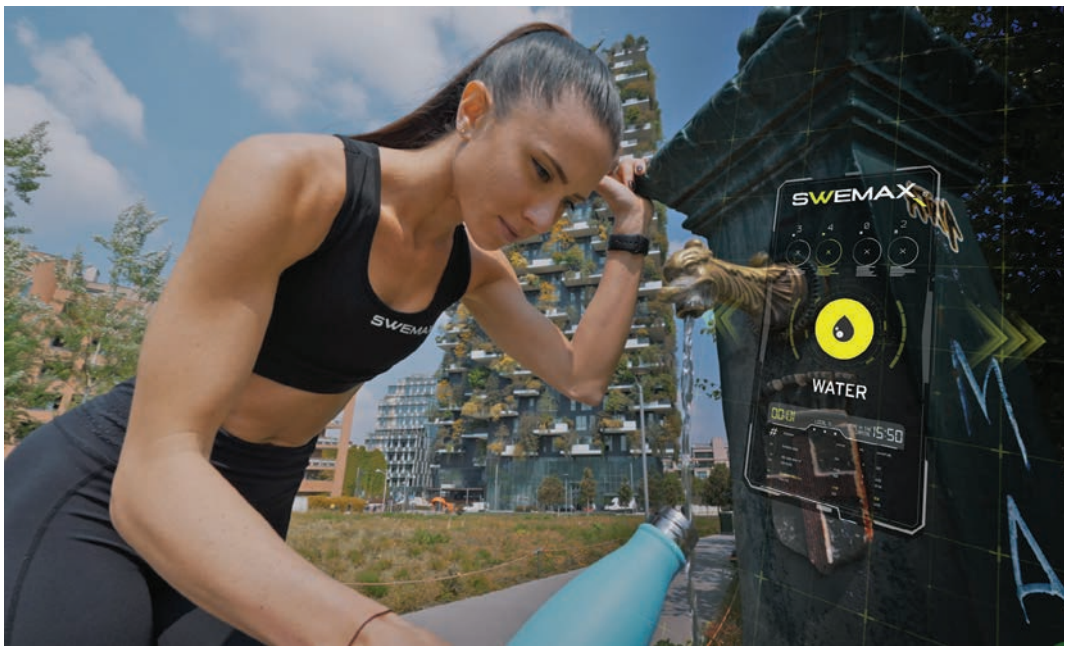
CREDIT: BLAUTIC

The concept includes an egg-shaped electronic module that clips onto a biosensor pad, and communicates biological data in real-time to a smartphone app. "By monitoring sweat, we can extrapolate water or mineral loss during intense sports activities such as running and cycling. Exhaustion can lead to cramps, mental confusion, even blackouts," says Klaas Van de Velde, project lead through his Belgium-based business development and marketing company, WorldKlaas. This insight can be used by an athlete to optimise hydration and salts reintegration, improve fitness condition and preparation for competitions.

During the SmartX accelerator programme, the size and weight of the 'egg' was reduced by 30%. The biosensing patch was enhanced in terms of sensitivity and stability. Italian knitter Staff Jersey was enlisted to develop the seamless and close-fitting tank-top which holds the electronic components. Several prototypes were developed and tested with athletes. With these developments, the company says its current iteration is now market-ready.

Training and posture guidance

Pikku Active promises to deliver AI-based training assistance using smart textiles. It is part of a platform of training devices and programmes for professional athletes developed by Blautic,



Swemax's smart shirt combines a biosensor and a textile patch that connects to an electronic element which transmits data in real-time to a smartphone app. It seeks to help athletes avoid reaching a state of exhaustion due to dehydration and loss of salts during training and physical activity.

CREDIT: SWEMAX

based in Valencia. During the accelerator programme, it was able to develop new smart textile-based features such as textile electrodes that capture EMG signals. The movement and muscle activity data is then sent to a smartphone app. The company has paired up with research and innovation centre Aitex to design the smart textile, active sportswear manufacturer Atika Sports, and Life Fitness House, all based in Spain, the third providing validation of the training assistance technology.

"The system is designed to be used by trainers, clubs and physiotherapists. It can measure a person's condition before and after hip surgery, for instance, to ensure a person recovers the same mobility after surgery," says Javier Soriano Falco, Blautic founder and CEO. The company is also investigating possible applications in virtual reality gaming to encourage physical activity in the metaverse.

Designed for industrial uses, but having possible sports applications as well, Dynaback is a smart posture-monitoring top. Developed by Bulgaria-based Madesign, it has five sensors placed along the spine that measure upper body movement for musculoskeletal monitoring. This direct and automated monitoring of position was found to provide superior data compared to traditional motion-capturing technologies, company founder, Sabri Mahdaoui, tells *WSA*. Part of both the SmartX and SmartEEs platforms, the start-up teamed up with German textile tech company Amohr, which provided the conductive tapes, improving on an earlier wire-based connecting system.

The Dynaback T-shirt captures a user's body movements and sends an alert whenever irregular movements occur. The company believes its products will also help better understand the reasons for musculoskeletal problems, in addition to protecting workers. The project is fairly advanced, and has already begun to manufacture runs in the 100,000s, with ongoing tests in Bulgaria and France, says Mr Mahdaoui. "The challenge is not the technology, the technology works; the challenge is bringing value to the user," he says.

Many other SmartX and SmartEEs-backed projects targeting health, sports and industrial applications were featured during the two-day event in Paris. The projects described here are just a tip of the iceberg, and they are roughly in a similar state of development and market readiness. They confirm the importance of collaboration but also the existence of a strong network of companies across Europe with expertise in smart textiles, electronics and software. These pan-European networking programmes may have thus found a way to unlock some of the barriers to bringing these innovative smart textiles to market.



The Dynaback top, by Madesign, has sensors placed along the spine to track a wearer's upper body motions. An alert is sent when it senses irregular movements.

CREDIT: DYNABACK BY MADESIGN


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> **"We are seeing a lot of interest for alternatives to cotton; we feel a real market pull"**
>
> ANGELINE ELFSTRÖM, SÖDRA ONCEMORE

Cellulose from cotton comes full circle

Of all the waste that the apparel industry generates, cotton waste could be considered one of the more valuable resources to keep out of landfills and incinerators. Demand is high for cotton-rich fabric scraps, deadstock, unsold goods and whatever post-consumer clothes and other materials can be culled from the mounting piles of discarded household textiles. These can be shredded and mechanically recycled into new cotton fibres, or they can be liquified into pulp to make regenerated cellulose fibres, such as viscose or lyocell.

While mechanical recycling tends to break down cotton fibres, the process of regenerating cellulose creates a new fibre whose properties are akin to 'virgin', manmade cellulosic materials. As the companies investing in these technologies begin to scale up, industrial volumes of the regenerated materials are becoming available. A telling sign of a promising future for this new crop of fibres is the launch by Levi's of its Original 501s in a blend of organic cotton and Circulose, a regenerated cellulose fibre made from cotton pulp by start-up Renewcell. This marks a true breakthrough for the Swedish company, as "it is truly an iconic product," says Nora Eslander, Renewcell's head of communications. With this symbolic achievement, it hopes to convince other major brands to envision replacing cotton, or polyester for that matter, with its circular regenerated cellulose solution.

Renewcell, which was set up in 2012, is far from the only company in this emerging field of textile-to-textile recycling. Austrian manmade cellulose fibre producer Lenzing launched Tencel x Refibra fibres made from textile waste in 2017. Infinited Fiber Company was established in 2018 when it retrieved a carbamate cellulose regeneration process originally developed by VTT, the Technical Research Institute of Finland. Evrnu, founded in 2014 in Seattle, is yet another company developing a similar technology. It recently raised $15 million to meet surging demand for its fibre regeneration platform called NuCycl. The company says it will use these funds to expand its operations in South Carolina.

Processing cotton waste to reprieve its cellulose content is one of the more advanced chemical recycling processes in development. The companies in this field are optimising their technologies and securing feedstock to keep operations going as they begin to scale up.

New facilities in the works

In Sundsvall, in the north of Sweden, Renewcell is in the final stages of setting up an industrial scale plant in a former paper pulp processing mill that closed in 2020. It will bring both the building and the onsite water treatment plant back into use. "The infrastructure is there; we do not need to build a new factory and we have hired staff, experienced workers, who were laid off when the paper mill closed," says Ms Eslander. In another eco-responsible move, it has acquired a second-hand drying line. This should allow the company to scale up in a relatively short two-year period. Its existing facility, located in a former Akzo-Nobel factory in Kristinehamn, Sweden, produces up to 4,000 tonnes of Circulose pulp per year. The new plant will have a total capacity of 60,000 tonnes and will begin operations this spring, according to the company.

Because no start-up is an island, Renewcell has also formed partnerships with traditional manmade cellulose producers to transform its Circulose pulp into fibre. "Sanyou in China is our biggest partner; it processes two-thirds of our production, representing 40,000 tonnes," says Ms Eslander. It has also signed a letter of intent with German viscose maker Kelheim.

Production of Circulose has not yet begun at Kelheim, as Dr Marina Crnoja-Cosic, business development director tells *WSA*. "We are in the phase of technical feasibility and optimisation of production," she explains. Kelheim could be one of the first Europe-based companies to turn

Lenzing's Tencel x Refibra fibre is now a part of the company's carbon-zero platform. Tencel x Refibra fibres have a carbon footprint of 2.5 CO_2e/kg (cradle to gate), and refers to the fibre itself, not to the recycling technology. This data will be added to the Higg MSI, the company says.

CREDIT: LENZING





Södra mixes pulp from wood and from cotton waste to make OnceMore which in time will have 50% recycled content. CREDIT: SÖDRA

post-consumer waste into new fibres when operations begin. Lenzing's Tencel x Refibra fibres can include post-consumer waste, but its main feedstock is post-industrial cotton.

Chinese viscose manufacturer Yibin has recently achieved a breakthrough of its own by producing a recycled viscose filament made from 100% Circulose. Renewcell's partners most often blend 30% to 50% Circulose with conventional wood pulp. "It is not a technical issue, but a matter of volumes, as we have not been able to supply the quantities our partners need," says Ms Eslander.

Infinited Fiber Company is also in the process of building a large-scale facility. It currently produces its regenerated Infinna-branded fibre from post-consumer textile waste at two pilot facilities, located in two different cities in Finland. "This allows us to produce enough fibre to send sample batches and small commercial batches to our customers, and we are finetuning the processes at our pilots so that we can boost output this year and next. Unfortunately, even with this additional production, we can't serve everyone," says Kirsi Terho, Infinited Fiber Company key account director. The new plant will begin operations in 2024 and will have a capacity of 30,000 tonnes per year. The company has a short-list of possible locations, and plans to finalise its decision in the first quarter of 2022.

The Finnish company also intends to license its technology. "We are first and foremost a technology company, and licensing our technology is a key part of our strategy," says Ms Terho. This will enable other fibre producers, such as existing viscose manufacturers, to add Infinna to their product portfolios. "We want Infinna to become a mainstream material as quickly as possible so that it can really make a positive global impact by reducing textile waste and the burden on virgin resources from creating new textile fibres. We can't do this on our own," she adds.

In its main plant based in Mörrum, Sweden, Södra, a cooperative wood pulp producer, has been developing a textile waste recycling process since 2019, to make a regenerated cellulose fibre it calls OnceMore. Initial research goes back to 2016, with the first lab tests beginning in 2018, says Angeline Elfström, OnceMore's business development manager. The cooperative structure, with its 52,000 members, may be slower to develop new processes compared to single-focused start-ups, but it has the advantage of an operational mill running 24/7. "We are a small team at OnceMore, but we are backed by a very large organisation," she says. In its first iterations, OnceMore contained only 3% textile waste, but it now incorporates 20% certified recycled content. "Our target is to reach 50%, and we are moving forward progressively as we want to maintain the same attributes. The material needs to align with industry expectations," she says. Production capacity is growing steadily, and has increased tenfold since summer 2021 to reach 6,000 tonnes, she says.

A well-established wood pulp producer, Södra is a long-standing supplier to "all major manmade cellulosic fibre manufacturers. We are seeing a lot of interest for alternatives to cotton; we feel a real market pull," says Ms Elfström. Södra and Lenzing came to an agreement last June to work together to increase the use of post-consumer textile waste in their processes. The cooperation involves the transfer of knowledge between the two companies with the goal to recycle 25,000 tonnes of textile waste per year by 2025.

Lenzing has been steadily increasing the proportion of recycled content in its Tencel x Refibra fibres, going from 20% to 30%, with plans to reach 40% in 2023, and 50% by 2025. The cooperation with Södra will enable Lenzing to broaden the range of suitable materials used to make Tencel x Refibra fibres. "We can currently add white cotton or polyester to our sources of raw material with a further increase of the raw material base to come," says Caroline Ledl, head of product management at Lenzing.

Expanding waste resources

Most of the cotton-to-cellulose pulp makers can only process waste materials, whether pre- or post-consumer, that have a high proportion of cotton, ideally as close to 100% as possible. Södra is an exception as its technology separates cotton from cotton-polyester blends. "The polyester is incinerated and used to power the process," says Ms Elfström.



Levi Strauss is introducing Renewcell's Circulose, a regenerated cellulose fibre made from textile waste, into its iconic 501 jeans. CREDIT: LEVI STRAUSS

Until recently Södra's process could only accept white or light-coloured waste that it retrieved from hotels, restaurants and laundries serving the hospitality industry. It has partnered with hotels in the UK through the Textile Services Association (TSA), a trade association for the textile care services industry. "We need volumes, not just 100 kg here and another 100 kg there," says Ms Elfström. "If we were to use household waste, we would need a partner that collects and sorts it, like paper."

Södra has recently begun to accept coloured textile waste, and announced a collaboration with Swedish grocery retailer ICA to recycle its used workwear, which uses black and green fabric. Instead of being incinerated, 56,000 garments will be the raw material for as many as 28,000 new ones. "This is the first time that coloured workwear from blended polycotton materials will be recycled and used for new textile fibres on a commercial scale in Sweden, and possibly the world," says Ms Elfström.

Renewcell is seeking to lower the threshold of suitable feedstock to 90% cotton content, which would allow it to accommodate the presence of elastane. It has formed partnerships with used garment collectors, including Bank and Vogue, one of its largest suppliers, and says it has secured 50,000 tonnes of used clothing annually.

Meanwhile, Lenzing says it is working with customers and partners to develop customer-specific take-back systems. Infinited Fiber Company is working with suppliers in Finland and abroad to secure its supply of textile waste. It recently announced an agreement with Lounais-Suomen Jätehuolto (LSJH), a Finnish municipal waste collection company, which, says Ms Terho, is currently building a processing plant for discarded textiles.

All are counting on the implementation, within the countries of the European Union, of a separate collection of used household textiles by 2025 at the latest as part of the EU's Green Deal. In Finland, legislation has already been passed and separate collection of household textile waste will begin in 2023. The EU lets each country decide how to manage this waste, whether it is the responsibility of municipalities or specially formed organisations. In France, Refashion (formerly known as Eco-TLC) levies a tax on all companies that sell apparel, footwear or home linens in the country. These funds are used to increase waste collection and its recycling. In 2020, the latest figures available, it collected 204,000 tonnes of used goods and received €34.5 million in 'eco-fees'. Part of these funds are used to finance research into recycling processes. Refashion has distributed €5 million to some 55 projects since its inception 11 years ago.

Further research

Amsterdam-based sustainability organisation Fashion For Good launched a new research programme known as The New Cotton Project in October 2020. It has rounded up a consortium of 12 companies, from all stages of the recycling supply chain, and focuses exclusively on post-consumer textile waste.



Infinited Fiber Company is busy preparing its first commercial-scale plant that will have an annual production capacity of 30,000 tonnes and which will begin operations in 2024.

CREDIT: INFINITED FIBER COMPANY

The project is making good progress, says Paula Sarsama, New Cotton Project coordinator and Infinited Fiber Company product manager. Dutch used clothing collector Frankenhuis and REvolve waste, which tracks waste materials, have mapped the textile waste flows within the EU, and have evaluated available textile streams to identify which are best suited to Infinited Fiber Company's process. Xamk, the South-Eastern Finland University of Applied Sciences, has refined the pre-treatment process. Spinning partners, Turkey-based Kipas, Slovenia-based Tekstina and Portugal-based Inovafil, have made yarns from regenerated Infinna fibres. These, she says, have been made into fabrics for quality review and dyeing and printing tests. Brand partners adidas and H&M have meanwhile finalised designs, conducted consumer research, and run fabric tests to compare the qualities of Infinna to virgin cotton. The positive results from these tests now enable the consortium to move on to the next step, which is to carry out the process on a larger scale. If all goes as planned, adidas and H&M will be presenting finished products made from regenerated Infinna fibre by the end of the project in 2023.

By that time, Renewcell's Circulose and Lenzing's Tencel x Refibra fibres will no doubt be available in greater quantities and partnerships with brands and retailers will bring these novel, regenerated cellulose fibres to market. The prospect for this type of chemical recycling is positive, though narrow, as it requires cotton-rich waste materials. It also remains to be seen whether these lyocell or viscose fibres can themselves be recycled. Research is under way here, but remains at lab-scale. Extracting cellulose from used cotton clothing has proved its potential; it is time to identify and optimise cost-efficient methods of extracting cotton-rich items from the mountains of used textiles that are discarded every day across the world.



RISE TO THE CHALLENGE

New synthetic yarns that biodegrade in landfill hundreds of times faster than ordinary polyester have caught the eye of running apparel brand Pressio.

Biodegradable breakthrough

It may seem to fabric manufacturer Paradise Textiles that recognition of its achievements has been slow to arrive even though, ironically, speed is the big selling point of its latest breakthrough. The company, which has its headquarters in Taiwan and its main production facility in Wuxi in China, had been operating and supplying some big-name apparel brands with fabric for 25 years before it caught the attention of the ISPO Textrends international jury in the autumn of 2021.

This selection panel compiled its list of the best products for spring-summer 2023 and included Paradise among the winners for its BioFuze fabric. Constructed from 55% biodegradable polyester (PET) and 45% biodegradable polybutylene terephthalate (PBT), BioFuze earned the jury's praise as "one of the world's first synthetic fibres that returns to earth hundreds of times faster than ordinary polyester".

In its presentation of BioFuze, Paradise Textiles points out that ordinary polyester garments probably take hundreds of years to biodegrade in landfill, but it says its new product is not ordinary polyester. Tests that a specialist New Mexico-based operator, Eden Research Laboratory, has carried out suggest that after 30 days in a regulated landfill environment, a garment made from BioFuze will have begun to attract micro-organisms that accelerate the process of biodegradation.

After 100 days, the garment will have begun to show a reduction in mass and by the time 200 days have passed, 45% of the garment will have biodegraded. In a little over another month, it will be 70% biodegraded and the process will continue until only biomass, water and some methane remains. According to Paradise, in a regulated landfill environment, it should be possible to capture that methane and use it as a source of energy.

Paradise applies an additive to achieve all this. It does this when it makes the chips and the biodegradability is then something permanently embedded into the fibres when it extrudes them. It is this additive that attracts the micro-organisms in landfill and binds these to the yarn to allow them to go about their work of breaking down the fibres, speeding up the natural process, but without causing the fibres to fracture and break down into micro-plastics. Instead, conversion of the fibres into water, methane and biomass takes place at molecular level.

Quick off the mark

Compression-enhanced athletic clothing brand Pressio has wasted no time in incorporating Paradise's biodegradable polyester fabric into a new collection of performance apparel, Pressio Bio. Launched in 2021, the brand is the brainchild of Jamie Hunt, one of the founders of the 2XU brand. For him, the appeal of biodegradable products is that they are part of an aim to make every aspect of the business fit its sustainability model. There is great interest in recycled material, but what happens to garments at the end of their useful life is what he refers to as "the missing link".

Fabric made from biodegradable synthetic yarns, enhanced with cooling and warming technology from 37.5, feature in the new Pressio Bio running tights.

ALL CREDITS: PRESSIO

In an ideal world, it would be possible to use materials time and time again, with nothing going to waste, but while we wait for those days to come, biodegradation is a better end to the product lifecycle than much of the apparel industry can offer at the moment. Mr Hunt explains: "Ultimately, our goal is to have solution-dyed products, recycled products and biodegradable, all in one. We'd love it if everything could be recycled right now, but I think we all know that's not going to happen at the scale required for a very long time."

He contends that Pressio will work to add "piece after piece to the jigsaw". Next year, for example, it will introduce biodegradable garments that have been constructed using fabric made from recycled polyester. And meetings are already taking place between the brand and textile suppliers that are working on bio-based yarns with similar properties, in terms of such as moisture management, to synthetic fibres. "We are working towards bio-based yarns that will, in future, offer the same qualities as synthetic yarns," he explains, "but at the moment, the best option we really have is to get PET from water bottles. That has to be better than taking it from oil. We're also trying to eliminate any garment dyeing because that has an impact on waterways that will take hundreds of years to solve."

First mover

Jamie Hunt says he spends most evenings watching television, but with his phone or his computer to hand to be able to read about breakthroughs in textile science, researching new technology. One evening, following up on a notion to introduce biodegradable yarns, he came across Paradise Textiles. "I got in contact with them and started talking to them about what they had developed," he explains. "In my eyes, it was clear that Paradise, with what it was doing with BioFuze yarns, was a leading company in this. One of the beautiful things about Pressio being a small, agile company is that, within four weeks, we had some samples made up, which we tested. Within ten weeks we had fully developed our product. We believe we're the first brand in the world to be using it, which is very exciting for us. The results are quite phenomenal."

Pressio Bio running tops and T-shirts, were soon on sale in important partner retailers, ranging from the sport-specific Run And Become to the world-famous Harrods in London. Pressio has given the name BioSol to the fabric it has made using BioFuze yarns, using a dual-filament construction to provide the tops with permanent moisture management to keep runners cool and dry. The tops also have anti-bacterial treatment from Rudolf.

Bottoms in the collection use a version called BioSol Power 37.5, which, as the name suggests, incorporates technology from Colorado-based 37.5 alongside yarns engineered, by the same process as described, to biodegrade at enhanced rates in landfill. With this, active particles permanently embedded at the fibre level, capture and release moisture vapour to prevent sweat from forming and help cool wearers down when they are hot. The same active particles trap energy to warm them up when they are cold. Jamie Hunt, who moved six months ago from New Zealand to a new base in London says he had been hearing good things about 37.5's technology for years and was confident it would work well. Wearing some of the BioSol Power 37.5 running tights to help him endure his first winter in the UK has proved that this confidence was well founded. He says: "I know there can be some cynicism around heating and warming technologies, but I have tried it in freezing cold London weather and the heating aspect definitely does work."



Pressio believes it is the first brand in the world to start using fabric developed from Paradise Textiles' BioFuze synthetic yarns. Tests show the material will biodegrade in landfill hundreds of times faster than normal polyester.

Maximum performance

He calculates that the biodegradable properties could add between 20%–30% to the cost of the fibre, but points out that this translates to an increase in cost of a final garment such as running tops that should be closer to 10%. Adding thermoregulating properties to the biodegradable yarns in the bottoms adds a little more. He does not regard this as "a massive increase"; a much more serious problem to overcome is limited availability of the technology. He would like it to become more easily available and for more brands to begin using it. "We want a sports performance industry in which properties such as biodegradability are part of the norm," he says.

Mr Hunt's belief is that one of the most difficult challenges that brands face in creating new sports textiles is that natural fibres cannot deliver what he calls "maximum performance". He views this as unfortunate and adds that he would love to be able to use cotton or wool, not least because these fibres break down much more easily at end of life. "But we just can't," he says. "They do not wick moisture; cotton and wool both hold on to moisture. There is nothing out there at the moment that is going to mimic what we get from synthetic fibres." He says this is the reason his brand is interested in developments such as bio-based yarns that will offer the same performance, plus natural biodegradability, but warns that these products may still be four or five years away. "That's the future," he says, "but right here, right now, we're really happy with the results that we are seeing with the fabrics we are using for this biodegradable collection."



> **"The Olympic spirit will popularise the passion for winter sports in China even more."**
>
> TINE DEMEC, ELAN SKIS

A bright outlook

Even as the latest wave of covid-19 rolled around the globe, preparations for the 2022 Winter Olympics and Paralympics, due to be held in and around Beijing during February and March, continued. "China will do its best to deliver a splendid, exceptional and extraordinary [Winter Games] for the world, making all participants feel spring-like warmth and injecting more solidarity, confidence and strength into the world," underscored Chinese foreign ministry spokesman, Wang Wenbin, in January.

All things relating to the running of the Winter Games may not be quite full steam ahead, at least not in terms of stakeholders' original plans (Beijing was chosen to host the Winter Games back in 2015). For example, the Beijing 2022 organising committee, citing covid concerns, announced in January that tickets would not be sold to the general public for any event. Major sporting and winter technology trade shows Ispo Beijing and Alpitec China, were both still on course to go ahead in December at the China National Convention Center, but were postponed late in the day for the same reason. Brands that hoped to be there were perhaps able to console themselves with the following words, commonly attributed to the Chinese sage Confucius: "Happiness is not at the top of the mountain, but in how to climb".

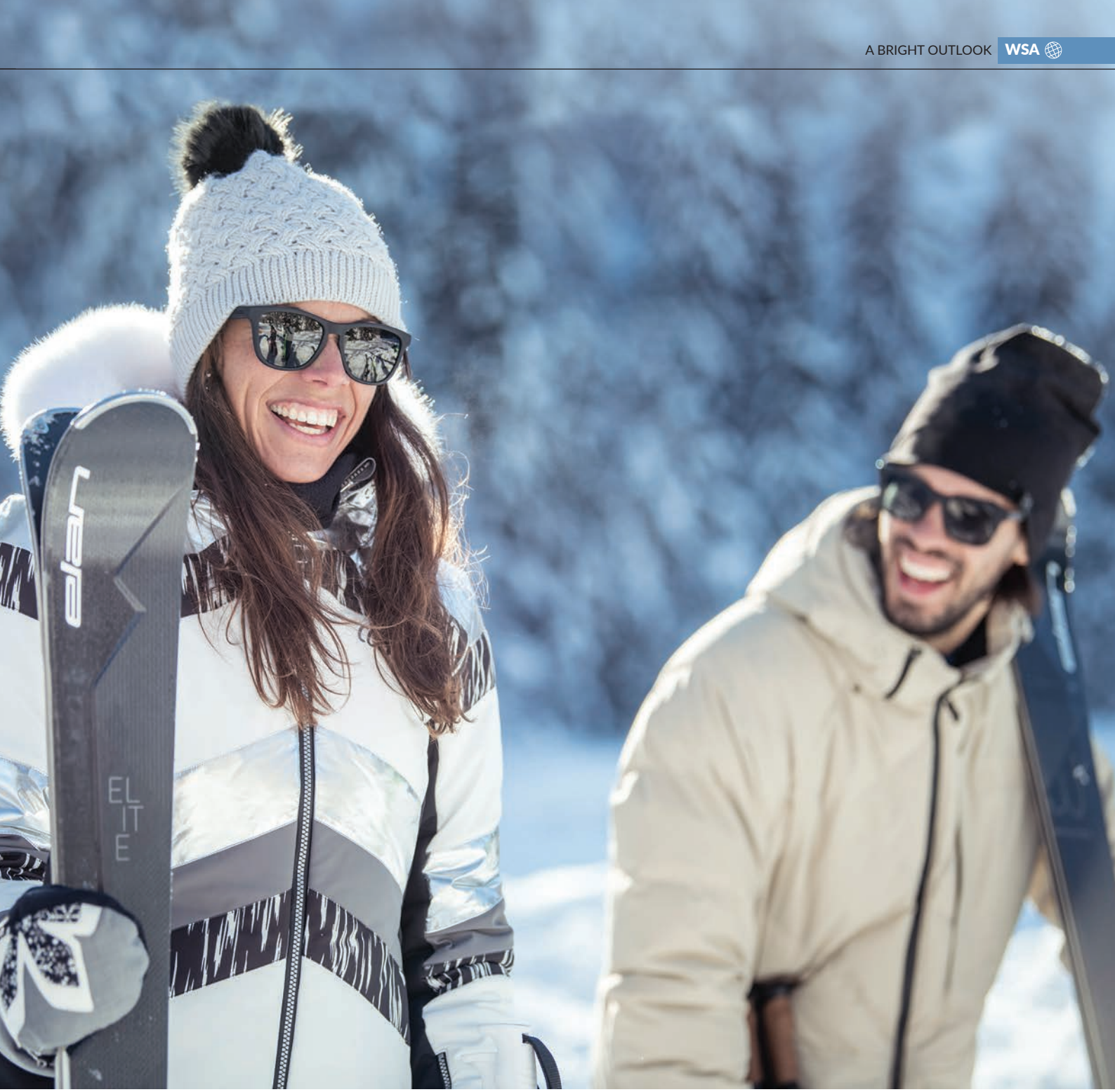
How to climb

The Beijing 2022 competitions will be broadcast by China Media Group (CMG) via 8K ultra-high-definition transmission, in addition to the Olympic Broadcasting Services and other rights-holding broadcasters. Known as China's principal state media company for radio and television, CMG is home to leading enterprises including the China Central Television (CCTV) and China Global Television Network (CGTN), plus the China National Radio and China Radio International radio stations. Whereas, according to the International Olympic Committee, the Tokyo 2020 Games provided fans with more content on more screens than ever before via television, digital, apps and social media, one might reasonably conjecture that CMG's state-sponsored broadcasting efforts, alone, will successfully reach the eyes and ears of a sizeable slice of China's roughly 1.4 billion-strong population. Perhaps more so than ever before.

NEWCOMERS

For international winter sports brands, the issues of how to harness the energy around Beijing 2022 and grow market share in China are of standout importance. Particularly in the current, ever-changing, climate.

Compared to Japan's population of around 125.8 million, combined with a palpable sense of national pride bound up with Beijing being the first-ever city to host both the Summer and Winter Olympics, this may not, in reality, be too much of a stretch for China. In a recent interview with news agency Xinhua, an unnamed spokesperson for the nation's General Administration of Sport confirmed that a winter sports "culture" has been deliberately cultivated by the government via various media streams over the past several years. Yet, China's engagement with winter sports since 2015 has exceeded even the state's own expectations. More than 346 million Chinese people have now participated in winter sporting activities since 2015, according to the results of a survey released by the country's National Bureau of Statistics (NBS) in early 2022. This figure represents a significant leapfrog past the state's initial target of logging 300 million engaged citizens following its successful bid to host the Winter Olympics. As per NBS' data, 37.3% of Chinese winter sports participants (82 million



Although no tickets will be sold to the public, organisers have announced that covid-safe groups of spectators will be invited to be present during the Winter Games.

CREDIT: KLEMEN RAZINGER /ELAN SKIS

individuals) were aged between 18 and 30 years old, the largest demographic group.

All this is to say, despite any additional covid-related complications, China's exposure to winter sports is not only set to further blossom and bloom under the magnifying lens of the Winter Games but so, too, in all likelihood, is its appetite for lively participation in this mode and manner of activity as the mood matures.

Cold to gold

Area sales manager for Slovenian skiwear and equipment brand Elan Skis, Tine Demec, agrees. Mr Demec tells *WSA* that Elan has been active in the Chinese market since the year 2000, but he attributes the business' "notable" growth in China over the past five years to the upcoming Winter Games. In particular, he emphasises Beijing's investment in raising the status and accessibility of winter sports in the run up to the Olympic and Paralympic competitions. Due to covid, Mr Demec's company was last able to visit the Chinese capital for Ispo Beijing and Alpitec China in 2019 (it also attended the China International Import Expo in Shanghai the same year). Further, in tune with many other businesses with a vested interest in the Chinese winter sports market, Elan was forced to abandon its plans to attend Beijing 2022 on account of the pandemic. "Nevertheless, we will cheer for our Elan athletes [from afar]," Mr Demec supplies. On the connection between the Winter Games and boosted brand revenues, he is similarly optimistic: "We are sure that the Olympic spirit will popularise the passion for winter sports



According to NBS data, the majority of the 346 million people who are said to have engaged in winter sports since 2015 hail from east China (143 million individuals), followed by residents of west China (84 million), central China (68 million) and, lastly, north-easterners (51 million).

CREDIT: SAMO VIDIC/ ELAN SKIS

[in China] even more and we anticipate greater sales in the territory in the future."

Alpitec China's brand manager, Geraldine Coccagna, shares in this positive sentiment, revealing that "most" of the trade show's international exhibitors continue to do "very well" in China, despite the various competing forces that have inevitably shaped a climate of uncertainty around the world. She also tells us that the country was able to keep the majority of its ski resorts open during covid, which encouraged domestic ski tourism when travellers may more ordinarily have opted to partake of the Japanese slopes or ventured even further afield during snow season. Ms Coccagna envisions that Chinese ski resorts, especially, will maintain their growth (and investment) momentum even after the Winter Games have concluded. In his oft-cited "white book" on China's ski industry during 2020, which also reports on how the Chinese ski season fared over fiscal 2020-2021, vice chairman of the Beijing Ski Association and chief executive of Beijing Carving Ski Sports Development Group, Wu Bin, does not dispute this.

Rather, Mr Wu rates the performance of China's ski industry during the 2020-2021 season as "outstanding", suggesting that the market more or less returned to 2018-2019 levels over the period. He uses consultant Laurent Vanat's 2021 report on international snow and mountain tourism to throw the Chinese ski market into sharp relief to the rest of the world. (Mr Vanat's findings suggested that 2018-2019 was the best snow season of the century so far across the globe, while 2019-2020 was, by contrast, the worst.) Skiing is not the only winter sport to have experienced something of a boom in China in recent years, however. According to NBS statistics, the country's total number of standard-sized ice rinks has risen to 654, representing a 317% increase since 2015. As for ski resorts, these have also grown from 568 in 2015 to 803 today. This current winter alone, Chinese citizens are expected to make 305 million winter sports tourism-related trips, just over 50 million more trips than they made last year.

The snowball effect

China's leading sportswear brand, Anta (an official sponsor of Beijing 2022), is one of several organisations, including the Beijing Institute of Fashion Technology and fellow domestic brand Peak, to announce or unveil local activewear research centres in recent months. For its part, Anta has thus far opted to partner with major universities (Donghua in Shanghai and Tsinghua in Beijing) in doing so, while others have gone it alone. Ultra-thin and ultra-light thermal textile technologies and cooling fabrics have already been singled out as key areas for research and development for its joint venture with Donghua University. As former Swarovski executive and founder of winter sports consultancy SnowHow China, Hermann Winkler, has written, local enterprises such as Anta and e-commerce giant Alibaba already carry significant weight in terms of their investments and activities in the winter sports realm, but he also underscores the successful presence of French brand Rossignol and Helsinki-based Anta subsidiary Amer Sports, the owner of outdoor brands including Salomon and Arc'teryx, in the market.

To an observer, the time has perhaps never been better to be a winter sports brand operating in China. However, especially with travel restrictions still in place, foreign-operated firms seeking to take off in the market on the back of the Winter Games' popularity will need a meticulous media strategy, capable of highlighting their own culture of innovation, to stand out. To cite Mr Winkler once again, it is likely that Beijing 2022 will not be remembered as "the beginning of the end" for winter sports in China, but rather "the end of the beginning".



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Second chance for circular suede

FOOTWEAR TECHNOLOGY

Puma has launched an experimental shoe collection that will test strengths (durability) and weaknesses (biodegradability) and determine if industrial composting could create value as fertiliser at the end their useable life.

Admitting failure is often tricky, but Puma says its foray into circular designs in 2012 with the InCycle Basket initiative did not work out as planned. At the time, the German sportswear company believed the way to create a compostable shoe was to make its classic Puma Suede design from materials including linen and organic cotton, with a sole made from a biodegradable plastic called APINATbio. There were questions over the environmental profit and loss system that was used to compare the suede and InCycle Basket shoes, and these initial figures were missing from the commercial launch in 2013. Despite the ambition, InCycle collections were dropped after four seasons due to a lack of demand and the realisation that more research was needed

"In 2012, our circular ambition was bold but the technology wasn't quite there," admits Heiko Desens, Puma's creative director. "As they say, with every challenge there's an opportunity and we've continued to push ourselves to do better by applying our strengths as well as acknowledging and improving on our weaknesses."

Puma has now returned to suede with the launch of another initiative designed to test biodegradability and circularity. Puma Re:Suede is the first concept from its new Circular Lab. The pilot project involves 500 pairs that have been designed to be disassembled and will be sent to users in Germany this year to be tested for durability over six months.

After this, testers will pilot a new "takeback infrastructure" to send the shoes back to Puma and on to Valor Compostering, owned by Ortessa, a family-run group of waste specialists in the Netherlands. Here the shoes will undergo an industrial biodegradation process to determine if Grade A compost can be produced for agricultural use. "There is a lot more we can all be doing to

The Puma Suede was first launched in 1968. With the Re:Suede, the company wants to give its consumers a more sustainable choice, while showcasing the latest technologies.

ALL CREDITS: PUMA

help tackle waste management, but taking on that challenge alone can be a difficult task for any brand," says Ortessa CEO Rob Meulendijks. "We are delighted to be working with Puma on this special project."

> **"There is a lot more we can all be doing to help tackle waste management, but taking on that challenge alone can be a difficult task for any brand."**
>
> ROB MEULENDIJKS, ORTESSA

Tanning advances

Central to the switch back to suede in terms of circular thinking is a novel tanning process called Zeology, brought to market by Dutch leather chemicals manufacturer Smit & Zoon and its nascent Nera division. The system is based on the mineral zeolite and is chrome-free, heavy metal-free and aldehyde-free. Tanners around the world, and organisations such as the New Zealand Leather and Shoe Research Association and the University of Northampton's Institute for Creative Leather Technology in the UK have been among those to test the product over several years.

Smit & Zoon CEO Hans van Haarst told *WSA's* sister publication, *World Leather*, that Zeology has the potential to be "a gamechanger for the leather industry". "We've made upholstery leather for furniture, for aviation, for automotive, for garments, for footwear and for leathergoods," he says. "We've used different raw materials and we've conducted trials at 36 tanneries.

"Furniture and automotive brands definitely want this and luxury group Kering has already made public statements about insisting that its leather suppliers remove heavy metals from the tanning process [Kering owns around 10% of Puma's shares]. We are convinced this product fits with that."

Leather made using Zeology has a tight grain and high tear-strength and tests have shown shavings to be almost as compostable as pure collagen. At least 10 tanneries now supply the product, including Heller-Leder, Südleder and Gmelich & Söhne in Germany. Puma says its tests show the Zeology suede ensures better comfort for the wearer compared with the other biodegradable materials it evaluated. The outsole of the Re:Suede has also been improved to ensure optimal wear.

Waste reduction

While the pandemic caused problems for most businesses, Puma forged ahead with plans set out in 10FOR25, an evolution of its previous sustainability strategy. The Puma Re:Suede initiative will show how well the takeback scheme works in Germany, with a view to expand this to all major markets. The 2025 target is to reduce production waste to landfills by at least 50% from a 2020 baseline, and 90% of all footwear should contain at least one "more sustainable" component, compared with around a quarter now.

Following tough periods in 2020 and the start of this year, Puma increased sales by 20% in the third quarter to €1.9 billion. Despite the covid-19-related lockdown of production in Vietnam, an "overheated" freight market, port congestion and a difficult market situation in China, the outlook for the industry, and for Puma in particular, is very positive, the company stated.

It aims to share the insights gained from the Re:Suede project within the industry to achieve a bigger impact. "We hope that progress made during 'No Time For Waste' will help us continue to raise the bar in circularity testing," concludes Mr Desens, "enabling our consumers to make better fashion choices in the future, so their sneakers can go 'from suede to soil', without compromising on product style or durability during ownership."



Puma's new North America headquarters in Somerville. The group's 2025 targets include social and environmental goals, such as using 75% recycled polyester and exploring recycled leather.



The pace picks up

SUSTAINABILITY

Sustainability remains firmly on the agenda of almost every sports and outdoor company in 2022. More than that, a detailed new report insists that, as a result of covid-19 and the recent United Nations Climate Change Conference (COP26), the pace of change towards sustainable materials and practices is accelerating.

Two years of covid-19 have interrupted business plans and product launches of many kinds (just ask any organiser of an industry exhibition or conference). Nevertheless, a report that the World Federation of Sporting Goods Industry (WFSGI) and consultancy firm McKinsey & Company presented in late January insists that last year, 2021, was not just good but "great" for many sports and outdoor brands. "The sporting goods industry performed the rare feat in tough economic circumstances of returning to pre-covid-19 levels of growth," it says.

WFSGI and McKinsey published the report, Sporting Goods 2022, before most companies had compiled full-year figures, but it predicts that 2021 results will put the global sportswear market at the pre-pandemic levels of 2019. It goes on to forecast that growth will continue at almost 9% per year and that the market will be worth $400 billion in 2025. The authors offer a number of reasons for this optimism. "The tumultuous events of the past two years are reminders of the fragility of human life and the ecosystems that support it," they say. "As a result, many people have reconsidered their lifestyles. Sporting goods companies have been able to help, and while uptake has been uneven across demographics, there are signs post-lockdown that changed consumer behaviours are here to stay."

Natural alignment

Brands' increasing ability to provide consumers with lower-impact products, supported by more convincing and more sincere corporate sustainability strategies, is helping the sector. Perhaps surprisingly, these quieter years of the pandemic seem to have speeded this up. "Climate

Sharing is caring. French skiwear brand Picture is one of a number of sports apparel companies that are launching product rental programmes at the moment, arguing that hiring expensive, high-performance apparel for a few days at a time is more sustainable.

CREDIT: DAVID MALACRIDA

change has steadily climbed consumer agendas over recent years," the report explains, "and the impact of the covid-19 pandemic has accelerated its progress. People, now more than ever, understand the strong connection between their choices and the world they will leave for future generations. Sporting goods companies are naturally aligned with these values. Sports, nature, wellbeing, and health are intrinsically linked."

There is much work still to do, of course. As the report points out, "brands must do more to enable their customers to make sustainable choices". Companies must focus more on sustainable materials, on circular business models, and on "helping consumers make choices that reflect their values".

In the first year of the pandemic, the authors noted that sustainability concerns were already leading brands to present products that they called more sustainable. They also suggest that there is evidence from high-profile events such as the COP26 Summit in November 2021 that "expectations are growing".

In the wake of COP 26, a number of sports brands made new public commitments on sustainability, for example, by signing the UN Fashion Industry Charter for Climate Action or setting science-based targets for emissions reductions, renewable energy, or transparency and reporting. Nike, for instance, signed a pledge with the Renewable Energy Buyers' Alliance to reduce its carbon footprint by 30% and use 100% renewable energy by 2025. "This shows that leading brands still see an opportunity to use sustainability to create a difference between themselves and their competitors," the McKinsey-WFSGI report says.

Our vulnerability

From this, the authors conclude that sustainability is certain to remain as one of the key themes in sports and outdoor clothing and equipment for 2022 and beyond. In fact, there is what they now call a "sustainability imperative" for companies in this market, and this is a theme that the report examines in some depth. It says searches by consumers in the US and Germany on Google with 'sustainability' and 'sportswear' as keywords have more than doubled since 2015. Now, two-thirds of consumers say that the promotion of sustainability is an important factor in their purchasing decisions. "The sustainability mindset has increased and accelerated," Zurich-based McKinsey partner Alexander Thiel says. "We're not sure of the reason but some research suggests that the more we reflect on our own vulnerability, the way many people did during lockdown, the more likely we are to care about the planet."

Careful not to name names, he says there are brands that already have a strong sustainability heritage behind them and brands that are already being genuinely innovative with the sustainable products they bring to market. "These brands are making a big impression and are able to differentiate themselves," he explains. The report's position on this is that it is positive, of course, but it says it will not be too long before sustainability becomes "so embedded in industry business models" that any chance for companies to set themselves apart will have evaporated.



Adidas CEO, Kasper Rorsted, is confident the brand can meet the ambitious sustainability targets it has set itself for 2025.

CREDIT: ADIDAS

"But we also see brands that have been disappointed in the past," Mr Thiel continues, "because while consumers insisted they wanted sustainable products, this was not always strongly reflected in the purchases they made." He also has some sympathy for consumers here, saying that products' true sustainability credentials have not always been easy to judge at the point of purchase. Benchmarking schemes for sustainable apparel are rarely comparable with each other or created using the same criteria, Sporting Goods 2022 points out. This is in stark contrast to other industries, including automotive and food, in which standards are "aligned and clear", it says.

From Alexander Thiel's point of view, the world of sports clothing, shoes and equipment is beginning to emulate those other sectors. "Everything has changed now," he says. "This is partly because many more consumers take this issue very seriously, but it's also that brands have become better at communicating about the sustainability benefits of their products. There has been a shift in mindset and brands today look at sustainability as an opportunity rather than as an obligation."

He explains that if brands look at sustainability as an obligation, they will only see it as something they cannot avoid spending money on. And they cannot afford to over-promise on sustainability and then under-deliver, Mr Thiel warns, because if a brand loses consumers' trust it will be almost impossible for it to get it back. If it's labelled as "a greenwasher", for justifiable reasons, it will be very difficult for it to recover.



One of the ways adidas believes it can gain access to more sustainable materials is by investing in smaller companies that are at the cutting edge of innovation. In 2021, it was one of a number of big names that invested in Finnish bioyarn developer Spinnova.

CREDIT: SPINNOVA

But if it is an opportunity it means that brands can be confident that sustainable products will help them not just gain consumers, but delight them. "I see a new dynamic now in this," he continues, "with companies trying circular business models and lots of new materials. And the rate of innovation is accelerating." Circular ideas that are taking hold include platforms for renting products out, rather than selling them. For example, from the start of 2022, customers of French brand Picture can hire €330 jackets for €13 per day.

Two priorities for adidas

One of the industry leaders who helped inform the report, adidas chief executive Kasper Rorsted, says the two main sustainability topics he wants to continue to address as priorities are reusable materials and carbon footprint. This is in the specific context of commitments adidas has announced already to making 90% of its products sustainable by 2025 and reducing the carbon footprint of each of its products by 15%, also by 2025. But, whatever happens along the way, he says telling the public the truth is essential.

"As an industry, we must always be transparent about what the consumer can have and what is not yet possible," he explains. "If we don't behave like this, people will become cynical and lose trust." Part of this is that certain products "will not be sustainable below a certain price point", Mr Rorsted continues, saying that consumers need to accept this and put their money where their well-intentioned social media posts are. Consumers need educating, he insists, and to accept that sustainability also comes with a minimum price tag, although he adds that brands must also resist any temptation to take advantage of this by applying what he calls "a price premium for sustainability".

In Sporting Goods 2022, McKinsey and WFSGI estimate that sustainability matters to around 75% of consumers, but that only around 50% say they are willing to pay more for sustainable products, and only 25% actually do pay more.

Solve the unsolved problems

Mr Rorsted makes it clear that adidas does not yet have all the solutions it requires to meet its 2025 targets, but expresses confidence it will have them in place on time. The authors of Sporting Goods 2022 say that, in materials, many brands are sponsoring or undertaking their own research into bioengineering, new fibres and traceability solutions. And there is another way. "We are working with large companies, collaborating with associations, and making strategic investments in smaller, innovative companies," Mr Rorsted confirms. "We are particularly looking at working with or investing in companies that are working on sustainable material innovation." In this, he says, adidas is operating less like a major sports group and more like a venture capitalist firm, setting out to provide the capital and the incentives for innovators "to solve the unsolved problems". After that, the job will be to take forward the good ideas that come from this, scaling them up, in the case of adidas, to perhaps 400 million pairs of shoes a year.



The Terrex FUTURECRAFT. LOOP Anorak concept from adidas, designed to be "returned and remodelled into new apparel" will go on release in the course of 2022.

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DIALOGUE

Cindy McNaull, Cordura business development director, Invista.

Stewardship and sustainability

Cordura business development director at Invista, Cindy McNaull, believes the brand's new re/cor recycled nylon 6.6 fabrics score well in terms of sustainability, but also meet its strict standards for abrasion resistance and tear strength.

Cordura is introducing its first 100% recycled nylon 6.6 fabrics this year; in what way does this new product reflect Invista's approach to innovation?

Our innovation pipeline is fully focused on listening to the voice of our customers. Throughout the development of our recycled fibre, which has been two years in the making, we listened closely to their needs, we collected insights, and we looked for ways in which we could provide new solutions across the supply chain. We were particularly attentive to our customers' environmental, social and corporate governance (ESG) goals, which we found to be very ambitious. Cordura re/cor is one way that we can help our partners and brands achieve their 2030 commitments. Aligning with their stewardship journey is a core part of our strategy as well. As a major producer of nylon, we are constantly working on yield improvements that have resulted in a continuous reduction of downgraded material. However, the scale of our manufacturing facilities ensures that we have line of sight to deliver against industry needs. Cordura re/cor RN66 is made from material recycled from our own operations. We control what we manufacture and have high confidence that fabrics based on our recycled nylon 6.6 fibre fully meet our brand standards. This was a big part of the development process and essential to the launch of our re/cor RN66 portfolio.

Can you walk us through the development of this new reference?

We began a few years ago what has been, fundamentally, an iterative process We started by developing and testing a polymer that had 50% recycled content drawn from pre-consumer waste. This allowed us to gain important internal knowledge and better understanding of the fibre's properties, and those of fabric made from it. We partnered with Dong Jin International, an authorised Cordura fabric mill based in Korea, to develop the first fabrics. It was important to go all

Cindy McNaull, Cordura business development director at Invista.

CREDIT: INVISTA

the way to actual fabrics as customers often want to see a tangible product. This partnership was instrumental in bringing a viable product to market. It was clear, from early on, that our customers wanted a recycled Cordura yarn made from 100% recycled material. A 100% recycled material allows our brand partners, as well as ourselves, to send a clear message. It also allows us, along with our partners, to achieve higher impacts. It is an all-round more compelling story. Cordura re/cor is 100% Global Recycled Standard (GRS) certified, and to provide our partners with verifiable and reliable information, we benchmarked our recycled nylon 6.6 fibre production process against our existing lifecycle assessment (LCA) for virgin N66. It found that, compared to the production of virgin nylon 6.6, Cordura re/cor RN66 leads to a decrease in greenhouse gas emissions of 83%. It reduces energy use by 82% and water by 57%. These are clear and quantifiable benefits.

These are strong scores for sustainability, but how do Cordura re/cor fabrics perform with regards to the label's expected durability and robustness?

Any product that is a part of the Cordura Advanced Fabrics platform undergoes extensive testing. Cordura re/cor RN66 is no exception. The fabrics developed, of which there are already 30, are in line with Cordura standards. We have tested them for abrasion resistance, and found that they are comparable in performance to virgin quality. We have also benchmarked re/cor fabrics and have found that they outperform competitive recycled nylon 6 fabrics in both tear resistance and tensile strength. The assurance that we could deliver the performance levels expected of a Cordura fabric is what enabled us to bring this project to the market. The first Cordura re/cor fabrics are being introduced in the heavier denier ranges, 210, 420, 500 deniers and multiples thereof. They can be used to make bags and packs, footwear, as well as garment reinforcements for protective workwear and activewear.

How does the development of this new reference fit into the Cordura Advanced Fabrics platform and strategy with regards to sustainability?

Cordura re/cor is a core feature of our global approach to stewardship. We have deliberately engineered it so that it can continue to grow in the future as well. The name re/cor itself was chosen because it can refer to a broad array of possibilities. It can evoke recycled, regenerative, or even renewed. These are all areas that we believe will be ever more important in the future. We took advantage of the launch of RN66 to create a family of responsibility-focused Cordura fabric technologies under the re/cor sub-brand. This portfolio includes our GRS-certified 100% post-consumer recycled polyester and our 100% pre-consumer recycled nylon 6 fabric technologies. Our solution-dyed nylon fabrics, Cordura TrueLock, also offer ESG benefits such as built-in colour that translates to significant reductions in water and energy use. The Cordura TrueLock manufacturing process also reduces CO_2 emissions compared to traditional dyeing processes based on a 2013 LCA study.

"We know what we manufacture and have high confidence that fabrics based on our recycled nylon 6.6 fibre fully meet our brand standards."



San Francisco-based Black Ember is one of the early adopters of Cordura's new re/cor recycled nylon 6.6.

CREDIT: BLACK EMBER

We at WSA have covered many innovative textiles announcements, but few of these successfully achieve a significant market presence. How does Invista address this challenge and convince brands to adopt a new technology and bring it to market?

We initiated a programme a few years back that we call Cordura Lab to Life in which we test fabrics by simulating real-life conditions. Furthermore, we take a very pragmatic approach to innovation, and this enables our customers to feel more confident introducing a new material. In the development of the recycled nylon 6.6, we have been working closely with a few early-adopter brands. One name I can mention is San Francisco-based pack maker Black Ember, which should be making an announcement soon.



Graphene keeps on giving

Engineering company Versarien sees vast potential for graphene to add beneficial properties to textiles and sportswear, with research unlocking new properties and applications.

The use of graphene in textiles has grown exponentially in the past 10 years, as more research is done on its unique properties and companies look to develop clothing that incorporates these benefits. UK-based advanced engineering group Versarien believes the sportswear sector is a natural fit, and is researching how graphene can make clothing more durable, moisture wicking and thermally and electrically conductive, among other things.

Graphene is a single atomic layer of graphite and is still relatively "young". It was characterised by scientists at the University of Manchester in 2004 and is the thinnest and strongest material by weight, offering strength that is 200 times that of steel, at only one atom thick. Graphite is an allotrope of carbon, meaning it possesses the same atoms but arranged differently. This arrangement allows it to take on different properties. It is flexible, transparent, highly conductive and seemingly impermeable to most gases and liquids. These properties are being exploited across industries ranging from building and transport to electronics.

"Researchers and developers are looking for new ways to enhance the properties of textiles through nanotechnology," Bobbie Lawrenson, Versarien's head of sportswear, tells us. "Graphene is one of the most promising of these technologies." His background as an ambassador for US brand Under Armour means he has experience of working around seasons, product launches and dealing with buyers in the sector. "I am able to understand the language and motivations of the sports brand collaborations I am involved in now," he explains.

Versarien has operations in South Korea, Europe and the US and graphene-focused departments at Graphene Centres of Excellence at the Universities of Manchester, Cambridge and Belfast. The textile applications it is researching include blending through melt processing, yarn coating, and printing and dyeing with graphene inks – although dyeing can be quite a wasteful process, with graphene ending up in wastewater.

Graphene can add durability to clothing when blended with fibres or printed on textiles.

ALL CREDITS: VERSARIEN

The preferred applications depend on what needs to be achieved, for instance, moisture wicking properties are dulled if graphene is inside the yarn, rather than coated on the surface, as it gets insulated.

The company is focusing on two applications: graphene ink and blending it with polymers. Its Cambridge site formulates and produces the graphene inks, which can be printed there or in Manchester. The inks are typically 100g of graphene in a litre of water, stabilised with soap-type molecules. Versarien prefers to use water rather than a chemical solvent as it believes it is better for the environment. The inks are then formulated for printing by adding polymers and different materials. Versarien has been testing fabrics with Sri Lankan clothing manufacturer MAS, adding polyurethane to the graphene so it can be cross-linked to the fabric with a chemical, which creates wash fastness. The graphene can be added using existing machinery at the textile manufacturer's end.

The thermal regulatory properties of graphene-wear creates an opportunity for the sportswear sector, says Mr Lawrenson. "The ability to cool you down when you are warm and warm you up when you are cold is an area textiles scientists are exploring. Graphene's conductivity uses the laws of thermodynamics, allowing the garments you wear to regulate zonal temperatures. And due to the way in which our graphene is incorporated, there is added improvement in drying rate, to allow the body to regulate itself through evaporative cooling."

Launched last October, Reebok's Thermowarm+Graphene internal grid print zone technology helps retain more heat than unprinted zones. The brand describes the collection as the first commercially priced use of graphene in sportswear, but does not name the supplier. The Versarien method prints the graphene ink in a hexagonal grid pattern onto the fabric, and chief technology officer Stephen Hodge admits zonal printing and patterns, rather than coating a large area, helps with costs. "There is a price uplift in some of these products but it's coming down all the time," he says.

Homogeneous yarns

The group is also blending graphene with other polymers, including polyester. It works with Warwick Manufacturing Group for melt processing and with industrial partners for the fibre spinning. When the fibres are extruded, they create homogeneous yarns with an even spread of graphene. Blending graphene in this way adds strength and durability, which Versarien says is one of the overarching sustainability features. "The aim is that garments will last longer with no fibre failure. For areas such as sports textiles, where materials are pulled, grabbed, washed, torn and subsequently thrown away, improved durability significantly impacts sustainability," says Mr Lawrenson. "Clothes would need replacing far less frequently, reducing waste, and slowing down the pace of environmentally damaging fast fashion."



Graphene ink can be printed on textiles. It is also being used for flexible electronics, due to its conductive properties.

However, the blends need to be well balanced; adding too much graphene could affect the mechanical properties of the yarn, such as the elongation.

Graphene can also be integrated into recycled materials. "Early results have shown that with the inclusion of our graphene there is a much lower need for virgin material to get to the finished 'recycled' fibre," says Mr Lawrenson. "Further work revolves around the enhancement of



Bobbie Lawrenson joined Versarien in 2020.



The Graphene Engineering Innovation Centre at the University of Manchester, where two scientists earned the Nobel Prize for Physics after 'discovering' graphene. in 2004.

textiles with the inclusion of graphene to enable end-of-life recyclability so that instead of ending up in landfill or the ocean, clothes can be broken down and remilled."

Versarien recently appointed a head of sustainability, and the company is mapping its carbon footprint. Graphite is a natural material that is mined, and there are no shortages, although the graphene Versarien uses for its inks is a synthetic version, created at very high temperatures. "We are developing processes to exploit some of the more futuristic properties of graphene, such as electroconductivity," says Mr Lawrenson. The company has also been working with a company in Spain to test its antimicrobial properties, with "positive results" against covid, although more research needs to be done.

Brand uptake

Several brands have already branched into graphene-wear, although most do not name the supplier. Hungarian sailing apparel brand 878 Company recently introduced a lightweight graphene fibre and neoprene hooded vest. UK outdoor brand Vollebak created a jacket with graphene nanoplates blended with polyurethane to create a thin membrane, bonded to nylon. Italian materials developer Directa Plus has launched several graphene-based products, early adopters including high-end Italian sportswear brand Colmar. More recently, Montreal-based trail running brand Norda used Directa's graphene membrane in the lining of a running spike. UK-based footwear brand Inov-8 has also released shoe collections with graphene in the rubber sole and in the foam.

Mr Lawrenson says footwear is an interesting sector. "It is great to see some of our competitors also bringing products to market as it demonstrates we are on the right track, it is confirmation that this is an industry that graphene can make a difference in. Almost all materials can be improved with two dimensional materials such as graphene and almost every application has potential to be stronger, lighter or improved, including anti-microbial performance. Maybe we could see an end to smelly trainers!"

> **"We're only at the beginning of the journey, with the unique properties of graphene, its usage is limitless."**
>
> BOBBIE LAWRENSON, VERSARIEN

Pooling knowledge

Versarien is now conducting wearer tests on garments in Manchester and Leeds, including abrasion testing, stretch and and recovery, water vapour permeability, water vapour resistance, absorbency, wicking, drying rate and thermal transfer. More brand and manufacturing partners are needed to advance results. "The team are graphene experts rather than textiles specialists. We look to take advantage of the strengths of the textiles specialists to understand where graphene will best make a difference to their product lines."

It is clear the material offers opportunities for the textiles sector, if the price points are workable. In some instances, private and public money can be harnessed to keep costs acceptable for consumers. Inov-8, for example, worked with the University of Manchester and benefited from a Knowledge Transfer Partnership, a UK government scheme that provides funding for innovative developments.

"We're only at the beginning of the journey," according to Mr Lawrenson on the opportunities in sportswear. "With the unique properties of graphene, its usage is limitless."

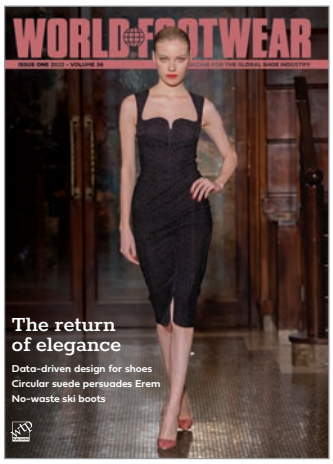
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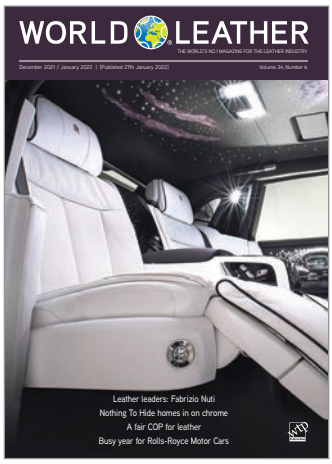
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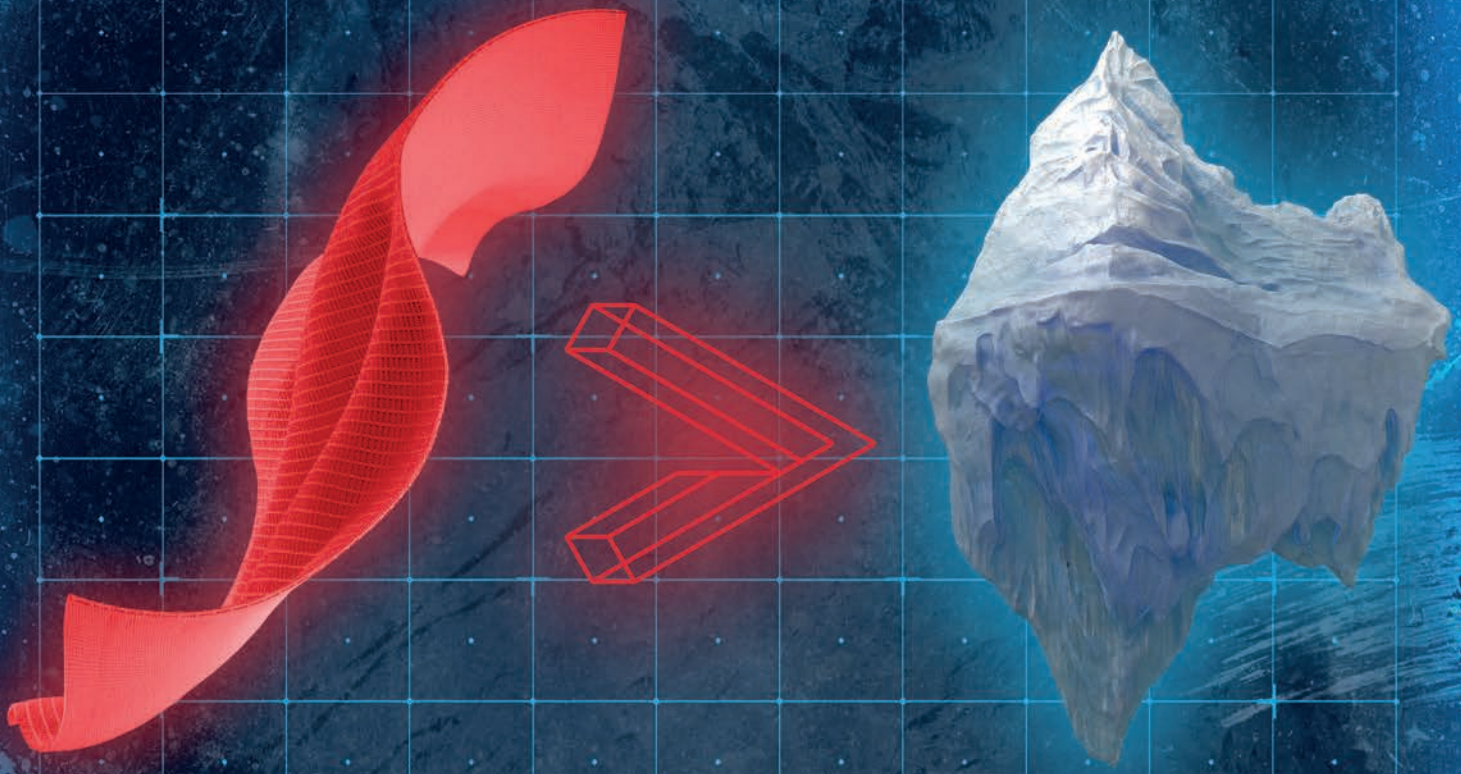
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