Recent innovation in fibres, fabrics and films points to lighter, stronger and smarter solutions for performance clothing.

Eye on the horizon

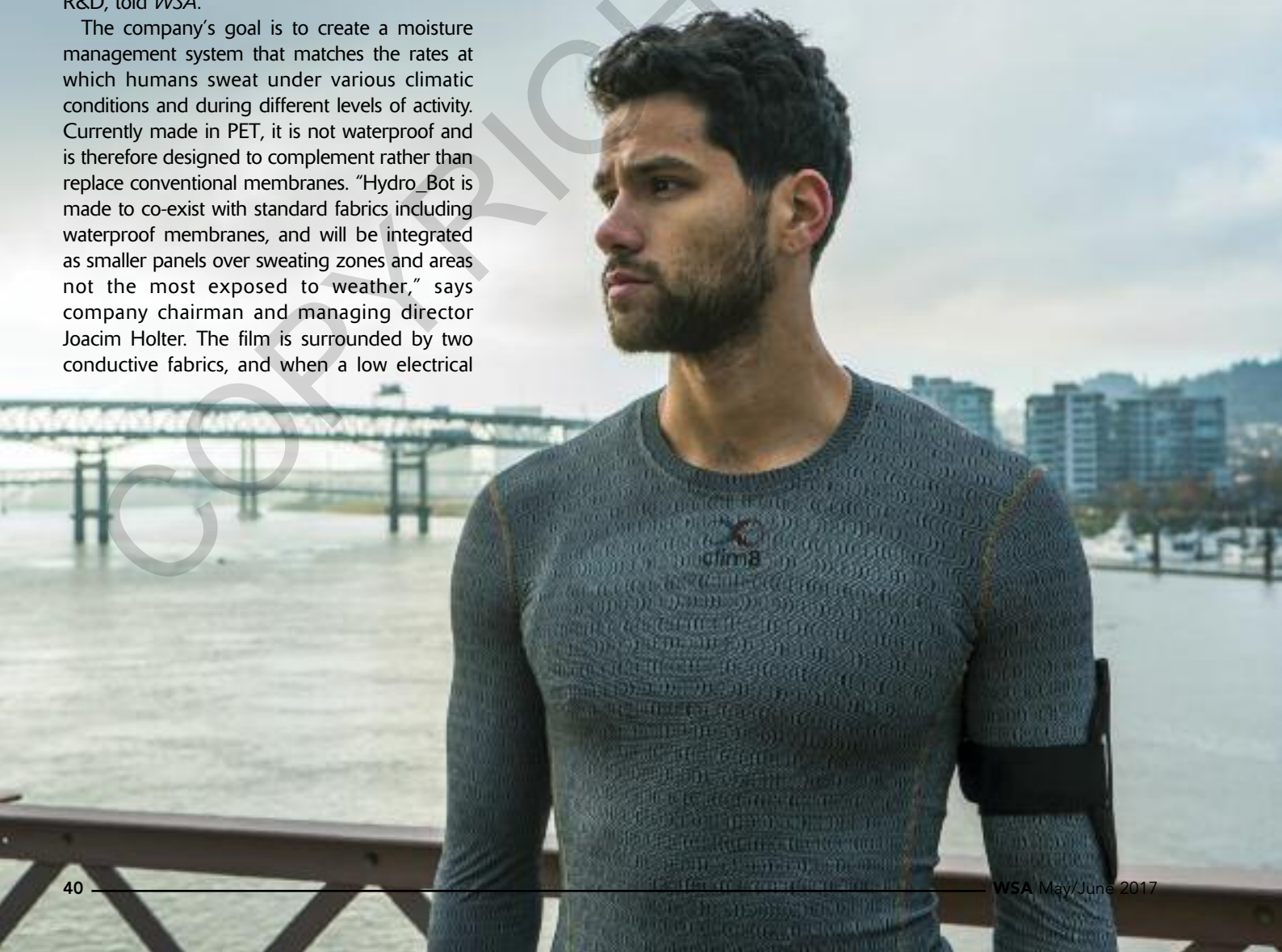
As the May edition of Techtextil in Frankfurt has closed on a record-making number of exhibitors, 1,477, from 55 countries, the crop of innovative textiles in development marks out 2017 as a strong year for innovation. The e-textile category is particularly dynamic, as component manufacturers create solutions in biometric and heating functions.

Moving moisture using electricity is one of the more disruptive technologies to be introduced and is the focus of electrokinetic technology specialist Osmotex, a company that originated in Norway and is now based in Switzerland. Its Hydro_Bot membrane technology is based on electro-osmosis, a "micropump" mechanism to transport liquid. "Electro-osmosis is a well-known principle that has not been much exploited in industry," Trond Heldal, Osmotex director of R&D, told *WSA*.

The company's goal is to create a moisture management system that matches the rates at which humans sweat under various climatic conditions and during different levels of activity. Currently made in PET, it is not waterproof and is therefore designed to complement rather than replace conventional membranes. "Hydro_Bot is made to co-exist with standard fabrics including waterproof membranes, and will be integrated as smaller panels over sweating zones and areas not the most exposed to weather," says company chairman and managing director Joacim Holter. The film is surrounded by two conductive fabrics, and when a low electrical pulse is sent through it (from 0.1 to 0.5 volt) this activates the electro-osmosis process that either dispels (negative charge) or guides (positive charge) water. In lab conditions, Hydro_Bot has been seen to transport up to 200 litres/m^2 in an hour, according to the company.

A waterproof-breathable membrane will typically require a difference in vapour pressure to transport moisture from the body to the outside. The Hydro_Bot system does not require this as a small electrical current activates the process. "Contrary to most membranes, ours will function in high humidity climates and in sub-zero temperatures," says Mr Heldal.

The electronic components of the technology include sensors and a connection to a smartphone app to gather input from weather stations and other services to determine the level of moisture movement required and "climatise"



The smart shirt developed by Clim8 calibrates the warmth it delivers to a user's pre-set preferences.

Clim8

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the inside of the garment. The company says it has 15 patent applications pertaining to sweat transportation and other processes.

Osmotex has worked with partners from across the supply chain to develop the technology. Swiss textile manufacturer Schoeller is its production partner in charge of creating the fabric panels. Wearable technology company Belginova supplies the electronics and Empa, the Swiss Federal Laboratories for Materials Science and Technology, has played a key role in the research.

Following the launch of the technology at ISPO, Osmotex has lined up a first user. Swiss skiwear brand Kjus will introduce it in its 2018/19 collection. The company is exploring other potential applications, which could be hearing aids, wound healing, medicine delivery or bacteria detection as this is "a true platform technology", says Mr Heldal.

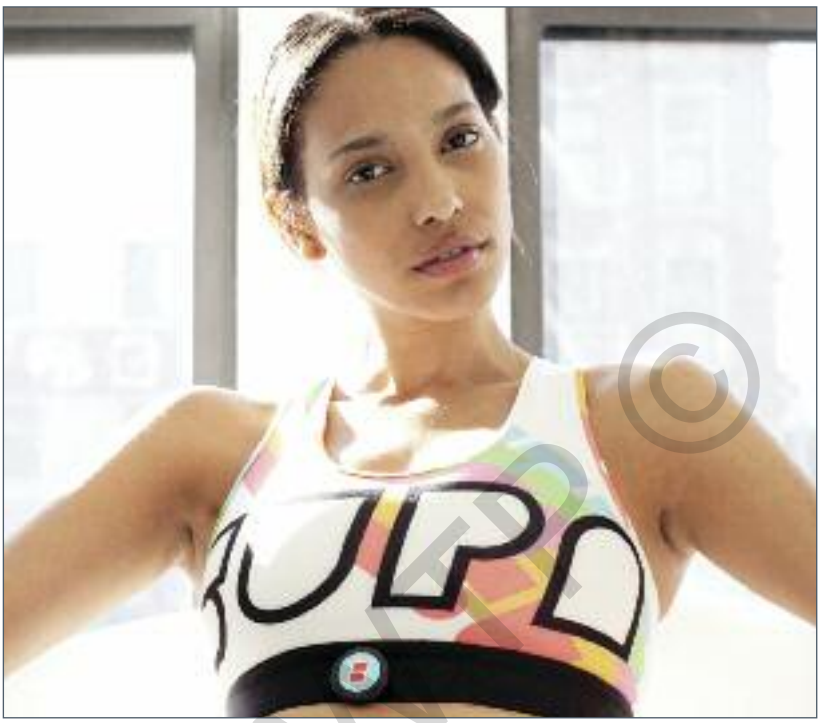
Smart components

French start-up Clim8, another new player in the electro-textile category, is working on a smart baselayer shirt that automatically regulates the temperature it delivers. The shirt's smart panel is knitted with conductive silver yarns and is equipped with sensors that measure skin temperature, ambient temperature, activity level and humidity. This data is transmitted to a smartphone app, which automatically adjusts the amount of heat delivered to the wearer's pre-set temperature preference and ensures that this is maintained. "As soon as you begin to exercise and the body starts to generate heat, the Clim8 panels will be turned off," says Julian Guéritée, Clim8's research director. For safety reasons, it will automatically shut off at 42-43°C.

The CEO of Clim8, Florian Miguet, explained to *WSA* that the company wants to be an ingredient brand and license its technology to large brands. He revealed that the first product will be launched in September this year with a Korean brand. The young company is working on developing a technology capable of offering a cooling effect on demand.

J.Nova, a Chinese company, introduced another novel heating technology. Like Clim8, it also won an ISPO award. The company has used conductive carbon nanotubes instead of metallic components, which are prone to oxidise in the presence of humidity, making its system more suitable for active sports uses. "The carbon-based nanotech material is safe, it has received FDA (US Food and Drug Administration) approval and is used in time-release pills, which means it can be can even be ingested," says Carsten Wortmann, CEO of Acanthurus, the European distributor of the technology.

Measuring only 0.24 mm in thickness, J.Nova's membrane is breathable, washable, flexible and therefore easy to integrate into clothing. The company has developed three versions that are designed to connect to a powerbank. The most elaborate has a Bluetooth chip that makes it possible to set the temperature using a smartphone app. Like Clim8, a safety feature stops the device from heating over 45°C.



The SUPA bra is one example of how smart components are now easier to integrate into clothing. The "digital platform for garments" as its developer, Sabine Seymour, calls it, can house any type of sensor, be it biometric or environmental such as UV-level monitoring. The bra connects to an AI-enabled app.

Anna Rose for She's Mercedes

Looking to simplify the integration of smart components into garment-manufacturing, Bemis, a sew-free bonding technology specialist, and Circuitex, the e-textile division of Noble Biomaterials, have partnered to create an all-in-one smart textile system. The three-layer material combines conductive tape supplied by Circuitex that is encapsulated inside two Bemis Exoflex films. The low-profile component stretches and breathes allowing designers more freedom in its placement. "It radically simplifies smart component integration into a one-step process," Lacey Johnson, brand manager at Bemis Associates, told *WSA*. More items of this type may be coming as Bemis is said to be investigating other solutions using printed circuits, such as those developed by DuPont.

Biotech innovation

While simpler smart clothing solutions begin to surface, spider silk is another cutting-edge textile development that will offer brands new high performance options. AMSilk introduced its patented Biosteel synthetic spider silk with adidas late last year. "We are the first company capable of supplying recombinant spider silk at tonne scale," says Severin Bertsch, head of AMSilk's fibre business.

The Munich-based company has developed a production process, which Mr Bertsch says is "an evolution of a common fermentation technology

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Adidas has announced that a limited series of trainers made in Biosteel, a synthetic spider silk developed by AMSilk, will be released this autumn.

adidas

using natural and sustainable carbon sources that e.coli bacteria convert into silk". The technology produces a white powder that can be spun into a natural silk biopolymer. Biosteel contains spider silk proteins in varying amounts, which suggests that the term 'silk' may be more appropriate than 'spider silk'. The fibre produced is said to possess unique properties including high tear strength, breathability, lightness and elasticity. It has been certified skin-friendly and biodegradable. "Its moisture management properties are due to the natural silk protein," says Mr Bertsch. The yarn used by adidas was developed with Gruschwitz Textilwerke, a partner company of AMSilk since 2014.

The company is working on developing another biotech silk inspired by a material that Green Lacewing insects produce to protect their eggs from predators. "This is a joint project with the Fraunhofer Institute for Applied Polymer Research in Potsdam and we are collaborating on creating a manufacturing process using bacteria," says Mr Bertsch. Green Lacewings produce a protein fibre that is stiff, contrary to the silk made by spiders and silkworms. "We believe it could find uses in medical or engineering applications where you need lightness and stiffness," he says.

The race to be the first to market a spider silk product is on, as US-based Bolt Threads demonstrated this March. It chose an unconventional venue, the technology and lifestyle convention South by South West, to launch a series of ties made in 100% Boltspun spider silk, containing "lab-grown" proteins, another bacteria-based fermentation technology. The company, which is backed by sportswear brand Patagonia, made 50 limited-edition neckties with a selling price of $314. This will be followed by adidas's Biosteel shoe, to be released this autumn. Production of The North Face Japan's Moon Parka, made in a biotech synthetic spider silk developed by Spiber, presented in 2016, has been delayed and a specific release date has yet to be announced.

Spinning new yarns

New fibre developments continue to push the boundaries of what's possible, as seen at a number of companies this year.

Acetate fibre specialist Eastman Chemical, based in Kingsport, US, has revamped the material to launch its new branded fibre Naïa. The wood pulp-derived yarn offers both sustainability and performance, says Heather Quigley, a company scientist. "It is a cellulosic fibre which means it is hydrophilic, and it has been acetylated, which gives it hydrophobic properties." A fabric made in Naïa "spreads moisture, dries faster than nylon and wicks more than polyester," she says. The company sees these characteristics as useful for intimate apparel and athleisure.

Korean weaver Bristex has expanded its range of recycled nylon fabrics in response to customer requests, KeunHun Chang told *WSA* at Performance Days in Munich. These are made from used fishing nets and Bristex buys them

Wicking, fast drying and cool to the touch fabrics made in Eastman Chemical's new Naïa cellulosic fibre target intimate apparel and athleisure.

Eastman Chemicals



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The Cordura ripstop fabric featured in Black Yak's autumn/winter 17/18 collection was developed with the help of design studio Development Never Stops and is part of the many new products the 50-year-old branded nylon is releasing this year.

Black Yak

from Korean polyamide producers Hyosung or Huvis. The new range also includes a fine denier hollow polyamide yarn that it weaves in 30, 20 and even 10 denier qualities. "These fabrics have a matte sheen that brands appreciate and they are available with two- or four-way mechanical stretch. Because they do not have Spandex, they are lighter weight," says Mr Chang.

In celebration of its first 50 years in business, Cordura is boosting its innovation stream with new versions of its fibre along with innovative fabrics developed with its mill partners and collaborations with design studios. Among the latest launches, it has partnered with German wool spinner Südwolle to create Cordura/wool yarns for performance base layers. Spanish spinner Ductel is introducing high performance corespun stretch yarns. These follow up on the patent-pending nylon 6.6 T420HT that has been two years in the making and was developed for the military, says Cordura global brand director Cindy McNaull. Collaborations with brands include new ultra lightweight ripstop fabrics developed for Korean sportswear maker Black Yak. Sustainability is also on the agenda, with Cordura Color Lock dope-dyed yarns, and fabrics coated with Susterra, a bio-based polyurethane developed by DuPont Tate & Lyle. "We're building a durable foundation for the next 50 years," says Ms McNaull.

These innovative textiles may or may not be used one day to live in space, the theme of the 2017 edition of Techtextil, but they will undeniably offer new performance solutions to those who live on Earth.



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