



Open-structured textiles play a key role in performance sports clothing. Added airflow speeds up the evaporation of moisture and enhances thermoregulation. New developments in this product category are raising the bar on what mesh fabrics can do.

Net assets

A visually striking product was voted a top innovation at the OutDoor fair in Friedrichshafen in July. Millet's Drynamic underwear is made in a seamless tubular mesh fabric and is designed to be worn under a conventional baselayer. By adding adding this new item to the outdoor enthusiast's wardrobe, the French alpine sportswear brand believes it has perfected the multi-layer clothing system.

Mesh fabrics have a long history in sports clothing and shoes. Three-dimensional spacer knits are used to lighten and ventilate sports shoe uppers. Body-mapped performance sportswear features panels made in netting to boost breathability in the areas of the body that sweat the most. Applying the open-structure fabric to the entire body, as Millet has done, signals a new approach, although Norwegian

brand Aclima may disagree, as this company has been offering net underwear for years.

"Drynamic is our 0.5 layer," says Frederic Fages, Millet's global brand manager. "It is made in a three-dimensional mesh and works with the base layer to accelerate water vapour transfer." This item adds a new layer to the brand's four-layer 'Interactive Shell System', which includes a weatherproof protective shell, an action shell providing wind resistance, a thermal shell and a transfer layer that wicks away humidity to the outer layers. "When you add the Drynamic layer, a wearer will practically not feel any humidity on the skin. It also reduces the potential loss of energy needed to keep the body warm," he says. Millet is already working on the next generation Drynamic singlets for spring 2018. These should combine open and closed sections in a hybrid

New York-based model and fitness advocate, Gigi Hadid, has become part of a campaign run by sports brand Reebok to inspire women to "celebrate the beauty of imperfection". The former competitive athlete in volleyball and equestrianism sports a mesh top illustrating how she fuses fashion and fitness.

 Reebok



Millet's innovative Dynamic seamless 3D mesh top heralds a new 0.5-layer category. Added air circulation is said to wick away moisture to avoid overheating during intense activities.



construction that should be more comfortable and durable.

Millet's award-winning underwear updates a product that has been in Adima's collections for years. This vertically-integrated Norwegian company that has spinning, knitting and sewing facilities in Krøderen, a village 100 kilometres north of Oslo, specialises in underwear. It used to make garments in cotton net and recently switched to wool, polyester-wool blends (WoolNet) and polypropylene (CoolNet). "The basic function of mesh is to allow airflow and to wick away humidity but it also insulates against the cold, and as an under layer, it is actually warmer than a solid fabric," Kari Hogema, head of product development, tells WSA. The brand's mesh products are lined with jersey at the elbows and knees for comfort and at the shoulders to protect pressure points when wearing a backpack.

Among the many performance features these surprisingly simple items possess, Ms Hogema points out that the open structure "solves the issue of wool's long drying times" and it can be worn in many different climate conditions. "CoolNet, which is made in polypropylene, is recommended for hard activities that will generate sweat, as it is better at wicking," says sales manager Lars Eivind Johansen. "WoolNet is an ideal all-around product that keeps the body warm even when wet, won't smell as much and

can be worn for longer periods of time. When it comes to sales, we sell about ten times more WoolNet products."

Ventilation and stimulation

As opposed to these almost fully transparent under clothes, many performance base layers feature body-mapped constructions combining several types of knit textures to target specific functions at different body areas. Falke, an underwear and sock maker based in Schmallingenberg, Germany, designs its products according to a concept it calls Air Ventilation, which optimises airflow. The warp knit fabric integrates fishnet sections that "open and close with each movement and step," says Michael Meier a Falke Ergonomic Sport System product manager. "The movement of the knit conducts air to the body. The air then transfers excess heat away. At the same time, it speeds up moisture evaporation, which cools the body. The warp knit technology also enables us to make seamless clothes, providing users with added freedom of movement and comfort."

Falke's Impulse Air Sock, a new product for spring-summer 2017, goes one step further. The open structure transports heat and moisture away from the feet but also stimulates receptors on the soles of the feet. "The stimulation of the receptors improves the body's coordination by providing more precise feedback regarding the position and distribution of weight on the feet. This unconscious knowledge helps improve the dynamics of movement," adds Mr Meier.

In addition to air circulation and wicking, Wool Net underwear by Norwegian brand Aclima insulates from the cold and can be warmer than a solid fabric says product manager Kari Hogema.



Engineered structures

With jacquard knitting and weaving, variations in yarns and the construction of the textile can be engineered to offer varied functions. Italian weaver Taiana has developed a series of fabrics with open and closed sections. "We customise the placement of the different sections to the specifications of each client," says sales manager Matteo Taiana. "The mesh sections provide added cooling and transparency, which is a request from customers." The advantage of the woven structure is that the mesh sections won't be as see-through as a knit and can therefore be used on a larger portion of the garment, he adds. The two ranges, Prey and PreyCool, are made with a special star-section yarn that enhances airflow and moisture management. "It dries twice as fast as a round-section yarn," Mr Taiana points out. He says these features can be useful for cycling and trail running clothing as athletes will be faced with extreme temperature variations. The concept has been adopted by adidas for its Adistar Engineered Woven seamless cycling kit, showcased at Eurobike this year.

Despite their intricate constructions, body-mapped baselayers tend to look alike and are now well-established on the market. But new options are emerging. Tianhai Athleisure Solutions (TAS), a new division of Chinese lace manufacturer Tianhai Lace, has decided to take advantage of its vast array of lace, rascheltronic and circular knitting machines to develop sportswear that offers innumerable possibilities for personalisation. The company is exhibiting at Performance Days in November to promote its 'Design-to-Garment' (D2G) solution in which each shape and pattern can be manufactured to a brand's specifications. "The company can develop almost any type of open structure, be it mesh, lace or variations on these," says Hans Bühr, a consultant for TAS. He believes the patterned knits will fill a gap in a market dominated by plain fabrics. The engineered-to-shape concept "allows any type of pattern repetition for tops and bottoms including finishing details such as hems, waists and necklines," he adds.

To cater to the specific needs of active sportswear and athleisure brands, TAS can use functional fibres that have moisture management, cooling or moisturising properties. Stretch can be adapted to need, from light hold to high compression, it says. It has partnered with HeiQ and can add the Pure Silk finish to give a softer hand feel to its fabrics. The company is also working with a team of researchers in Hong Kong to develop an exo-skeleton based on a lace-like fabric. "Our technology makes it very simple to add or take material out to pinpoint as precisely as possible the required function," says Mr Bühr.



A Falke Cool top from the Spring/Summer 2017 range features the brand's air ventilation technology that will open and close with the slightest respiratory or body movement, the company says.

 Falke

Spacer knits

Three-dimensional spacer knits have long been popular in footwear, and are gaining ground in apparel, from technical sportswear to high fashion. One of the more spectacular items exhibited at the Manus x Machina show at the New York Metropolitan Museum of Art this year was a wedding dress made by Chanel in what it calls "scuba knit", which looked suspiciously like a very fine spacer knit traditionally used in intimate apparel. Though very fine, these fabrics encapsulate a layer of air to enhance wearer comfort and reduce drying times.

Heathcoat Fabrics, based in Tiverton, UK, specialises in the three-dimensional knit, which it offers in a wide array of styles and weights, ranging from 130 to 900 grammes per square-metre. To address increased demand for these high-tech fabrics, it has installed three new warp-knitting machines in the past 12 months and is adding two more in the coming months. "These new machines will enable us to expand our designs and develop new structures beyond the standard shapes currently seen," says Heathcoat's Louise Davies. The company offers spacer knits with Coolmax and Coolmax FX yarns that provide moisture management and antibacterial functions. It also combines black yarns with undyed yarns to create different colour combinations. Responding to requests from its clients, the knitter also plans to increase its use of natural fibres, including cotton, in the future.

Besides the functional benefit of added airflow, spacer knits also have distinct aesthetics which make them popular in fashion and performance



Sensitive Sculpt Light fabrics by Eurojersey are also offered with perforations.

 Eurojersey

clothing. New design options are being made possible with digital printing, seen in the collections of several spring-summer 2017 fashion shows. In shoes, spacer knits are replacing traditional foams, says Phillip Wignall, Heathcoat's business manager for knitting. This has a number of advantages, he says: "The knit's airy structure means it is lighter than foam, it is made in polyester, which can be recycled, and it lasts longer as foams tend to break down over time and won't wash well."

Perforations and punches

Combining a technical feature with a striking graphic look, Eurojersey has created perforated versions of its Sensitive warp-knit fabrics. These are available on single- and double-layer bonded knits and with small or large holes. "Our laser-cut punched fabrics enhance the breathability of the garment and create a technical mesh look," says Matteo Agliaudi, Eurojersey's research and development manager, noting that from afar, the holes are not visible, which is an added perk designers can take advantage of. These fabrics are being used wherever added airflow is necessary, he says.

In a more classic vein, Italian warp-knitter Carvico has developed a new range, known as Spider mesh, with a slightly more open structure, made in either polyamide or polyester and with 10% elastane, for cycling or running clothing. A very fine mesh effect was recently shown at Eurobike. Cycling is a growing category for both Carvico and its sister company, circular-knit specialist Jersey Lomellina.

An innovative open-structure knit, Polartec Alpha is becoming the go-to solution for ultra-lightweight warmth among cycling brands.

"Polartec redefined the insulation category for the outdoors, cycling and athletics," says head product manager, Doug Kelliher. Traditional insulation, he says, locks in warmth. "Athletes are always moving and often overheat. As soon as they move, they need to unzip. Polartec Alpha retains warmth but when an athlete moves, air flows through to remove excess heat." The loosely knitted fabric does not require any scrim layers as most waddings or battings do. Polartec's latest development in this category, Alpha Direct, merges the open structure with a "solid" knit and does not require a lining fabric, further lightening the weight of the finished garment.

From baselayers to thermal layers and from delicate lace to fuzzy batting-like fabrics manufacturers continue to explore new end-uses and constructions for mesh materials. With their unique combination of emptiness and fullness, these fabrics lighten the weight of a garment, a frequent demand in performance clothing. This may also be their only weakness, which lies in their innate fragility.

The Insulated Brevet Gilet from UK cycling brand Rapha won a Polartec Apex Design Award in 2016. It is lined with temperature-regulating Polartec Alpha and is designed for long-distance riders who may encounter a wide range of weather conditions.

 Polartec

