

A new series of developments claims to adapt moisture management functions to the body's needs. These innovative baselayer textiles focus on optimising evaporative cooling, the body's natural mechanism for maintaining its core temperature.

Moisture management fine-tuned

The array of functional concepts found in the baselayer category is a testimony to the varied ways in which yarns, fabrics and finishes seek to provide an ideal combination of properties to address the subtleties of next-to-skin comfort. The microclimate located between the skin and the first layer of clothing is subject to fluctuating temperature and humidity levels that have a high impact on how an athlete feels and performs.

Among the novel solutions that are coming to market, London-based start-up MMT Textiles is working on a biomimetic pinecone-effect bi-component yarn called Inotek, which is said to adapt moisture management to the body's needs. Inotek is, in the company's words, a "mechanical shape-change staple fibre" combining two polymers in a sheath-core yarn. The two polymers react differently to moisture, one being hydrophobic and the other hydrophilic, making the yarn contract and twist. The increased crimp creates openings in the textile, letting more air through, thus speeding up the wicking process. The company has tested various combinations of polymers and does not officially say what materials it uses. In one of the patents it has filed, the pairing of polyamide 6 with polypropylene is mentioned as a possible combination.

MMT Textiles co-founder Dr Veronika Kapsali, who holds a doctorate in biomimetic textiles at the University of Bath's mechanical engineering department developed and patented the fibre. She based her work on research into the pinecone's hygroscopic, responsive shape-change mechanism. Earlier research by Japanese fibre producer Teijin had led to a similar bi-component filament yarn, which in the presence of humidity did not contract but rather elongated, causing the fabric to lose its dimensional stability, says Stuart Allion, MMT



37.5 technology is being featured in the Asics winter 14/15 collection, including the Winter Hybrid running jacket.

Asics / 37.5

Textiles co-founder, adding that “very few shape-changing fibres are able to revert to their original form; we have achieved this with the staple fibre”. The yarn is said to be suitable both for knitting and weaving.

Inotek manages moisture in a way never done before, claims Mr Allion: “Our technology reacts to water vapour before saturation, which means keeping the user comfortable for longer.” When the body begins to sweat, the textile opens to let more moisture escape. The fibre has undergone extensive lab testing, at the North Carolina State University Textile Protection and Comfort Centre as well as at Natick, the US army’s soldier systems centre, where textile expert Phillip Gibson has put the material through the lab’s humidity chamber, according to Mr Allion.

The development process for Inotek has been long and remains a work-in-progress. Among the many challenges, “finding the right finishing level for the bi-component fibres with regard to the management of static electricity during carding was a difficult task,” says Mr Allion. Work is already under way on a second-generation version that addresses the need for a more robust fibre that retains full functionality after the aggressive processes of carding and spinning.

The finest fibre count for Inotek currently weighs 1.5 denier, so that spinning into a 40/1’s yarn count required for some first-layer apparel items is difficult, and the company would like to reach 1.2 denier. Fabrics of good baselayer weight (150g/m²) have successfully been made and tested in 50/50 Inotek/cotton and 50/50 Inotek/Tencel.

Temperature or humidity activated

Inotek, like many moisture management textiles, reacts to humidity, while Adaptive, a fabric finish made by Switzerland-based HeiQ, claims to be one of the few next-to-skin solutions that reacts to temperature. The chemicals company believes temperature-activated materials are better at providing optimal comfort and has recently introduced an improved version of its high-tech finish.

Adaptive, as its name implies, is a dynamic - as opposed to passive - process that adapts its properties to need. “Skin temperature varies between 24°C to 34°C during exertion, which is the range in which Adaptive works at its best,” says HeiQ chief executive, Carlo Centonze. The topical textile finish, which is composed of what the company defines as a “hydro-functional polymer,” adapts its moisture affinity as the temperature changes. At low temperatures, the finish reduces evaporation of moisture, and at high skin temperatures, it enhances the release of sweat to optimise evaporative cooling, the endothermic (heat-absorbing) mechanism that cools our body, says Mr Centonze.



Adidas have also incorporated 37.5 technology in their latest Terrex Ndosphere Jacket.
adidas

The new, longer-lasting version of HeiQ Adaptive 4 will withstand 30 to 50 home launderings, depending on fibre and fabric construction, the company says. Fifty brands worldwide have adopted the concept. “2013 was in essence a year dedicated to early adopters; now we are seeing market leaders manifest interest for the finish,” says Mr Centonze, who mentions New Balance as a company that has made HeiQ one of its premium innovation partners.

The recent rebranding of Cocona into 37.5 is a telling signal of the new focus on maintaining an ideal core body temperature in performance textiles. The new name has inspired the Boulder, Colorado-based company to recast its key marketing message. “The human body is similar to an engine, and as such it heats all day long. When it reaches the point of overheating, the skin begins to sweat,” says 37.5 CEO Jeff Bowman. The activated particles in 37.5 are said to increase surface area by 800% and to have a high affinity for moisture vapour, moving it away from the skin. The particles are made from carbonised coconut husks, which the company says have an ideal pore size, compared to bamboo carbon, to adsorb (attract) and desorb (release) water vapour molecules. “As an ancillary benefit,” says Mr Bowman, “the pores also capture the molecules that typically cause body odour.”

A feature that distinguishes 37.5 from other comfort solutions is that it can be used in all garment layers, from next-to-skin to mid layer, in blends with merino wool or in fleece fabrics, and to outerwear, where the so-called active particles are embedded in a polyurethane membrane.

High-tech knits

A specialist in innovative next-to-skin concepts, Swiss sportswear brand X-Bionic has recently introduced a garment that attempts to “trick” the body into activating its natural body-temperature regulating system: perspiration. “The human body has heat sensors in the backbone that send a signal to the brain when it feels hot, triggering the skin pores to open and release sweat,” says X-Bionic research & development manager Linda Niessing. “The goal is to generate sweat production earlier in order to avoid peak temperature. This in turn helps the body save energy,” she says. Made for running and cycling, the Trick, as the new top is called, has a special insulating yarn and knit structure placed along the backbone, which makes that section of the body warmer, thus ‘tricking’ the brain into thinking it needs to initiate sweating.

Like other high performance ranges developed by X-Bionic, the Trick also features what the company calls the “3D Bionic Sphere System”: a three-dimensional knit structure with alternating ridges and air pockets placed in areas where the body perspires the most. “Excess sweat is absorbed by the ridges, which spread moisture over a larger surface and optimise evaporative cooling,” says Ms Niessing. “The air pockets on the outside trap warm air when the body is dry, and stores the extra moisture when the body sweats.”

Knit manufacturers are quick to point out the advantages of building moisture management into the textile itself without adding a fabric finish prone to washing away in time. “Choice of yarn, knit structure and finish all play a role in next-to-skin comfort,” says Manuel Barros, chief executive of Portuguese knit specialist LMA. As well as being a former footballer and now a keen cyclist, Manuel Barros worked for ten years at Citeve, the Portuguese textile industry’s centre for research and development. He is, therefore, well qualified to test many of the knits made by LMA; based on this, he considers ThermoCool to be one of the better solutions. “The combination of a hollow-core and a channelled yarn offers high performance moisture management and maintains the right balance of warmth and coolness,” he says.

Knit structure also contributes to wearer comfort, and one solution is to reduce contact between the textile and the skin. A grid-like honeycomb knit made by LMA is designed so that only 45% of the fabric is in contact with the skin, leaving 55% of the skin’s surface to interact with air. “Added air circulation improves wearer comfort and avoids the clammy feel of a damp textile on the skin,” says Mr Barros. The company applies a hydrophilic micro silicone finish to achieve a good hand feel, and also proposes HeiQ’s Adaptive as an option.



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X-Bionic

Dry-Clim, developed by Spanish knitter Sportswear Argentona (SPW), takes a similar approach to moisture management by reducing contact between the skin and the textile. First offered as a double-face knit combining a microfibre face and heavier denier yarn back, that is carbon brushed to reduce contact with the skin, the concept is now also applied to single knits. Lab studies have shown that 20% of the humidity stays inside and 80% wicks to the outside of the fabric, says the company. “Less humidity next to the skin provides buffering against temperature variations,” says sales manager Laurent Costella. Launched ten years



The compression sleeves made by Zensah feature a body-mapped differentiated knit structure and are made in a polyamide 6.6 developed for the purpose by Nilit.

Zensah

ago, Dry-Clim is SPW's best selling category, accounting for 30% of sales, according to CEO and owner Carlos Pares. He adds that the advantage of fibre-based concepts such as Dry-Clim is that "no chemistry is necessary. A garment washed hundreds of times will continue to function."

Double-sided fabrics are a "clever choice to ensure maximum comfort to the end user," confirm engineers at Carvico and Jersey Lomellina, two Italian knit manufacturers that are a part of the Carvico group, which also owns Eurojersey and is involved in the XLance joint-venture with Aquafil. However, they tend to think that it is more appropriate to speak of "a reduction in the resistance to the transfer of moisture rather than an increase in evaporative cooling".

Alternatives to polyester

While many active sportswear brands favour polyester for their baselayers, some prefer polyamide for its cool hand feel. Zensah, a maker of compression sleeves, that feature elaborate differentiated knit structures, works with a yarn produced by Nilit. The Israel-based polyamide 6.6 producer has recently expanded its ranges to offer new performance features.

Coffee charcoal is added to the polymer of the newly released Nilit Heat nylon 6.6 yarn to offer thermo-regulation, anti-bacterial and anti-odour properties. "The complex structure of the coffee charcoal additive in this yarn captures body heat and keeps it in the garment," commented Nilit technical service manager, Alon Weiser, in a company statement.

Polyamide 6.6 producer Nylstar has announced that it will invest €1.2 million in its production facilities in Blanes, near Barcelona, increasing capacity to 17,000 tonnes a year, a jump of more than 13%. "This investment is a direct consequence of the growing demand for fine-count yarns that has been reflected in our sales recently," said Zigor Kortazar, Nylstar's chief executive. Among the new products being rolled out, Nylstar Sublime is a super fine (0.47 decitex per filament) yarn that is said to be very good at wicking in addition to its cool and soft touch. The company is currently revamping its marketing strategy to focus more clearly on consumer benefits. As a result, Nylstar Gold is being rebranded as Nylstar Hyaluranon to market it as a cosmetic fibre and the former Meryl Active System is being replaced by Meryl Sport as the umbrella brand for performance end-uses, says Nylstar marketing manager, Carla Fernandez-Moreno.

Merino wool is another popular material in baselayers, offering its own set of performance features. As can be expected from a merino wool specialist, Designer Textiles International



French sports brand Salomon has incorporated 37.5 technology in a variety of products for the coming season, including the S-LAB Exo Zip Tee that combines moisture management and muscle support.

 Salomon / 37.5

(DTI) favours placing the merino wool yarns next to the skin in double-face knits. Though the fibre absorbs moisture, it doesn't tend to feel damp on the skin. "Merino keeps a cushion of moisture next to the skin, which means that evaporation continues, but at a slower rate," says DTI innovation and R&D manager, David Carter. "Traditionalists will want the natural fibre next to the skin, while new players are more receptive to placing a polyester yarn next to the skin," he says, singling out the options of mixing hollow and channelled yarns, as in ThermoCool, or blending merino with a carbon-enhanced fibre, such as 37.5.

The complex climate conditions in between textile and body are a source, for some, of new insight into how moisture, heat and textile react. Columbia Sportswear's Omni-Freeze Zero is a case in point and continues to be refined since its launch in 2013. "We understand better now how the process functions," says Woody Blackford, head of research and development. "The absorbent rings shift moisture away from the fabric to the blue polymer circles, and thus makes the evaporative cooling process continue for a longer period."

Whether they react to heat or to humidity, these innovative concepts continue to fine-tune their ability to manage moisture by keeping just the right amount of humidity next to the skin. Stocking water vapour, modulating moisture transfer or resistance, increasing air permeability, and reducing skin contact are just some of the ways they do the trick. 