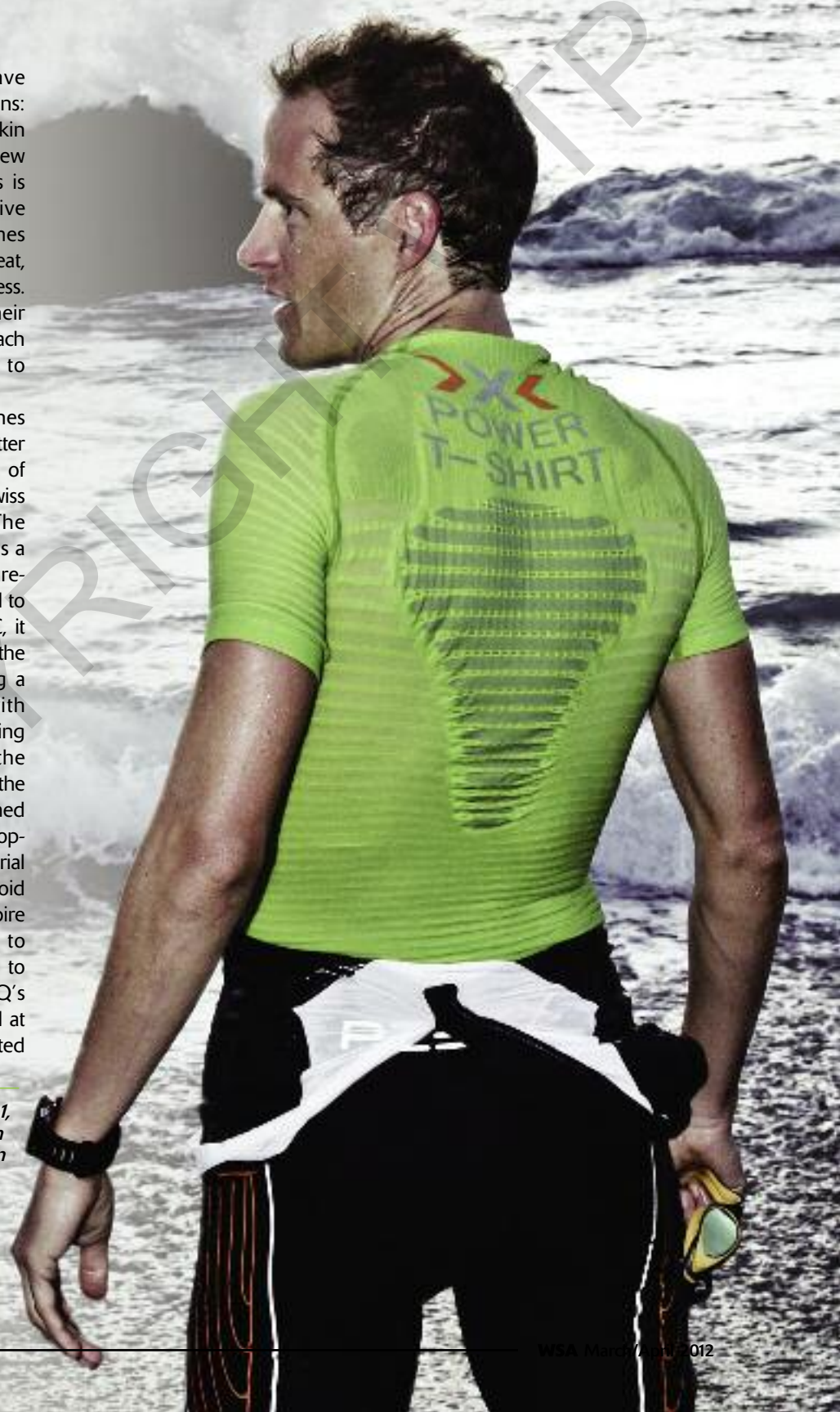
Keeping athletes cool in the course of exercise or competition is the goal of a series of new developments in fibres, finishing and fabrics.

Fresh solutions in the quest for coolness

Moisture management textiles have traditionally focused on two functions: wicking humidity away from the skin and accelerating evaporation. A new family of fibres, finishes and fabrics is looking to optimise the evaporative process itself. Evaporation consumes calories, thereby absorbing excess heat, which results in a feeling of freshness. These materials are in effect modelling their properties on the body's physiological approach to lowering skin temperature, which is to perspire when overheating.

These new moisture management finishes and fibres are refining their properties to better adapt to the body's needs. This is the case of Adaptive, a new finish developed by the Swiss specialty chemicals company HeiQ. The treatment is based on what the company calls a hydro-functional polymer that is temperature-sensitive and coats each fibre. Adaptive is said to work in two ways. Between 30°C and 35°C, it spreads moisture over the entire surface of the fibres, accelerating evaporation and creating a feeling of freshness. When saturated with moisture, the polymer is said to retract, expelling the humidity even faster. Below 30°C, the polymer regains its initial state and is dry to the touch, which explains why it is has been named Adaptive. This is an important feature for stop-and-go sports because below 30°C the material focuses on moisture absorption to help avoid post-activity chills. "The body begins to perspire at 32°C; Adaptive changes its reaction to humidity in a temperature range of 30°C to 35°C," says Christophe Maestripieri, HeiQ's regional sales manager for France. Launched at ITMA last September, Adaptive is being tested



Winner of a Eurobike Award in September 2011, X-Bionic's Power T-shirt is worn by the German ironman triathlete Timo Bracht and features an elaborate combination of yarns and knit textures, with alternating lines of compression which is said to help reduce not only skin temperature but blood temperature as well.
X-Bionic

COPYRIGHT

in a number of markets, including sportswear and bedding, and on polyester and cotton fabrics. HeiQ has yet to fine-tune the new process, which currently lasts for between 10 and 20 washes.

Columbia Sportswear is launching a new cool-effect fabric concept, Omnifreeze Ice, in its spring-summer 2012 collections, pursuing its strategy to provide consumers with innovative functional apparel. Omnifreeze Ice combines a special additive with a flat filament yarn. The additive changes state in the presence of moisture, producing a cool sensation. "The additive does not undergo a complete change of state, as in solid to gel, rather the substance absorbs moisture and swells, consuming energy in the process, which produces the fresh feel. The degree of coolness depends on humidity levels. In lab conditions, we were able to achieve a heat reduction of 1°C to 1.5°C, but it would be difficult to make that claim in real life," says Woody Blackford, Columbia Sportswear's vice-president of innovation. "The flat filament creates a greater surface of contact with the skin, and it has a higher degree of heat convection." By combining the additive with the flat yarn, the company can promote a permanent effect that won't wash out. Durability is estimated at 50 washes, although the cool feel will erode over time, according to Mr Blackford.

With the introduction of Duoregulation, European fibre producer Advansa has also made a move to emphasise adaptive comfort by revamping its description of how ThermoCool works. The fabric concept is said to optimise the body's natural thermal capabilities by combining two types of fibres. When the body perspires, the modified cross-section polyester speeds up moisture evaporation. In cold conditions, the hollow core polyester filament kicks in to provide thermo-buffering, which also helps prevent post-exercise chills. The two combined are said to reduce temperature variations to keep the body in an ideal "comfort zone".

Moisture management 2.0

Luxicool, the polymer developed by the Belgian company Luxilon, is another recent addition to the fresh effect fibre family. The soon-to-be patented polymer combines hydrophilic and hydrophobic molecules that break water molecules apart and is also conductive. These two properties are what cool the skin (the fibre was featured in *WSA* May-June 2011). After having developed a range of Luxicool knit fabrics with the French knitter Sofileta, Luxilon is now working with a manufacturer of woven fabrics. "Initial testing indicates that the woven could be even more effective, bringing skin temperature down by another degree [achieving a difference of] nearly 5°C and with a lower level of residual humidity," says Herbert de Breuck, Luxilon's sales and R&D manager. Other tests, also done at EMPA in Switzerland, have shown that Luxicool fabrics return to normal temperatures faster than other fibres. "This is important because after a marathon for example, you want the fabric to stop cooling the body," adds Mr de Breuck.



In 2012, Columbia Sportswear is introducing Omnifreeze Ice, a combination of fibre and additive that produces a cool effect when moisture reaches the surface of the fabric. Colombia

French knitter Sofileta has not only developed a range of fabrics with Luxicool but is also offering cooling fabrics treated with HeiQ's Adaptive finish. "These products are part of a whole new category of textiles that combine advanced moisture management with a cooling effect. They push back the limits of humidity saturation, delaying the moment when the textile clings to the body and feels clammy," says Dominique Heuillard, project and product manager at Sofileta, in France.

Despite its apparent efficiency at keeping the body cool when in activity, Luxicool does not have a cool hand when first touched. "The fresh feel begins when the fabric comes in contact with humidity. It takes a few minutes for the process to begin," says Mr de Breuck. Luxilon is investigating the possibility of incorporating a phase-change substance to the fibre and has joined the European research programme Noterefiga, which is working on temperature-regulating substances based on bio-sourced phase-change materials (PCMs). A new bi-component version of Luxicool, with PCMs added to the polymer, could be launched by the end of 2012.

Cool to the touch

PCM-based textiles, such as Outlast, are often cool to the touch, but they do not wick away humidity or accelerate moisture evaporation. They are said however to minimise perspiration

COPYRIGHT WTF

by reducing temperature variations. Several cool-hand fibres are being introduced and claiming both a fresh feel to the touch and improved moisture management.

Italian technical textile manufacturer Lenzi Egisto has been working with a PTFE or fluorofibre, called Tepso, which has a cool hand to the touch. Because the PTFE polymer (which is the same chemical composition as Teflon) is said to have low friction, Lenzi Egisto first used the fibre in apparel made for people suffering from psoriasis. The company is now introducing it in sportswear as Tepso Dynamic.

Cool Jade is yet another new development in the cool-hand fabric category. Jade-based fibres are currently being developed by a number of Taiwanese companies that presented their fabrics at Performance Days last autumn. The fabrics are made using a polyester fibre, often given an x-shaped cross section, incorporating jade powder. Though technical data is hard to come by, these cool-effect fabrics are said to reduce skin temperature by 2°C to 4°C. The presence of the jade particles produces an endothermic reaction that absorbs energy, generating a feeling of freshness. The jade fibre fabrics do feel cool to the hand, at first touch, after which the fabric stabilises at ambient temperature due to heat convection.

Hyperbola, Labtex, All Magic Sports (Magic Cool), Chia Her, Far Eastern New Century (Top Cool) and Chieftex are some of the many Taiwan-based companies that have recently added the so-called jade fibres to their functional fabric offering. For summer outdoor sports, Chieftex for example combines the cool feel of jade with UV protection. "A nano-sized cooling mineral derived from jade is integrated into the filament to boost the fibre's cooling capacity. A special cross-section improves humidity diffusion and moisture release, which also contribute to cooling the body during exercise," says Henry Huang, Chieftex's export sales manager. Chase Wong, at Chia Her, another Taiwan-based company, stresses however that though "the first touch is cool, the fresh feel doesn't last long". French outdoor brand Millet is introducing Cool Jade in its spring-summer 2012 range. Sophie Duflos, the company's head designer says the fabric "feels different when worn; it really has a fresh hand." This is seen as an added benefit in stores because, she says, "the first feel is fresh, which is an added incentive to buy the garment".

Menthol freshness

Menthol additives are yet another option in the fresh feel fabric group. Textile finishing suppliers such as Cognis and Blondel, among others, encapsulate menthol-type substances that can be grafted to a fabric. However, the burst of freshness released by the microcapsules doesn't last long. Once the capsules are empty, they no longer produce a cool effect. The problem with menthol is that it creates a fresh feel but does not trigger the physiological reaction of sweat evaporation, says Cyril Chaigneau, research and development textile engineer at Damart, in France. The French mail-order company is investigating a new option based on encapsulated xylitol. A by-product of beechwood cellulose (the raw material for Lenzing's Modal fibre), xylitol is another type of fresh-effect additive often used in chewing gum. The substance was the subject of a thesis by a young textile engineer, Gauthier Bedeck, the recipient of the Theophile Legrand award for textile innovation in 2010. Damart has partnered with Bedeck to bring his invention to market. The process is based on what Bedeck calls a "hydric phase-change material" or HPCM. When moisture penetrates the semi-permeable membrane of the microcapsules, it dissolves the xylitol, an operation that absorbs heat and cools the body. Damart is currently working on making the process viable on an industrial scale and plans to introduce the cool effect finish in its spring-summer 2013 Ocealys range.



Millet's X-Cool seamless knit base layers are made from 75% recycled polyester and 25% Cool Jade polyamide, a fibre that has a fresh feel at first touch.
Millet

Traditional cool and dry options

The original "cooling" fibre, Coolmax was introduced in the mid 1980s and is considered the first moisture management fibre. The polyester filament has a modified x-shaped cross-section, which increases fibre surface area, boosts moisture transport, and accelerates the evaporative process.

Many other manufacturers have since launched polyester filaments with modified

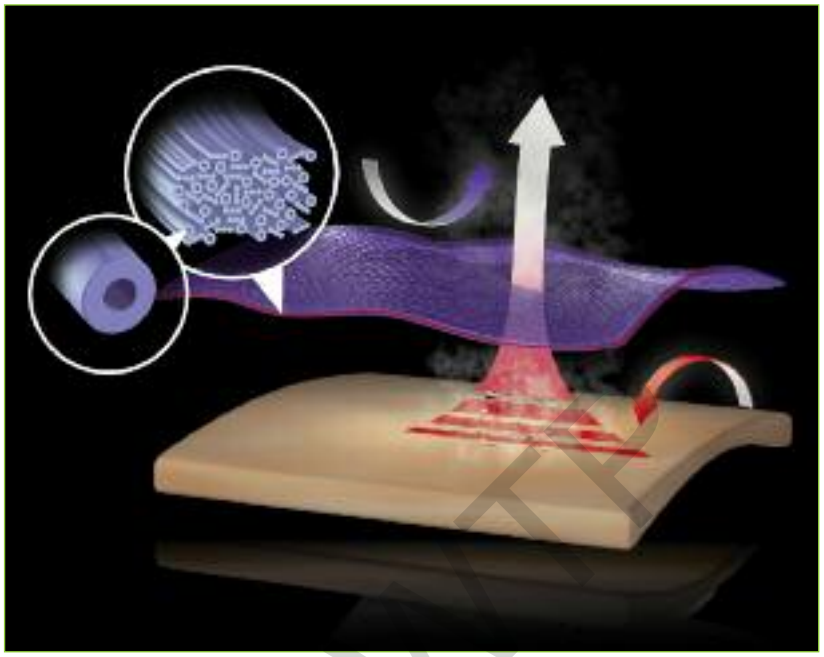
COPYRIGHT WTP

cross-sections, including Burlington (Cooltec), Sofila (BeCool, also available in polyamide), Korteks (Dry Touch, a polyester with five channels), and so on. Invista's Coolmax itself is now given a six-channel cross-section. These varied yarn geometries increase the fibre's surface area compared to conventional round cross-section yarns. Turkish fibre producer Korteks says Dry Touch has a surface area that is three times larger than a round filament.

Polypropylene is another traditional fibre used in first-layer moisture management apparel. While polyamide and polyester retain some humidity, polypropylene is considered a superior hydrophobic fibre as it absorbs no water, which implies that all the moisture evaporates, and cools the skin. A study conducted by Turin Polytechnic in 2011 concluded that the thermo-physiological comfort of a Dryarn polypropylene T-shirt is due to "less variation in skin temperature around the mean value thanks to its low thermal resistance" and "management of perspiration".

An Italian company SIXS has developed a patented double-face knit combining polypropylene (Aquafil's Dryarn) with a carbon fibre (from Technofilati) to further improve the evaporation process, says Marco Dall'Olmo, company manager. Other Italian companies, including Mico and Tecso, exhibited seamless high-tech sportswear collections made in Dryarn polypropylene at Ispo in January.

From fibre geometry to new additives and polymers, sportswear brands now have a wide array of fresh-effect materials to choose from in the quest to keep athletes cool in the heat of exercise.



Advansa's ThermoCool combines modified cross-section filaments with hollow core filaments to provide enhanced moisture evaporation and thermo-buffering.
Advansa

