Looking for new fields—innovations initially developed for athletes are set to make an entrance into sleepwear and home textiles.

Performance around the clock

For those who thought that functional textiles had reached all possible markets, it's time to think again. Up till now exempt from the quest for performance, nightwear is emerging as a new market where performance clothing might boost recovery and optimise sleep.

It is not all that surprising, as it is estimated that roughly one-third of our life is spent in bed. Time devoted to resting, recovering and bunking down could conceivably be improved by using functional fabrics, developing better nightwear designs and, in this day and age, even sleeping on smart bedding.

The world of wearables and the Internet of Things (IoT) has turned its attention to sleep, as dozens of brands develop sensor-embedded mattresses and pillows that track sleep-cycles and provide data-based guidance to help users sleep better. Even fibre manufacturers are moving into this area, as seen with the smart pillow concept developed by polyester manufacturer Advansa with French smart tech company Cityzen Sciences. This "personal sleep coach" known as IX 21 is outfitted with electronic sensors that monitor movement, sleep cycles and ambient noise all night long. Data is transmitted to a smartphone app that will also wake up users up at the optimal point within their sleep-cycle. Advansa states that its system does not emit any radio waves, and can be used when the phone is in flight mode. French bedding maker Dodo has introduced the system and pairs the app with a subscription for personalised coaching.



BeGood by Human Wellness, a division of the Abati Group, has developed loungewear and shapewear made in fabrics that are said to offer both far infrared reflection and encapsulated cosmetic actives. Tests have shown that they improve subcutaneous microcirculation and skin hydration.

BeGood

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Introduced earlier this year by Canadian smart textile specialist Myant, Skiin is what the company calls a "digital second skin" clothing platform for monitoring. The seamless underwear has been designed to be as comfortable as possible so as to be worn 24/7. This, the company claims, enables wearers to gain "holistic insight" into their physical and mental state. "Skiin garments can help the wearer in a variety of ways – helping them obtain better sleep, control their stress and their overall physical and mental health, and that's just the beginning," Tony Chahine, Myant founder and CEO declared at the time of its launch. Better sleep is one of the key benefits put forward by the company, as its system monitors not only the wearer's sleep-cycles but also the environment by connecting to and adapting smart lighting or thermostat devices throughout the night.



Canadian smart textile company Myant introduced Skiin at the CES show in Las Vegas this year. Six sensors embedded in the underwear track daily activity, sleep and stress levels and are also capable of connecting to other smart Internet of Things (IoT) devices.

Skiin by Myant

Better recovery

Sleep is widely viewed as an optimal time for the body to recover, and the process can be optimised as US-based Under Armour claims to do with its Athlete Recovery Sleepwear, launched in 2017. To develop the functional clothing and bedding, the sports brand collaborated with Redwave Global, a Pittsburgh-based technology company specialising in far infrared materials. "By harnessing the physiological benefits of far infrared, we create therapeutic apparel able to improve health as it's worn – making recovering from an all-out effort faster, easier and more efficient," Dr Alan Letton, head of the company's technology committee, has stated.

Home textiles has become one of 37.5's fastest growing markets and its activated carbon performance textiles technology is now available in functional bedding made by US brands Buffy, Pottery Barn or Sheex. These new home textiles clients represent a year-on-year growth of 80%, claims the company, based in Boulder, Colorado. Its mineral-enhanced fabrics are said to deliver moisture management and microclimate regulation. "Room temperature and humidity play a role but it's actually the personal microclimate created in your bedding that determines comfort, and if you share a bed, that microclimate might be quite different to that of your partner, exacerbating the problem," says 37.5 founder and CTO Dr Greg Haggquist. Third-party field tests have shown that subjects spent twice the time in the comfort zone with its technology compared to identical bedding without 37.5. The active particles are permanently affixed to the fibres and refreshed at each laundering, the company states.

Wellness 24/7

Yarns containing far infrared-reflecting minerals, microencapsulated cosmetic actives and even graphene are some of the innovative materials being used to make nightwear and loungewear. Italian technical textile specialist Abati Group launched BeGood, a consumer-facing wellness and shapewear brand in 2013, to offer wellbeing functions day and night. For this new venture, Abati developed two new yarns, Dermafibra bio infrared and Dermafibra cosmetics.

Dermafibra bio infrared is a polyester yarn containing organic crystals. "These include titanium, silicon, magnesium and zinc, that reflect infrared radiation back to the body. This warmth penetrates the first layer of skin and stimulates microcirculation," says company founder and CEO, Andrea Abati. Dermafibra cosmetics is a bicomponent yarn combining the bio infrared polyester with a polyamide yarn containing microcapsules charged with active ingredients, such as caffeine, aloe vera, vitamins A and E. The microencapsulation technology chosen by the company reacts to heat levels. "The microcapsules release their contents when the temperature reaches 35°C," says Mr Abati.

The bioceramic yarns developed by Tecnofilati, one of the family-owned company's divisions, is already being used in mattresses, Mr Abati said at a Performance Days panel discussion on performance sleepwear. "It has a positive effect on recovery due to the reflection of far infrared rays that stimulate microcirculation and have a detoxifying and relaxing effect on muscles," he claimed.

Shanghai-based graphene specialist Kyorene has also identified sleepwear as a market where the often-called "miracle material" can provide superior comfort. "In baselayers, graphene dissipates energy and heat, thereby reducing sweat-levels and improving wearer comfort. Our material has also been found to emit negative ions. Medical studies have shown that these have a beneficial effect on metabolism and

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blood flow and can be good for recovery," Kyorene vice-general manager Romain Henricart tells *WSA*. For nightwear applications, he recommends using a polyamide yarn with graphene oxide plated on the back.

Time well spent

Sleep is deemed an ideal context to deliver wellness and cosmetic functions for Devan, a supplier of speciality chemicals and additives for textiles based in Ronse, Belgium. Looking to expand its wellness range, the company recently launched R-Vital, a finish that embeds microcapsules containing ubiquinol, an oxidised form of coenzyme Q10 (CoQ_{10}) and a powerful antioxidant and booster of cellular functions, the company states. "The human metabolic system produces Q10 naturally, but as we age, its levels decrease. Q10 is part of the body's energy-producing system at cell level. R-Vital can help the body maintain a high level of Q10 and thus boost the body's energy-production and help it to be more effective. This can have an effect on recovery," Devan R&D manager, Roberto Teixeira, said at the Performance Days panel talk. Devan has exclusive rights for textile end-uses through a partnership with the Japanese pharmaceutical company that supplies ubiquinol, said to be a stable form of Q10. [The use of ubiquinol is not approved by the USFDA for the the treatment of any medical condition but is sold as a dietary supplement.]

"Nighttime is a good environment for this product as it allows a long exposure period of seven to eight hours," says Mr Teixeira. In-vitro tests have shown that three to four hours are necessary for the active ingredient to pass from the skin to the blood stream. "If a garment is worn for just one hour, there will also be absorption, at a lower proportion of maybe 20% to 30%, but that will nonetheless energise the body," he further said.

Devan has patented a method of binding microcapsules directly to a textile without requiring a coating, which allows the textile to breathe and keep its flexible properties, added Mr Teixeira. The company's microcapsules release their actives by friction, as opposed to the release mechanics chosen by Abati. "We chose the heat release function as it enables a minimum wastage of the actives," says Mr Abati.

With regards to longevity, considered to be a weak point of microencapsulated actives applied to textiles, both companies downplay this issue. "Our microcapsules only release their content when in contact with the skin and we combine them with far infrared reflection. When the microcapsules are empty, the FIR will continue to have an effect," says Mr Abati. The company claims that the microcapsules will continue to function for 100 washes. Devan's capsules are composed of 90% active ingredient and only 10% polymeric shell, points out Mr Teixeira. "Our binding technology creates a high level of adherence so that the capsules do not wash out during laundering." Devan also claims to apply a high level of actives. "We have calculated that each square-metre of fabric treated with our microcapsules has an equivalent of two years of daily doses of cream applied to the skin. As opposed to certain vitamins, this concentration level of ubiquinol does not pose a saturation problem," he says, "more is actually better."

In this instance, a textile application can provide deeper and longer-lasting effects compared to other methods of assimilation, as clothes are generally worn for extended periods of time. From wellness to performance, these new fabrics are redefining the notion of recovery and beauty sleep.



The technology behind Under Armour's Athlete Recovery Sleepwear and bedding is based on far infrared reflecting materials developed by Redwave Global.

Under Armour

The encapsulated ubiquinol found in R-Vital, developed by Belgian speciality chemicals company Devan, delivers a textile skin treatment while you sleep according to the company.

Devan



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