

Interesting innovations in the USA

New technologies in the field of performance and protective apparel are in steady movement through the pipeline these days. Some of these innovations involve the burgeoning science of nanotechnology, while others employ creative combinations of high-tech coatings and fabrics. Some of these industry-changing technologies were on display at the recent Techtextil North America (TTNA) exhibition in Atlanta. The show is a compact version of the sister Techtextil in Frankfurt, but it has steadily gained in stature since its inauguration in 2000 and many leading names in the industry choose this venue to debut new products.

New developments were not only abundant on the TTNA exhibition floor, but were also revealed at the accompanying symposium, an increasingly popular event. Nanotechnology's penetration into various sectors of technical textiles was a major theme.

"We were really pleased with the outcome of the symposium," said industry consultant and symposium organiser Bill Smith of Industrial Textile Associates. "The emphasis was on nanotechnology with two complete sessions and most

other sessions having programmes related in some way to nano. It is definitely the hot topic in the industry today, but there is a long way to go to develop and implement nano and to realise its full potential. There's a lot of hype on the subject and some confusion as to what nano really is, and we must be careful not to utilise the term irresponsibly or where it doesn't fit. As some speakers pointed out, it is extremely difficult to effectively utilise nanotechnology in fibres and fabrics. Carbon nanotubes is one area and the growing and harvesting of them into high performance yarns has been demonstrated but has a long way to go before it is commercial or cost effective—but it will be. Electrospinning is another technique and is just now showing promise of real-world possibilities as manufacturing techniques are developed and scaled up."

Ciba's products are used by many textile manufacturers to add an array of performance characteristics.

 Ciba

Sweet smell of success

NanoHorizon's E47 fabrics were one of the primary examples of nanotechnology at TTNA. E47 employs SmartSilver nanotechnology-enhanced anti-odour additives for fibres and fabrics. SmartSilver permanently bonds to fibres without altering their native characteristics.

"The new E47 fabrics' permanent anti-odour properties are ideally-suited for performance apparel, footwear, sporting goods and many other products such as helmets, gloves, uniforms, upholstery and carpets," says Dennis Schneider, E47's director of marketing and sales.

Schneider says E47 offers a high-performance, permanent anti-odour solution for designers seeking to work with a choice of fibres and fabrics, including polyester and cotton. Nylon and polyurethane will be available soon.

"E47 is engineered at nanoscale to ensure that fabrics are easy and safe to manufacture," Schneider says. "E47 additives for fibres are fully compatible with high-speed extrusion equipment. Their 19-nanometer particles cannot clog spinnerets and they allow all manufacturing processes to run at full speed."

High energy protection

One of the technologies unveiled during the symposium came from Dow Corning and has applications in sports and activities that can benefit from protection against high-energy impacts. This has presented a challenge for manufacturers for many years as they have tried to develop systems that protect without sacrificing flexibility, breathability and ease of use. Dow Corning senior chemist Graham Budden presented his company's Active Protection System (APS) as a new solution to this problem.

"A large and important user of such devices is the motorcycle garment market, where most current protective apparel consists of hard plastic or semi-flexible moulded plastic composite parts," says Budden. "These hard-armour systems protect body areas likely to receive high impact force in a crash – such as the rider's back, shoulders, elbows and knees. By their very nature these parts are not flexible and are difficult to design for comfort. They are usually produced as standard, one-size components to fit all sizes which are attached to the garment for use, and removed when the garment needs to be laundered. Because of the need to remove the protection, the method of fixture to the garment allows some movement of the device which can compromise the efficacy against impacts."

Budden says that although hard-armour suits which meet the safety standards are commercially available, they have very limited flexibility and are uncomfortable to wear. He says

Nanotechnology on a global scale

Nanotechnology is becoming increasingly accepted as the 'way forward' in technical textiles and the big brands are already picking up on this.

Adidas has just incorporated US-based Nano-Tex's Coolest Comfort moisture management treatment into its Yocum activewear line. Nano-Tex, with operations in the USA, Belgium, China, England, India, South Korea, and Turkey, develops and markets a family of nanotechnology-based textile treatments. Its Coolest Comfort moisture management treatment is a fast-acting moisture wicking fabric enhancement that pulls perspiration away from the skin to keep the body cooler, dryer and more comfortable. The treatment is formulated for resin-treated cottons and synthetics. And it seems it's not only Adidas that is convinced by the company's nanotechnology—to date more than 80 textile mills worldwide are utilising its treatments in products sold by more than 100 apparel and interior furnishings brands, including New Balance, Gap, Lee, Champion, Levi and Simmons.

American companies are not alone in seeing the potential of nanotechnology as a market set to burgeon. Even well-established, successful companies such as Japan's Toray have invested heavily in developing new possibilities in the sphere of nanotechnology. Toray launched its first nanoscale technology, Nanomatrix, back in 2004 and the company is dedicated to developing its technology further to avoid 'nano' from becoming just another commercial boom that disappears.

Its nanoscale processing technology is said to form the necessary molecular arrangement and molecular assembly to bring out further advanced functionalities in textile processing than in other existing nano-processing.

Nanomatrix focuses on the concept of 'self-organisation'—a phenomenon defined by Toray as forming a specific molecular arrangement as a result of interaction with the polymers based on specific conditions such as temperature, pressure, magnetic field, etc.—with the aim of providing functionality to the fabric. By controlling the conditions associated with the interaction and responses between the functional material and the polymers, Toray has succeeded in forming a uniform coating as small as 10 to 30nm on the surface of fabrics.

Whilst Toray focuses on durability, Switzerland's Schoeller touts its nanosphere technology for its ability to facilitate the principle of self-cleaning fabrics. Schoeller uses nanoparticles to replicate the self-cleaning properties of plant leaves, thus producing materials that are water, oil and grease repellent. This technology has now even been applied successfully to natural fibres.

A great deal of progress has been made in the field of nanotechnology to date, but with an ever more aware and demanding consumer, textile companies know that there is a great deal more potential in this area. With this in mind, German chemical giant BASF recently opened a research centre for nanotechnology in Asia. The new centre in Singapore will involve €13 million expenditure up to 2008, and will employ 20 staff, mainly scientists and technicians.

"This is a bold step for BASF – a step geared to helping us realise our ambitious goals in nanotechnology," says Dr. Stefan Marcinowski, member of BASF's Board of Executive Directors and Research Executive Director. "The new centre will allow us to work more closely with highly respected research institutions in Asia and to attract top talent, enabling us to better serve our customers in the region."

"We plan to spend around €180 million in nanotechnology research world-wide between 2006 and 2008," he adds.

Without a doubt, nanotechnology is a small science with huge appeal to both consumers and manufacturers world-wide. 

APS offers superior defence with comfort.

"It is a highly effective system, providing premium impact protection, yet is fully flexible and breathable in wearing. The technology consists of a soft malleable and formable dilatant silicone, which is impregnated into a three-dimensional spacer textile support. The extent of the impregnation is controlled so that the fabric remains both fully breathable for maximum comfort and easily bendable to allow conformity to the body."

Budden adds that the dilatant nature of the silicone means that when it is impacted as a result of a collision, it instantly transforms from a soft flexible material to a rigid solid, but only for the duration of the impacting force. After the force has been dissipated through the dilatant/fabric construction, the silicone reverts to a soft and flexible state.

"The choice of fabric used as the carrier also plays an important role in performance," he says. "The carrier chosen has a diamond surface configuration made from multi-filament polyester yarns, with the spacer yarns formed from monofilament polyester to create the three-dimensional structure that is just 4.5mm thick. When this fabric is impregnated with the silicone, it is particularly important to present the silicone in such a way that it can readily absorb the impacting force through the spacer yarns in the direction of the force. By careful design of the dimensions of the spacer textile, this orientation is assured, allowing the silicone to absorb maximum force, yet leaving the fabric completely breathable.

"When this fabric is impacted, the force is first received by the dilatant coating on the surface and spacer yarns that are immediately in the direction of impact. These become rigid and transmit energy to adjacent spacer yarns that also become rigid, thus spreading the impact. Multiple layers of the spacer textile allow the energy absorbing quality to be tuned to specific body areas or different applications. This means the technology can be easily adapted to many different applications and is not limited to motorcycle garments."

Budden says that because APS is much thinner than other protective devices and not shape-specific, it affords designers more flexibility. In addition to clothing for motorcyclists, Budden says the fabric is especially suited for contact sports such as soccer, football or hockey. He says the technology can also be designed into protective gear for body-specific parts such as shin guards, headgear, knee and shoulder pads, footwear and gloves.

The right chemistry

Textile chemical specialist Ciba's products are used by many textile manufacturers to add an



array of performance characteristics now deemed essential by discriminating end-users. Jack Larkins, Ciba's NAFTA vice president for technical textiles, says the area of flame retardants and antimicrobials are amongst today's most desired textile chemicals. He says Ciba also draws a lot of interest in other textile effects including colours for all fibres and finishing effects ranging from a soft hand through moisture wicking and repel-and-release chemistries to UV protection.

In the coating and laminating field, Trann Technologies, a US manufacturer, is active in a variety of sectors, including performance apparel fabrics. Samuel Goldstein, Trann's director of marketing, says Trann's coatings can be applied to Spandex, cotton and other fabrics in a variety of techniques to enhance the properties of these materials. Silicone applications allow for moisture barriers, stain resistance, wrinkle resistance and fade resistance.

Another innovation in the specialty chemicals sector comes from France-based Rhodia, which recently debuted its Advantex One product, a new generation of highly durable softshell composite fabrics for high-performance outerwear. Rhodia touts its attributes as including long-lasting water repellency, multi-directional stretch and breathability. It is also considered 100% waterproof and windproof. Rhodia is partnering with Salomon to produce the fabrics and the two companies have spent several years in R&D work and field testing of the new product.

North Carolina-based Glen Raven Technical Fabrics is expanding its GlenGuard FR line of work apparel fabrics with the inclusion of fleece and outerwear apparel fabrics designed to protect workers from burn hazards as well as cold temperatures. The fleece fabric is a soft-pile fabric with applications in vests and jacket linings, while the heavyweight outerwear fabric

Dow Corning presented its new Active Protection System (APS) at TTNA.

 Dow Corning

provides protection from the cold and rain. The fabrics are a blend of Kermel fibres with solution-dyed FR modacrylic fibres. With these products, Glen Raven is targeting the annual North American flame resistant fabric market that is estimated at more than 33 million yards.

The company launched its new fabric this year with a major industrial laundry service and a specialty manufacturer of arc flash clothing. It is also working with several protective apparel makers who are adding GlenGuard to their product lines while several major industrial and petrochemical companies are running field trials.

"GlenGuard fabrics are inherently flame resistant and also colourfast, even after repeated commercial launderings," says Glen Raven's Hal Bates. "These woven fabrics are soft to the touch, contributing to a perception of comfort."

Italian firm Technofilati promotes its Resistex Carbon yarn as having capabilities to make garments impart a positive influence on muscle performance in activities requiring a long-term strain or in high-temperature environments, such as aerobic sports. The yarn is composed of a special continuous filament of conductive material with an active carbon and cotton, polyester or nylon base. The yarn has an anti-static effect that improves electrical efficiency, promoting blood circulation.

Back to nature

One of the more noteworthy recent developments in performance apparel technology, TrapTek, was not present at TTNA, but is receiving widespread recognition as a breakthrough. TrapTek's all-natural technology permanently embeds activated carbon into fibre and yarns to provide an array of high-performance enhancements such as evaporative cooling, odour absorption and UV protection. The technology is especially environmentally friendly as it derives from a virtually endless natural resource, coconut shells. TrapTek's founder Greg Haggquist, took the coconut carbon technology, long used in water filters, and developed a way to embed it into textiles.

"We were looking for a special type of activated carbon and coconut had all the qualities we needed," Haggquist recalls.

All of the activated carbon TrapTek uses comes from coconut shells, a raw material readily available in the US and overseas markets.

"The antimicrobial market has been based mostly on trying to kill off bacteria to eliminate or reduce odours," he says. "Activated carbon absorbs odours."

TrapTek offers versatility to the textile industry and can be used in knitted and woven fabrics as well as nonwoven products. The company already has an impressive list of global partners. It got its entrée into performance apparel

through cycling specialist Cannondale, which debuted its L.E. Carbon category last autumn. Cannondale is using carbon fibre in its entire range of products including shorts, jerseys, gloves and socks. L.E. Carbon is said to provide a 50% increase in moisture transfer compared with standard polyester and can offer an ultraviolet protection factor of up to 50+ depending on fabric construction.

United Knitting, a much touted manufacturer of high-performance knits developed the Cannondale fabrics.

Another specialist in textile chemical innovation is Clariant. Brad McClanahan, the company's US marketing manager says there are several areas of concentration. "One of largest areas of interest in the development phase at the apparel level is a built-in deodorant and anti-microbial effect," McClanahan says. "We are looking for specifically maintaining the built-in deodorant effect without any negative influence in wickability or moisture characteristics of fabric."

"We continue to see lots of interest in moisture management in general, even on cotton, where there's an interest in maintaining cotton's natural wickability."

McClanahan says there's renewed interest among apparel makers in UV absorbers in terms of protecting against harmful UV transmission.

What's the next product poised to come off the technical textile drawing board? One possibility was offered at the TTNA symposium by Fred Cook, a textile professor and researcher at the Georgia Institute of Technology. Cook highlighted a project funded by the National Textile Center involving the development of shape memory polymers.

"By making use of the latest basic science of shape memory polymers, we will design, develop and produce fibres that when formed into fabrics will exhibit superior comfort behaviour," Cook says. "As the future US market share is substantial for these niche products, aiding the transformation of the cutting edge research knowledge base to value-added products in shape memory polymers is the primary focus of this work. We are seeking to synthesise polymeric materials with one and two switching temperatures as shape memory polymers."

Innovation is still alive in the USA. The new technologies on show at TTNA highlighted that, particularly in the area of niche products, the developed world still has room to grow. 🌐



Advanced Shield jacket with Rhodia's Advantex One – a highly durable softshell composite fabric.

 Rhodia