Watch this space

Welcome to the third edition of the ITMA Technical Textiles Bulletin – where we provide a snapshot of the latest news, insight and research in advanced textiles as ITMA 2015 draws nearer.

I’m pleased to say that since the last edition of the Bulletin, the strength of the industry response to our international showcase has prompted the addition of an eleventh hall to the exhibition. This hall will house the Fibre and Yarn, Research and Education, Colourants and Chemicals, and Software and Recycling sectors. With such a huge exhibition footprint we can guarantee that end-to-end products across the entire textile and garment-making chain will be on show in Milan, complemented, as ever, by a programme of knowledge exchange and networking platforms.

The printing area, in particular, has more than doubled in space from the last show in 2011, affirming our decision to expand it into a dedicated chapter. Digital printing is growing and developing at a truly rapid pace, and as part of our increased focus on this sector we will also host the Digital Textile Conference at ITMA 2015, providing an overview of where production level digital printing is expected to go next. The fascinating area of 3D printing is also prompting much interest in our industry, and we explore the possibilities in this Bulletin’s Insight section.

2015 welcomes the launch of the ITMA Sustainable Innovation Award, created to recognise outstanding industry members and postgraduate students for their contributions to the sustainable development of the global textile and garment industry. This echoes the ITMA 2015 theme, ‘Mastering the Art of Sustainable Innovation’, which invites leaders of the industry to source sustainable technologies and share their expertise in this fundamental area with colleagues and visitors at ITMA.

I hope you enjoy this issue of the ITMA Technical Textiles Bulletin.

Charles Beauduin,
President, CEMATEX
www.cematex.com
Sigmatex, an independent converter of carbon fibre, headquartered in England, has been awarded UK government funding through the Advanced Manufacturing Supply Chain Initiative (AMSCI) for a project that aims to produce higher volumes of composites in the UK to accelerate vehicle lightweighting. Sigmatex is keen to promote the shift in the automotive industry, where products previously designed and manufactured from metals are now being replaced by carbon fibre. Carbon fibre textiles are an enabling technology and can open up new ways of designing improved products to achieve higher performance through lightweight strength, Sigmatex said.

The Sigmatex Lightweighting Excellence Programme (LX) has been awarded £3.8 million from the latest AMSCI round of funding. The LX consortium will address the lack of capability in the automotive sector to manufacture composite components at high volumes of scale in the UK by connecting the key elements of design, manufacturing, and capacity for production. The lightweighting programme is a strategic cooperation led by Sigmatex in partnership with Caparo Advanced Composites, Cranfield University, Expert Tooling & Automation, Granta Design, Group Rhodes, LMAT, Surface Generation, and Tilsatec, with support from Axillum Research and Axillum Lightfellows. Three UK-based automotive OEMs will work closely with the LX manufacturing and technical partners. A total project value of £7.15 million of joint funding from AMSCI and the industry will support the creation of 238 new jobs and safeguard 144 existing jobs between 2015 and 2021, according to the LX project team.

Sigmatex’s Chief Executive Officer, Scott Tolson, said: “The automotive industry is achieving huge advances in creating more efficient cars. However, there is also significant potential to make cars lighter by the use of carbon fibre. This innovative project aims to develop ways to reduce the cost, and upscale the incorporation of composites in cars, so that such materials can be used in a wider range of vehicles. With the support from OEMs, this is a real opportunity to create a UK supply chain that is able to meet the future demands of this important and growing industry.”

ADC gets US patent for lightning strike solution

Automated Dynamics (ADC) has received a US patent for incorporating lightning strike protection (LSP) layers into composite structures.

The innovation, which received patent 8,947,847 from the US Patent and Trademark Office, promises to significantly lower production costs in several industries where such protection is necessary, including aerospace, oil and gas, and wind energy. “The necessary trend towards lower density LSP solutions has complicated integration of an automated manufacturing solutions,” said Ralph Marcario, Vice President of sales and marketing for ADC. “This technology enables automation of this critical step and provides significant improvements in production time and dramatic decreases in production cost.”

The invention incorporates metallic lightning strike materials using traditional equipment and techniques for fibre placement and tape laying, produced by Automated Dynamics and others. The metallic mesh is embedded into pre-impregnated tape, offering the mesh support during placement and assuring full consolidation into the composite matrix. It is compatible with both thermoset and thermoplastic resin systems.

ADC said the technology could be readily incorporated into the composite structures it produces for companies in the composites end markets. The company added that its automation equipment could be easily augmented to enable this capability.
AFM Heatsheets scoops innovation award

Chicago-based AFM Heatsheets, a manufacturer of reflective insulation fabrics, was recently announced a recipient of FabricLink Network’s annual Top 10 Innovation Awards for its Ultraflect insulation fabric. This year’s Top 10 winners included innovative manufacturing and production technologies, novel insulation solutions, and advancements in textiles for a variety of markets. “This award is a true testament to the work our team has done to research and develop an innovative product that will help take our industry to the next level,” said Chris Falk, President of AFM Heatsheets.

The award-winning Ultraflect is a reflective lightweight polyester woven insulation fabric featuring Heatsheets’ Silver Lining technology. While reflective insulation technology isn’t new – inducted into the Space Foundation’s Hall of Fame in 1996 after being used as protection from extreme temperature changes in outer space – Ultraflect translates the products originally developed for space environments into today’s demands for comfort, convenience, style and function. “Ultraflect provides comfort in a more compact form,” said David Deigan, founder and chief technology officer for AFM Heatsheets. “It’s an ideal insulation solution for performance wear, outdoor fashion apparel and shelter products such as sleeping bags, tents and emergency bivvys.”

Ultraflect incorporates an ultra-thin, soft and durable reflective-insulation membrane laminated to familiar woven fabrics. It delivers protection from the burning rays of the sun or can stimulate warming. “The goal is to provide streamlined solutions that impose little change to the appeal of the host fabric in outward appearance, drapeability and launderability,” continued Deigan.

Each year, FabricLink Network chooses 10 of the most exceptional textile based materials and technologies that are commercially available. The awards recognise the research and development efforts required to create new products for the speciality fabric market.
Boot drying technology from Biovation

Biovation, a technology design and manufacturing company, has developed a new tactical boot-drying product for the US Marine Corps. DryRight is a nonwoven, non-powdered sheet designed to combat the negative effects of constant wet feet. The product was funded, developed and tested in collaboration with the US Marine Corps to help them perform their best, as poor foot care is a significant contributor to lost combat readiness, said Biovation. The product is rolled and inserted into a wet boot, and antimicrobial materials dry the boot and ensure the foot health of the wearer. The inner layers comprise a biodegradable polymer and proprietary chemistry which enable quick and high capacity wicking and moisture lock. While the durable outer layer provides an anti-fray, tear-resistant and robust surface designed to withstand and function in all climates. DryRight is designed to be lightweight, portable, and to prevent unnecessary foot injury while never needing to be wrung out or washed. A single unit can be re-used between 10-15 times with ‘recharging’ (air drying) and is manufactured with greater than 50% bio-content. DryRight provides maximum boot dryness in all foot contact areas, regardless of climate and weather conditions, within six to eight hours.

Biovation’s CEO Kerem Durdag, said: “The foot health of Marines during training and deployment is a primary medical concern for the force. We have developed DryRight to provide an efficient and effective tool for Marines both in combat and training. Biovation is proud to partner the Department of the Navy on this important project to protect Marines in the field.”

Vessels tethered with Dyneema

Petrojarl Knarr, the first floating production, storage and offloading vessel (FPSO) is set to use Lankoforce rise tethers made with Dyneema DM20 fibre. The combined materials are designed to hold the vessel’s risers and umbilicals in position and are connected to subsea production systems such as well manifolds, wellheads and well jumpers. Dyneema DM20 builds on the strength and weight advantages of other Dyneema fibre grades, like SK78. However, the difference is said to be its long-term performance under permanent loads (also known as creep performance). Through its low and predictable creep characteristics, Dyneema DM20 extends the range of Dyneema applications in offshore to long-term permanently loaded systems, Dyneema said. As a result, offshore operators are increasingly considering switching to ropes made with DM20 to anchor their Floating Production Units, typically in combination with polyester, the company added.

“Our latest grade, Dyneema DM20, builds on the strong performance of our well known Dyneema SK78 and other grades,” said Jorn Boesten, Segment Manager for Offshore DSM Dyneema. “Its use in this challenging offshore environment shows the trust the industry has in Lankhorst Ropes, DSM Dyneema and its products. This only strengthens our commitment to the offshore industry.”
FibeRio ventures into performance apparel

FibeRio Technology Corporation, a nanofibre solutions company, is partnering with VF Corporation, a leader in branded lifestyle apparel, footwear and accessories, to develop and commercialise performance apparel fabrics. The partnership centres on FibeRio’s Forcespinning technology platform and its ability to produce nanofibre material in high volumes. VF intends to incorporate FibeRio’s capabilities and expertise across its three Global Innovation Centers which focus on advancements in performance apparel, footwear and jeanswear.

“VF’s Global Innovation Center strategy centres on the pursuit of design and materials that will redefine the future of apparel and footwear for our consumers,” said Dan Cherian, Vice President of VF Global Innovation Centers.

“Our partnership with FibeRio is a great step towards the co-development of proprietary, high-performance nanofibre materials that will help push the boundaries of performance and explore the creation of new apparel and footwear market categories.”

FibeRio CEO Ellery Buchanan said: “We are excited to partner with VF Corporation on our Forcespinning-based advanced nanofibre textiles. VF’s long history of brand strength and operational excellence along with our leading commercial scale nanofibre production expertise creates an excellent opportunity to proactively shape the competitive landscape.”

Promoting the venture, FibeRio said the higher surface area and smaller pore size of nanofibres improved the characteristics of fibrous material. It means performance levels in any given application can be materially improved using less material in the end product, which also allows for lighter weight and lower cost, according to FibeRio.

NASA collaborates on advanced composites

NASA has established a public-private partnership with five organisations to advance knowledge about composite materials that could improve the performance of future aircraft. Composites are innovative new materials for building aircraft that can enhance strength while remaining lightweight. The US space agency selected the National Institute of Aerospace (NIA) in Hampton, Virginia, US, to manage administration of the Advanced Composites Consortium, which is working to improve composite materials research and certification. Included in the consortium are NASA’s Advanced Composites Project, managed from its Langley Research Center in Hampton; the Federal Aviation Administration (FAA); General Electric Aviation, Cincinnati; Lockheed Martin Aeronautics Company, Palmdale, California; Boeing Research & Technology, St. Louis; a team from United Technologies Corporation led by subsidiary Pratt & Whitney in Hartford, Connecticut; and the NIA.

“NASA is committed to transforming aviation through cutting-edge research and development,” said Jaiwon Shin, associate administrator for NASA’s Aeronautics Research Mission Directorate in Washington. “This partnership will help bring better composite materials into use more quickly, and help maintain American leadership in aviation manufacturing.”

The NIA will handle communications within the consortium and help manage the programmes and financial aspects of members’ research projects. The NIA also will serve as a ‘tier two’ member with a representative on the consortium’s technical oversight committee. NASA formed the consortium in support of the Advanced Composites Project, part of the Advanced Air Vehicles Programme in the agency’s Aeronautics Research Mission Directorate. The project’s goal is to reduce product development and certification timelines by 30% for composites designed for aeronautics applications.
Insight

As a catalyst for change and competitiveness across the textile and garment industry, 3D printing is gaining momentum across various markets. A broader choice of raw materials has played a huge role in 3D printing’s breakthrough into textiles. Once only achievable with hard plastics, time spent on research and development have made it possible to 3D print using textile fibres or filaments.

One notable example of this technique is a 3D-printed dress designed by Francis Bitonti for New York Fashion Week – based on a new polyester filament commonly employed for medical sutures and specialised nonwovens. The creation of the Verlan Dress is said to have involved around 400 hours of printing on tiny systems, producing one of the first 3D-printed garments to have drape and texture. This prompted other manufacturers to experiment with textiles, with excitement building around so-called ‘drop in’ polymers as the basis for synthetic materials.

3D knitting technology
3D printing may be a relatively new concept, but the open-source version of technologies it incorporates have been around for a long time, particularly in the field of 3D knitting. At successive ITMA shows over the past 20 years, the development of 3D knitting technology by major machine builders – notably Japan’s Shima-Seiki, Italy’s Santoni and Stoll of Germany – has wowed the crowds with the infinite possibilities of seamless, 100% CAD-created designs.

In 2013 German manufacturer Stoll developed a new knitting machine dubbed a ‘3D printer for clothes’. A modern-day version of a traditional knitting loom, the machine ‘prints’ clothes by reading measurements from software to “create any knitted garment in any dimension imaginable”.

This was followed by OpenKnit, the brainchild of designer Gerard Rubio that is able to knit entire seamless garments in less than one hour using a software interface and a digital hub to share digital garment designs.

Teijin accelerates automotive CFRP business

Teijin Limited has created a new division to strengthen its business in the high value-added area of automotive-use carbon fibre reinforced plastic (CFRP). The Automotive Business Development Group was launched on 1 April 2015 as a new entity under the Carbon Fibers & Composites Business Unit. It is responsible for marketing thermoplastic CFRP, formerly handled by the Teijin Composites Innovation Center, and thermoset CFRP, formerly handled by Toho Tenax.

Teijin Composites Innovation Center will now focus on developing technologies for individual projects, said the company. Teijin developed Sereebo, the world’s first mass-production technology for thermoplastic CFRP with a one-minute takt time, in 2011. Current efforts are focused on developing automotive CFRP products for global automakers in Japan and other countries. Toho Tenax, which spearheads Teijin’s carbon fibres and composites business, is developing automotive-use products such as high-efficiency thermoset CFRP and rapid-curing carbon fibre sheet pre-impregnated with matrix resin.

A 3D phenomenon

Tipped to grow 500% in five years, the 3D printing market boasts an abundance of untapped potential. We take a look at the innovations fuelling this success, as it strives to leap past the stage of basic prototyping.
Like 3D printing, or ‘additive manufacturing’ as it is also known, being able to trial a knitted product design digitally before making the first sample ensures the minimisation of waste. It is this sustainable approach that analysts say will “revolutionise” textile manufacturing.

“3D printing brings several performance and efficiency advantages to the table that translate into high quality; far greater than what can be achieved through conventional manufacturing,” says Technical Insights Research Analyst Jithendranath Rabindranath. “Therefore, organisations are embracing various approaches to expand the applicability of 3D printing.”

Mastering sustainability
ITMA 2015’s subsequent theme of sustainable innovation is timely, as manufacturers throughout the textile supply chain strive for efficiency. And that’s not all they can achieve through 3D printing. Along with a high degree of accuracy, the technology ensures the ability to build customised prototypes without the need for time consuming and expensive retooling. It allows the simultaneous use of multiple materials, as well as competency over traditional techniques. But the real lift-off for 3D printing will arrive once it looks beyond basic prototyping and towards 3D manufacturing. That’s according to US tech company Carbon3D, which has developed a potentially “game-changing” process that pledges to do just that.

According to the company, the new process harnesses light and oxygen where the 3D object is “grown” in a pool of resin. The process was apparently inspired by the film Terminator 2, in which the T-1000 robot rises from a pool of metallic liquid. Carbon3D said the process is 25 to 100 times faster than conventional 3D printing and could potentially be used to make objects such as car parts, medical devices or shoes.

It is this commitment to research and development that, according to Rabindranath, will be the real catalyst in 3D printing’s success story.

“With burgeoning market potential and growing funding, the 3D printing ecosystem is taking shape,” says Rabindranath. “The contribution of multiple industry participants such as confederations, research labs, universities, start-ups, and established firms will further quicken the development and commercialisation of 3D printing technology, products, and services on a global scale.”
Underwater adhesive inspired by shellfish

A university chemist has developed an adhesive technology that could help bond items in wet, moist conditions, such as human tissue or underwater construction, by studying mussels and oysters. Jonathan Wilker, professor of chemistry and materials engineering at Purdue University in Indiana, US, developed the technology while studying the environmentally-friendly adhesive qualities of mussels and other shellfish. Wilker’s patented adhesive is comprised of similar components used by mussels in their natural adhesives.

“A lot of the chemistry involved in the animals’ adhesive is protein based, but no one is going to be able to make a complicated protein for large scale applications. So we are substituting simple polymers for the proteins while maintaining other aspects of the adhesive chemistry,” he said.

“We have looked at the design and synthesis changes that we can make and compared our adhesive to what the shellfish are making. The system can be easy to generate on large scales and yet still maintain the functions that we are after. This synthetic mimic approach then allows us to tailor the material for specific bonding situations and applications.”

Conventional adhesives currently available are made from petroleum feedstocks and can release volatile organic compounds and other toxic materials into the environment. Wilker’s technology can be developed from renewable resources.

Wilker and his team have created a platform technology that industry partners could develop in several ways. “We can design certain characteristics into the adhesive, but we won’t be able to focus on a specific product for a specific application,” he said. “It’s possible that we could connect with different companies that can develop the materials for several sectors including aeronautical or automotive manufacturing, biomedical joining of tissues, construction, coatings and cosmetics.”

New fabric wrist patch can charge smartphones

A study by Sungkyunkwan University in South Korea has found that a foldable patch of fabric wrapped around a wrist can gather enough energy from movement to power small electronic devices. The new fabric relies on the ‘triboelectric effect’, which happens when certain materials become electrically charged after coming into contact through friction with a different material. Electrons are transferred from one material to the other, causing one material to build up a negative charge while the other gets a positive charge.

Researchers at the university created a double-layer fabric out of silver coated woven textile, with one layer made with a plain silver coated textile. Scientists demonstrated the technology by attaching the generator on a jacket sleeve and embedding six LEDs, a small liquid crystal display and a keyless car remote control in the jacket. When the wearer moved his arms or wrist, the fabric turned each gadget on one at a time.

The scientists are now testing more materials for the generator that could yield even more energy, as well as textile based batteries and super capacitors to store energy from the generators.

The fabric patch is produced from a double layer of silver coated textiles. Photo credit: ACS Nano
Carbon nanotube fibres invented at Rice University in the US may provide the best way to communicate directly with the brain. The fibres have proven superior to metal electrodes for deep brain stimulation and to read signals from a neuronal network. Because they provide a two-way connection, they show promise for treating patients with neurological disorders while monitoring the real-time response of neural circuits in areas that control movement, mood and bodily functions.

New experiments at Rice have demonstrated that biocompatible fibres are ideal candidates for small, safe electrodes that interact with the brain’s neuronal system. They could replace much larger electrodes currently used in devices for deep brain stimulation therapies in Parkinson’s disease patients. They may also advance technologies to restore sensory or motor functions and brain-machine interfaces, as well as deep brain stimulation therapies for other neurological disorders, including dystonia and depression, the Rice research team said.

The fibres created by the Rice lab of chemist and chemical engineer Matteo Pasquali consist of bundles of long nanotubes originally intended for aerospace applications, where strength, weight and conductivity are paramount. The individual nanotubes measure only a few nanometres across, but when millions are bundled in a process of wet spinning they become thread-like fibres about a quarter the width of a human hair.

“We developed these fibres as high-strength, high-conductivity materials,” said Pasquali. “Yet, once we had them in our hand, we realised that they had an unexpected property; they are really soft, much like a thread of silk. Their unique combination of strength, conductivity and softness makes them ideal for interfacing with the electrical function of the human body.”
Industrial eco yarn technology for wood fibre

Spinnova Ltd, a Finnish research and development company, is working to take a process creating yarn from wood fibre using a wet-spinning technique to an industrial scale. It is developing fibre to yarn (F2Y) technology which is said to be completely different to traditional textile yarn production. This is because F2Y technology uses no chemicals to dissolve wood fibre to a polymer level and regenerate cellulosic filaments. Instead, it allows the production of novel, low cost and environmentally friendly textile yarns for filaments made directly from wood fibres through a wet spinning process.

Spinnova has acquired €1.95 million in investments to fund its breakthrough process. According to the company, the technique is ideal for refining long fibre-length woods, such as that of pine and spruce species. And it is the only technology which can be used to manufacture yarn directly from wood fibres without chemical processing. This means its F2Y threads are recyclable, environmentally friendly and cost-competitive, Spinnova said.

Cell-free substrate offers latest medical implants

Researchers at the Fraunhofer Institute in Stuttgart, Germany have teamed up with the University Hospital in Tübingen and the University of California, Los Angeles (UCLA) in the US, to develop scaffold substrates for implants.

The cell-free substrate contains proteins to which autologous cells bind and grow only after implantation. The solution is based on electrospinning, a process in which synthetic and biodegradable polymers such as polylactides are spun into fibres using an electrical charge. These fibres are then used to create a 3D nonwoven fabric.

According to the institute, implants based on autologous cells are more likely to be accepted by the human organism. While electrospinning helps create a cell-free substrate on which cells can grow after it has been implanted in the patient’s body. “Each type of protein attracts specific cells, which adhere to the scaffold and grow there. By selecting the appropriate protein, researchers can build up heart tissue or regenerate other damaged organs,” said Dr Svenja Hinderer, a research scientist working on the project.

The substrate is spun into a fine sheet and cut to the required size. To repair damage to the heart muscle, for instance, a scaffold corresponding to the extent of the damaged area is placed in like a blanket over the muscular tissue. The polymeric fibres gradually degrade in the human organism over a period of approximately 48 months. During this time, the cells that bind to the proteins find an environment that is conducive to their growth. They then construct their own matrix and restore the functions of the original tissue, the institute said.

The team is working to bring the substrate to market as an alternative to conventional heart valve replacements.

An electron microscope shows cells adhering to the electron substrate. Photo credit: Fraunhofer IGB
New structures ‘tougher than bulletproof vests’

Researchers at the University of Texas in the US have created new structures that exploit the electro-mechanical properties of specific nanofibres to stretch up to seven times their length, while remaining tougher than Kevlar. These structures absorb up to 98 joules per gram. Kevlar, often used to make bulletproof vests, can absorb up to 80 joules per gram.

Researchers hope the structures will one day form material that can reinforce itself at points of high stress and could potentially be used in military aircraft or other defence applications.

In a study published by ACS Applied Materials and Interfaces, a journal of the American Chemical Society, researchers twisted nanofibre into yarns and coils. The electricity generated by stretching the twisted nanofibre formed an attraction 10 times stronger than a hydrogen bond, which is considered one of the strongest forces formed between molecules.

Researchers sought to mimic their earlier work on the piezoelectric action of collagen fibres found inside bones. The hope was to create a high performance material that can reinforce itself, said Dr. Majid Minary, an assistant professor of mechanical engineering at the University’s Erik Jonsson School of Engineering and Computer Science, and senior author of the study.

For their experiment, researchers first spun nanofibres out of a material known as polyvinylidene fluoride (PVDF) and its co-polymer, polyvinylidene fluoride trifluoroethylene (PVDF-TrFE). They then twisted the fibres into yarns and continued to twist the material into coils. This was followed by measuring mechanical properties of the yarn and coils, such as how far it can stretch and how much energy it can absorb before failure.

“Our experiment is proof of the concept that our structures can absorb more energy before failure than the materials conventionally used in bulletproof armour,” Dr Minary said. “We believe that, modelled after the human bone, this flexibility and strength comes from the electricity that occurs when these nanofibres are twisted.”

Dr Majid Minary from the University of Texas, Dallas