

# Nextec research leads to award-winning technology

How an Italian company has become well established during the past ten years as a major developer of technology for the protective footwear and clothing market.

A decade ago, the combination of many years' experience in the apparel and footwear industries along with a burning ambition to develop new technologies for outdoor and protective clothing led a group of Italian entrepreneurs to establish their own company – Nextec.

An opportunity to create new protective technologies by a 'cross fertilisation' research and development method was quickly identified. This involved looking for an interchange of technical knowledge and ideas with companies in other industrial sectors, then adapting these existing processes to applications with the new materials Nextec was beginning to produce.

"Knowledge and skills have been gleaned from such specialisations as

the textile industry," says Nextec's Head of Research and Development, Dr Matteo Morlacchi. "This has helped us with fabric finishing, the thin polymers sector assisted with polyurethane films, and the aerospace industry has provided an understanding of moulding 3D parts in carbon." Dr Morlacchi has a PhD in Mechanical Engineering from the Politecnico di Milano, and joined the company in 2004 after 15 years in the textile industry, where he worked on the development of hi-tech functional fabrics.

Whilst Nextec markets and sells a line of materials under the 'Ledra' trademark, the company's 'OutDry' technology represents its core business, and has been designed for

manufacturers of waterproof and breathable footwear and gloves. According to Nextec, the principle behind this technology is quite simple, involving a press machine bonding a waterproof and breathable barrier directly to the inside of the shoe upper or glove shell.

The bonding of the membrane to the external shell rather than to the lining has already been achieved on outdoor garments such as jackets and trousers. On these items it is possible to bond the membrane to the fabric, then cut and seam the jacket or trousers with, as a final step, the seams being sealed by tape. Dr Morlacchi says this process could not be used on footwear and gloves, as there are too many curved and narrow seams for taping machines to cope with. If used, the tape would cover a large part of the upper surface, dramatically reducing breathability. Because of this difficulty, the search was on to discover how to bond the membrane directly to the inner side of the shoe upper. However, the main difficulty faced was how to obtain a steady, consistent lamination process on a three-dimensional, uneven surface like a shoe upper.

## Positioning in the production line

Through extensive research and development, Nextec produced a membrane with an integral hot-melt glue mesh and designed an automatic machine in co-operation with Italian



*Nextec OutDry membrane positioned on an upper*

footwear machinery manufacturer Sagitta Spa. This equipment has been developed from aerospace industry science and is capable of providing a uniform pressure and temperature on the whole upper surface. It also has sufficient capability to be integrated in a shoe factory production line and, on average, allows one operator to complete one pair of footwear each minute. This process now makes it possible to bond the membrane onto the assembled and stitched upper or glove shell, sealing all the inner material surfaces and seams together in one step. Patents have been granted worldwide on the process, machinery and finished products.

As a result of the OutDry process, water is said to be blocked by the external shoe (or glove) layer, and not by the water resistant lining – by which time the water has already penetrated right through the external layer of the product. Hence, Nextec claims that there is no weight increase caused by water penetration, and that an air layer surrounding the foot (or hand) keeps

the wearer's skin dry. The thermal insulation and comfort are said to be improved, with footwear giving a better fit and less risk of blisters. Gloves are also claimed to fit better and give increased dexterity.

“This is our real strong point, as we can't rely on heavy marketing investments or brand awareness,” says Dr Morlacchi. “In the case of OutDry, the advantages in terms of water resistance are obvious when compared to the standard 'bootie' technology, as the protective membrane layer is closer to the external shoe surface and far from the foot.”

Since the lining hides the membrane, OutDry technology is marketed as being invisible on the final product. This means that there are no limitations in the choice of the lining material – a very important component in terms of comfort. Another very important advantage of the product stressed by Nextec is the very limited space taken by the membrane (less than 0.03 mm thick) within the footwear or gloves.

“OutDry technology now enables a manufacturer to produce water resistant



*Dr Morlacchi receiving the Volvo Eco-Design Award*

shoes where it was previously impossible with the standard 'bootie' system because of its bulkiness and layer separation,” states Dr Morlacchi. “One example is for a soccer boot we recently worked on. This particular sports shoe has the upper laminated by



*Machine bonding of the OutDry membrane to the inside of the upper*

the OutDry membrane in a three-layer construction, which completely blocks water, whilst leaving the player with great sensitivity and feeling. Similar applications are under development for running and golf shoes, where lightness, control, and feeling are vital, and too much thick material between the foot and the upper is unacceptable.”

## Joining forces

Nextec’s research and development policy mainly focuses on technology transfer to obtain an improvement in performance for an existing product. However, with the aim of further developing the performance of the company’s technologies, the R&D team is becoming increasingly involved in original ‘grass roots’ research.

In order to make the best use of research and development investments, Nextec has formed partnerships with other companies, exchanging developments on new materials or chemicals with licensees of granted patents. Nextec’s main co-operation is with Komatsu Seiren, a Japanese producer of PU functional thin films, which is now developing films and bonding systems specifically and exclusively for the OutDry technology.

At the same time, Komatsu Seiren is the licensee of the technology for the Japanese market.

“We are currently working on the combination of OutDry with a new technology to increase foot ventilation from both the upper and the outsole,” remarks Dr Morlacchi. “This is to meet a specific request from customers with heavy duty requirements – for example, the armed forces – but we feel it could well be exploited for sports use.”

## Global reach

Nextec’s headquarters are located in Busto Arsizio, a city in the Northern Italian region of Lombardy. In line with the development of the international footwear market, in 2006 Nextec established a branch located in Guangzhou (China), which is home to production, logistics and part of the R&D activity. Sales are run worldwide directly by Nextec, with the exception of USA, where the company has a distribution agreement with Mitsubishi International, to covers the outdoor market.

The OutDry business model consists of licensing the technology and trademark (registered worldwide) to footwear and glove manufacturers, as

well as supplying machinery, technical assistance and materials for the manufacturing process. In addition to the growing interest from mountaineering and trekking footwear brands, other categories are approaching Nextec, and applications have been developed for golf, sailing, soccer and running products.

The company has also successfully introduced OutDry technology to customers who manufacture and supply products for military and safety applications. For the past two years, all Italian fire rescue teams have been equipped with a protective glove featuring the technology and, recently, some NATO armies have certified OutDry as the new waterproofing system for their troops’ footwear.

OutDry’s process and its limited impact on the final product’s design, enables it to be adopted in the manufacture of products where other technologies cannot be used for technical and aesthetical reasons (such as in running shoes, golf gloves and leisure shoes), Nextec claims.

Nextec is now planning to further boost investments in research and development. An increase of present laboratory space and testing machinery has been planned for 2009, with research becoming more oriented toward environmentally-friendly solutions. This is a field where OutDry has already achieved important results and, due to the company’s efforts, it was presented with a Volvo Eco-Design Award during the 2008 ISPO Fair in Munich.

“This new method for the environmentally-safe production of waterproof and breathable footwear through a combination of the OutDry membrane system and 3D-lamination technology will revolutionise the footwear industry,” claims Mark Held, member of the Volvo Eco-Design Award jury and General Secretary of the EOG Association for Conservation – an initiative from the European outdoor industry with the stated objective of protecting the world’s wild areas.

“By entirely replacing solvent-based glues and other chemicals used in conventional methods of producing waterproof shoes, the OutDry technology has proven a clear winner,” he continues.