


WORLD FOOTWEAR

A breakthrough in waterproof footwear?

A small UK company believes that it may have developed something that could revolutionise the outdoor footwear sector. There have been many companies in the past who have rushed to market with what they claimed was ground-breaking technology only to fail. Corfam, recalled in the last issue of *World Footwear*, was one of the most spectacular in this respect.

P2i, however, appears to be somewhat different. Rather than rush forward, it has proceeded carefully, pausing many times to make sure it was going in the right direction and that it had all the right equipment. One might expect no less from a company employing a team of plasma scientists, with nine out of 15 members of staff having PhDs.

One of them, Dr. Stephen Coulson, was carrying out research at the University of Durham in northern England until a few years ago. His specialist interest was in making textiles water and oil resistant and his work attracted the attention of the military. The authorities believed his ideas could lead to a potential defence

against nerve agents and provided funding for P2i to start up. He was joined one-and-a-half years ago by Dr. Graham Hine who became chairman and CEO.

GAS MASKING

The technology starts off with a sealed chamber capable of holding a vacuum. Once the air has been removed to create a total vacuum, a tiny amount of special chemical known as a fluorinated acrylate monomer is pumped in. This is liquid at room temperature but turns to gas on hitting the vacuum and penetrates every fibre, substance and surface of a material or product inside the chamber.

The final stage of the process involves the application of a plasma treatment. This bonds the gas to every part of the product to form a nanocoating of between 10 and 60 nanometres. This effectively lowers the surface energy, causing oil, water and other liquids to form almost perfectly spherical droplets on the surface that will run off as quickly and smoothly

*Liquid runs off the material
as quickly and smoothly as
a ball-bearing*



P2i claims plasma-bonded nanocoating 'ion-mask' can make any shoe:

- as waterproof as shoes with a membrane
- more waterproof than shoes with DWR treatments
- more breathable than either membrane or DWR enhancements
- more risk-averse if manufacturing is in the hands of a partner
- high-performance at a lower cost
- faithful to the design the brand wants

as a ball bearing. The nanocoating does not change the drape or the feel of a material but lowers its surface energy to three times below that of untreated polytetrafluoroethylene (PTFE).

The process has been found to work not just on textiles, but on metals, ceramics, leather and a host of other materials. However, the three applications it has been decided to focus on initially are laboratory consumables, filtration products and footwear. Determined to fully exploit its breakthrough, P2i has looked at a variety of market sectors and, although it believes its ion-mask technology may have an almost limitless number of applications, it has decided to initially focus on these three, of which footwear looks to be the most exciting.

WHOLE SHOE WATERPROOFING

The reason lies in a recent series of further important breakthroughs that P2i believes could enable a new generation of truly-breathable, yet waterproof shoes to be in retail stores in time for next autumn. As a result, the company will install equipment in two Chinese factories by the end of this year for use on shoes for two major brands. One of the models involved is a running shoe, one a leisure shoe and the third is a golf shoe. While no names are mentioned at present, the company's lead-client has apparently described the waterproof and hydrophobic functionality ion-mask makes possible as being 'an exciting evolution'.

The claim is that a shoe with the ion-mask nanocoating will be as waterproof as one with membrane technology and more than those with a durable water repellent (DWR) treatment. It will also be more breathable, cheaper to treat and will make no impact on a footwear brand's design rules. The key factor, however, is that the whole shoe is treated rather than just the materials that go into it.

Because of the plasma treatment, the nanocoating goes on to

every part of the shoe—even the laces. Stitching perforations above the featherline will remain open and not become clogged as the decrease in surface energy causes beads of liquid to run past and over them rather than into the shoe. P2i believes that its ion-mask is the first technology to make it both possible and affordable for manufacturers to make the whole shoe waterproof.

Breathability in waterproof footwear has always been a problem and, up to now, the most successful way commercially to make it waterproof has been to use a membrane. While a shoe with membrane technology is more breathable than a plastic bag, Dr. Coulson says it still does not compare with an ordinary one. He maintains that ion-mask, on the other hand, makes no difference to airflow in shoes or to a wearer's ability to push hot air out and draw cooler air in by means of the bellows effect that comes into play as they walk or run.

LASTING EFFECT

We have all seen how many water-resistant treatments begin to weaken after hard wear. So, is ion-mask any better? Dr. Hine says it is and feels that waterproofing footwear is only worthwhile if the treatment used can withstand the stresses and strains we subject our shoes to. He insists that ion-mask can, and that he has test data to prove it. P2i scientists have worked extensively with CTC in France and Hong Kong, and with SATRA and Intertek in the UK in regard to testing. This has included obvious waterproof and abrasion tests, and, at P2i's insistence, extensive flex-tests to see if the test shoes could still withstand water penetration after 100,000 flexes. Unlike many DWR treated shoes, they did.

However, Dr. Coulson does feel that certain test processes tend to work better with certain types of shoe and therefore wants to develop his own. Furthermore, in spite of the need to test the whole shoe, P2i does take part in fabric-testing as at present it is the only way it can measure itself against others.

The company also says that its plasma treatment produces the same result every time and can therefore overcome any shortcomings due to manufacturing processes such as stitching or locally supplied materials. This includes the need to rely on manufacturing partners to check and reject individual shoes or entire batches that don't come up to scratch.

FREEDOM OF DESIGN

A further advantage the company is pushing is freedom of design. No matter what materials are used in a shoe (the average athletic shoe could easily have six different types in its construction) or where, the plasma treatment will bond the special monomer on to the surface and protect it. Factory production is no different from any other shoe as there is no membrane bag to produce, test and install. In fact, any shoe of any design can be treated at the end of its normal production sequence.

Dr. Hine and his colleagues at P2i firmly believe they have come up with the answer to a shoemaker's dream that any shoe can be made waterproof. If this is indeed the case, they will have achieved a major breakthrough that will have enormous implications for both shoe manufacturers and the suppliers of existing waterproofing technologies. Only time and the market place will truly tell. 