

The footwear industry in developed countries is increasingly following the path of innovation in order to survive. Some very clever technologies are emerging but these are often expensive, difficult to apply and suit only specific types of shoes. Here is one that would appear to be just the opposite.

A very smart material

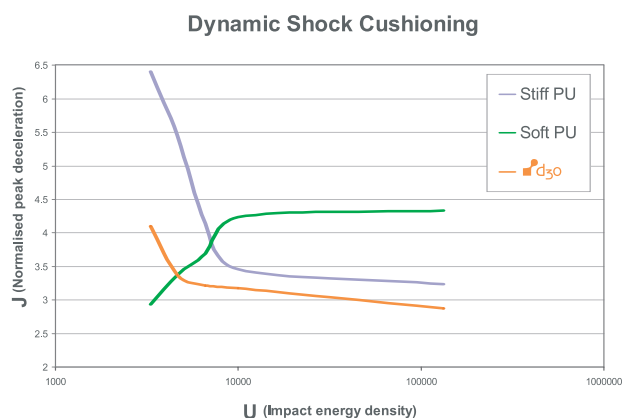
d3o Lab is a small, rapidly growing, UK company, formed in 1999 and which currently only consists of ten people. What it lacks in numbers, however, it more than makes up for in terms of scientific and technical qualifications. It has also developed a revolutionary concept in comfort and impact absorbent materials—d3o.

How does it work?

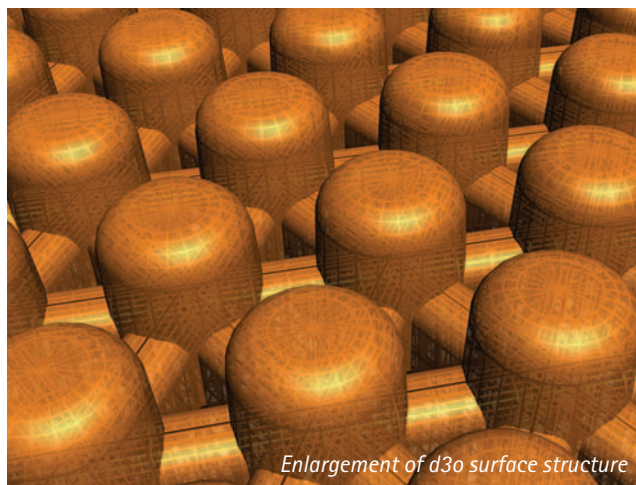
The material is composed of 'intelligent' molecules that flow over each other when you move, but lock together under shock impact. In other words, it actively changes its stiffness in response to the level of dynamic load applied. It is therefore soft and flexible when walking, but stiffens under shock to absorb the increased impact force. It then returns to its original state after the impact has passed.

What is it like?

Very clever and, unlike some other approaches to the same problem, totally non-mechanical. The company is naturally reticent as to what goes into the product but, needless to say, it involves an intriguing combination of chemical constituents.



Stiffer materials tend to perform well at high impacts but poorly at low and vice versa. d3o appears similar to a soft material at low impact but, as impact energy level rises and soft materials become less effective, it reacts like a stiffer material, absorbing higher shocks and so reducing the need to compromise comfort and performance in the shoe.

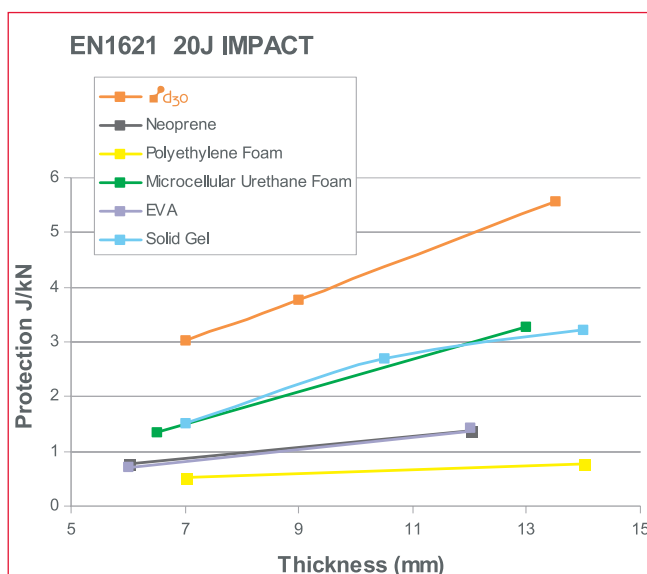


Enlargement of d3o surface structure

It can be produced in either sheet form or as moulded components. In sheet form it can be factory processed like any other insock material. The moulding process used means that moulds for producing custom shape insoles are not prohibitive either. It also appears to compare favourably with high performance PUs.

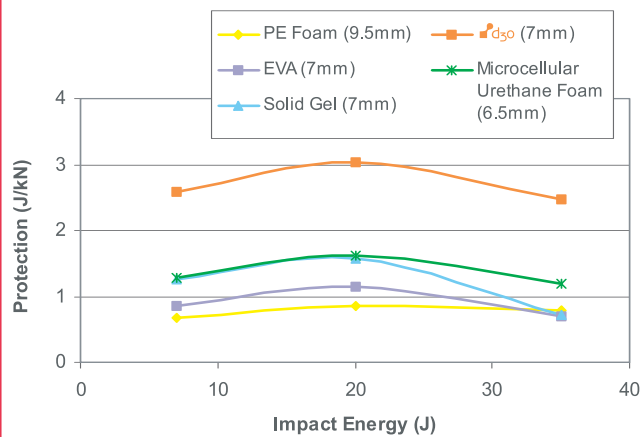
How well does it work?

One answer is to look at the illustrated test results comparing it to other systems.



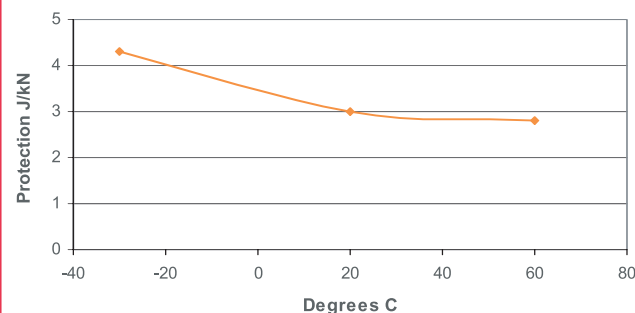
Impact performance compared with other materials commonly used for shock absorption in shoes. The test measures the force transmitted during a 20 joule impact for a range of material thicknesses. The protection (J/kN) or level of energy required for the impact to transmit 1kN of force can then be calculated. The higher the value the better the protection.

Protection vs Energy Level



This graph shows the ability of d3o to respond instantaneously to differing levels of impact load by comparing it with the same set of materials at varying energy levels.

d3o Impact Performance with Temperature



It also performs well over a wide temperature range. This graph shows the results of three identical samples tested at widely differing temperatures and impacted at 20J.

What else does it have?

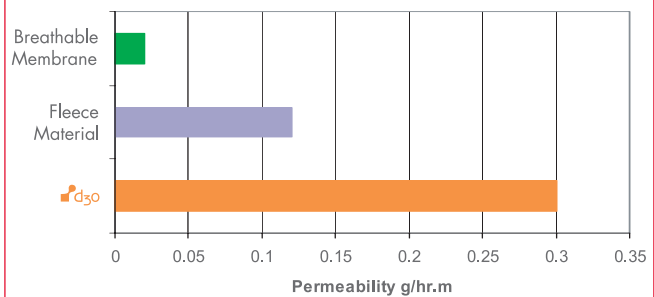
Well, unlike some other shock absorbing materials, it operates effectively at a thickness of 7mm and down to 4mm for less severe applications. This immediately makes it applicable to quite a wide range of footwear types and not just high-performance sports shoes. Its good breathability suggests it would be comfortable to wear all day, so this should be good news for postmen. It also sounds like good news for people tramping round exhibitions.

Is it commercial yet?

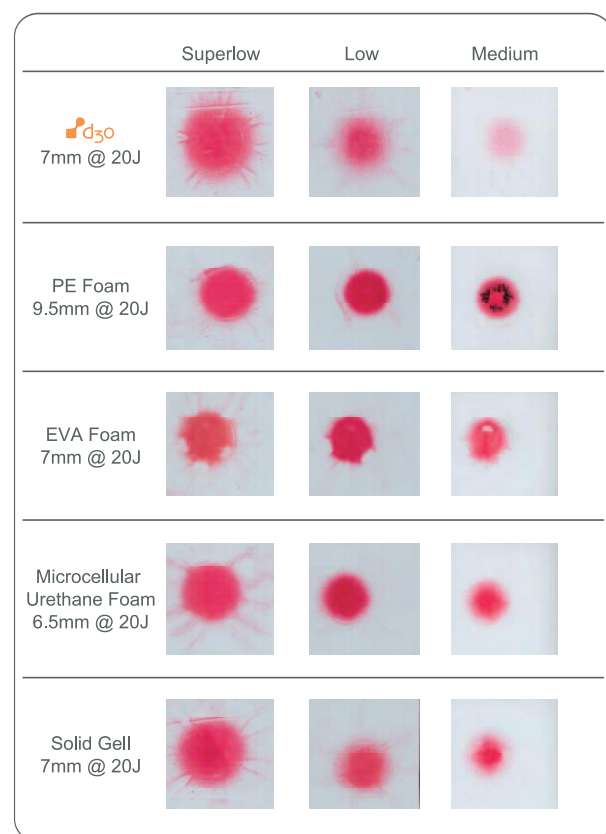
Yes, Globe launched its Icon skateboard boot at the Action Sports Retail Show in January. While this is a specialist application, it does demonstrate the potential. Traditionally, this type of footwear has used EVA as the shock absorber. The drawback was the thickness, which reduced feedback to the rider. The fact that d3o can be used so much thinner has answered this problem as well as offering a soft cushion. Professional riders have also reported an increased control of the board as well as a reduction of painful heel and foot bruising.

d3o Lab is working with brands producing and marketing other types of footwear ranging from football boots to ballet

Permeability Results



d3o also compares well in regard to permeability against ASTM E96-00 standard.



The level of pressure transmitted during impact is important in a shock absorbing material. Pressure sensitive films indicate levels of pressure transmitted during impact. The darker the colour red the more intense the pressure. Medium (14007000psi), low (350400psi) and superlow (70350psi) sensitivity tapes are simultaneously used to illustrate pressure spread and intensity. This set of signatures shows that d3o transmits the lowest pressure for a 20J impact on both medium and low rated films. The ultrasensitive superlow film also shows that the material spreads the force over a larger area.

shoes. At this stage, the cost might appear high compared with established systems and materials. However, these have the advantage of established volume usage and no doubt, as this new material comes into wider use, the cost of its special raw materials will fall and so it will become more cost-effective in the wider market.