



PUTTING A BOUNCE INTO WALKING

The idea of designing footwear with comfort as the primary aim really started with the sports shoe phenomenon of the latter part of the last century. Wearers found the shock absorbing qualities of these shoes offered a new walking experience and began to demand the same in their every day footwear. While the bulky nature of sports shoe soles allowed for a substantial shock and pressure absorbing layer to be incorporated, the thinner soles of dress shoes did not, so another solution was needed. The answer was a thin urethane foam developed by Rogers Corporation in the U.S.A. during the 1970s called Poron Performance Cushioning.

WHAT IS IT?

Poron is the name given to a series of flexible polyurethane foams made from chemical reactions between isocyanates and polyols. A mixture of these two chemicals is mechanically frothed and spread on to a substrate. The reaction between them is then accelerated by heat to turn it

into a fully cured foam sheet. While this may sound simple, needless to say it is not. The reason Poron foams do what they do lies in their structure, so the first thing is to consider what is demanded of them.

In most instances, under-foot comfort depends mainly on the insole or the foam foot bed material combined to it. Modulus or softness in this area affects both immediate (perceptive) and long-term (performance) comfort. End use determines the required modulus so dress shoes tend to use soft foam and sports shoes a much firmer one. A wide range of modules is therefore essential.

Cell structure is all-important and uniformity of cell formation essential. If it collapses under compression and temperature, compression-set resistance and impact attenuation can be greatly reduced. Furthermore, a non-uniform cell structure can also lead to inconsistent moisture management which is another facet of overall foot comfort.

Open cell foams perform better in thin substances than closed ones which derive a significant proportion of their

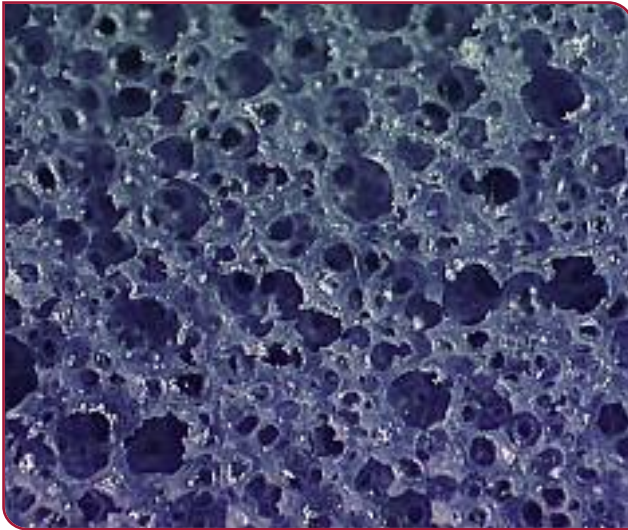


Fig 1a – Poron open cell foam.

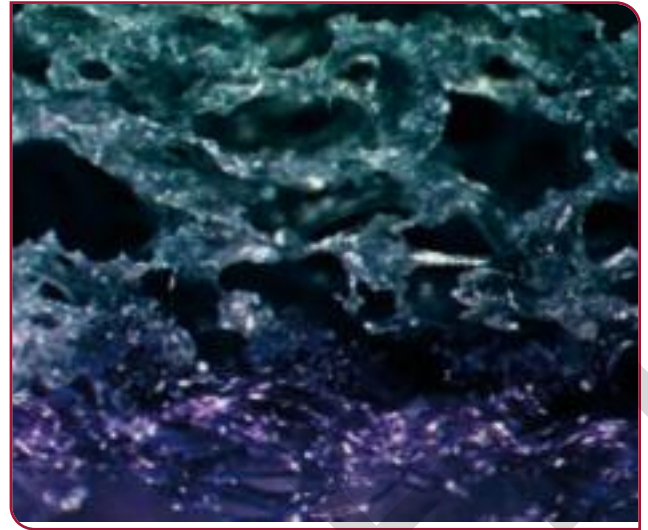


Fig 1b – Typical closed cell foam.

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modulus from compressing the gas inside each cell. This gas diffuses over time, reducing load retention and causing compression set. The thick midsoles of sports shoes naturally take longer to breakdown than thin insole foams which is why closed cell EVA is still widely used for them. The magnified 50X optical micrographs in *Figure 1* compare the uniform structure of open cell Poron with that of a closed cell foam.

THE MECHANICS

Modulus varies depending on end use, so it is important to offer a range of moduli for different applications. Another key factor is change in the modulus of the foam with extent of compression. *Figure 1* shows how compression force deflection (CFD) relates to compression. Although foam suppliers provide CFD at 25% compression as a measure of softness, the weight of the person or dynamics of the application (walking or jogging) will apply varying amounts of compression. This can produce a modulus or hardness

value higher or lower than that at 25% compression even though this is the design parameter. It is important that a material's CFD curve remains flat over a significant range of compression to ensure the same modulus and comfort across a wide range of physical activities. The CFD curve of a material should therefore be used as a measure of its softness as much as the 25% CFD value (*Figure 2*).

Long-term or performance comfort is measured by the compression set resistance of the foam. Compression set is defined as the loss in thickness when compressed for a period of time at a specific temperature. Typically, for footwear materials, foams are compressed to 50% of original thickness and held at room temperature or 70°C for 22 hours (ASTM 3574 Test D). Physical activities such as walking, jogging or running, involve varying degrees of shock or impact on the feet, which may be transmitted to the rest of the body. Shock or impact is one of the leading causes of fatigue and injury in sports. Impact attenuation is a very

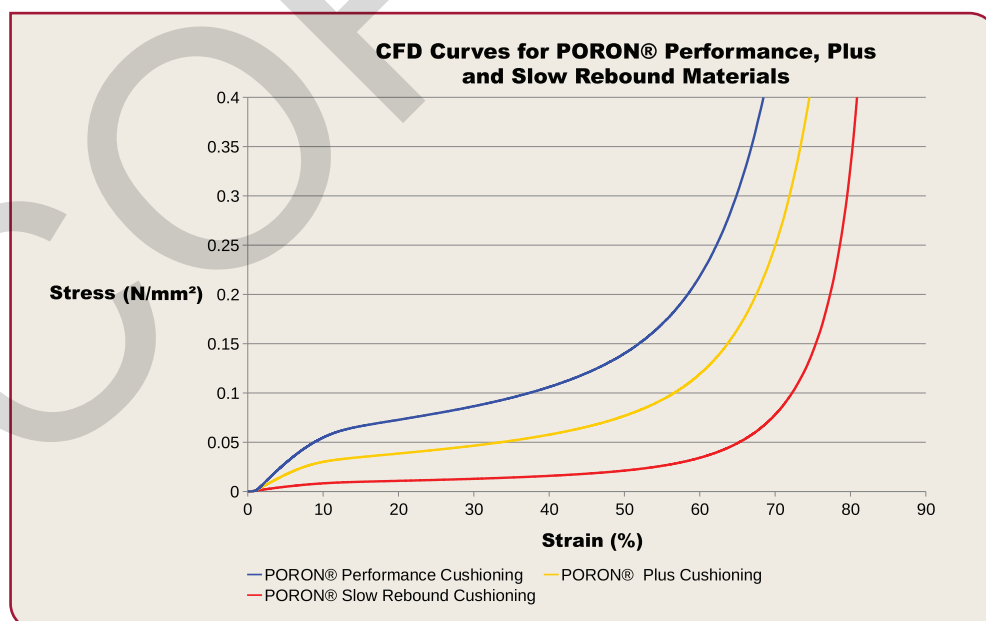


Fig 2 – CFD curves for Poron Performance, Plus and Slow Rebound Materials.

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effective technique of managing that energy in both sports shoes and everyday footwear.

For an insole foam to contribute to the total comfort of the wearer, both mechanical and sensory comfort features need to be provided by the material. Slow recovery foams allow for a combination of very low hardnesses, which provide perceptive comfort to the wearer while, at the same time, offering impact attenuation or shock absorption due to the nature of the polymer. Rogers believes that its foams are the only ones that combine this desirable combination of slow recovery with good moisture management and excellent mechanical comfort.

These foams are engineered to manage moisture from the foot as much as provide cushioning for it. The secret is once again the patented open cell structure which can be formulated to offer varying combinations of performance depending on the type of footwear involved. Typical cell diameters are 100-150 microns and the gaps between them only 20 microns (a micron is 1/1,000 of a millimeter). It is this open cell structure that makes the material breathable as well as improving compression-set resistance and long load retention for longer lasting performance in wear. Each cell acts like a tiny spring and, since it is an open cell, this spring has a wide compression range that provides much of the high shock absorption properties. The uniformity of cell structure also provides consistent mechanical and moisture transportation properties.

SPOILT FOR CHOICE

To accommodate the wide diversity of footwear types and applications, there are now more than 14 different versions of this versatile material in a huge range of colours and a variety of thicknesses, densities and surface finishes designed to meet the needs of just about any activity involving footwear. Choosing the right combination could be a daunting task. Fortunately, the company has a team of experienced sales engineers on hand and, if they are unable to find a regular product that meets a customer's requirements, one can be specially formulated.

Three key factors lie at the heart of the materials' success. First, no plasticisers are used in their formulation so they will not shrink, become brittle or crack with age. Second, they possess an extremely high level of impact absorption to reduce impact on feet and joints. In side-by-side drop weight tests, Poron materials have been shown to outperform vinyl sponge, neoprene sponge, sponge rubber, latex foam and solid viscoelastic. And, finally, they have that ability to breathe so feet stay dry and cool by drawing water vapour and perspiration away.

Warm and moist shoes provide an ideal breeding ground for bacteria and the resultant mould and mildew that cause foot odours. To combat this, Rogers infuses Microban antimicrobial protection into the foam to provide effective protection that lasts throughout its life. When microbes come in contact with the surface of the material, the protection

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penetrates its cell walls and disrupts key functions so they cannot grow or reproduce. The technology has undergone extensive independent laboratory testing and meets stringent requirements for the control and monitoring of hazardous substances. So, what are the basic types of Poron and what do they do?

Poron Plus is aimed at general footwear and comes in a variety of combinations with Microban as standard. It has a soft feel and offers good energy return to help reduce stress on joints and soft body tissues. It is available in a variety of densities, colours and thicknesses from 2.0mm to 12.7mm.

Poron Performance is designed for maximum repeated shock absorption from minimum thickness. It is claimed to help alleviate damaging shockwaves caused by strenuous activity making it suitable for sports, work and outdoor footwear. In this case, thickness runs from 1.0mm to 12.7mm.

Poron Slow Rebound takes a further step and continues to return to its original state after each period of use unlike other memory foams that tend to adapt to the wearer's foot over time. Made in soft, very soft, firm and very firm formats it is available with all the other regular variations.

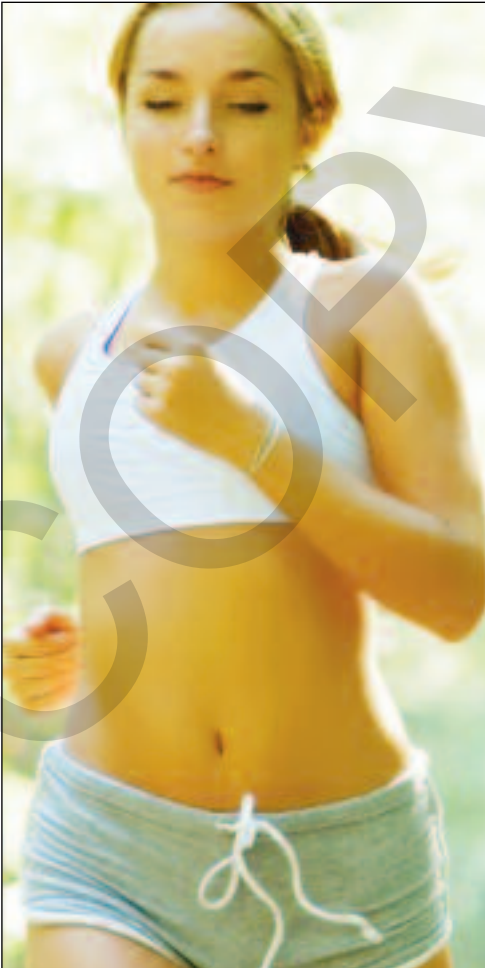
Poron Dual Layer (Figure 3) combines Slow Rebound and Performance in a unique two layer concept, but still continuous open cell foam, to provide customised fit and high shock absorption in just one material. Standard thicknesses are 3mm and 4mm although other material combinations can be produced.



Fig 3 – Section through Poron Dual Layer.

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Since developing this clever material over thirty years ago, Rogers has continued to refine its variations to cover as wide a range of applications as possible. Like many others, it has also sought to reduce its reliance on oil-based polyols. Using soy-based polyols, Poron ReSource boasts a 45% replacement level without losing quality or performance. And, not content with this, you can also buy Performance infused with lavender, rose or baby powder fragrances. Now, that's really putting a bounce into walking. 🏃‍♂️





YOUR COMFORT OUR PASSION

**THE AVERAGE INSOLE ONLY FILLS A SPACE
PEDAIR IS NOT YOUR AVERAGE INSOLE**

Dryer Feet

Odor Free

Green Biocide

Moisture Absorbing

Low Compression Set



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