

# The Evolution of Sorbothane® In Sports Medicine



## Development Of Sorbothane®

In 1975 – material scientist, Dr. Maurice Hiles embarked on a series of bold and fascinating human experiments. He had electrical probes surgically implanted into his own leg thus becoming a human test subject. These probes measured the effect that running and walking have on the human body.

The results of his experiments were surprising - they showed that the body could be subjected to up to 17 Gs of dangerous force when running. Dr. Hiles began working on a material that could absorb this harmful heel-strike shock before it entered the body. This new material would also need to possess excellent memory and perform over extended periods of time.

He patterned his discovery after the body's own shock absorbers, human flesh and the calcaneal fat pad. Dr. Hiles named his new synthetic material - Sorbothane. Dr. Hiles' unique viscoelastic material was awarded a 17-year patent and its initial application included the development of shock-absorbing Sorbothane Heel Pads and Insoles to comfort and help protect the body from harmful shock.

### **Studying Heel Strike**

During Dr. Hiles' testing, measurements taken at various positions in the human frame show that the shock from heel-strike is not a smooth wave flowing through the body. Rather it is a reverberation, like a shunting train, with successive sharp shocks transmitted rapidly up the skeleton and then radiating slowly in shear outwardly from the bone, through the surrounding soft tissues.

Not only do these rogue shock waves retard recovery, they can also contribute to pain and degeneration. Achilles Tendonitis, for example, was thought to be the result of the force of the foot hitting the ground causing micro tears in the muscle fibers and was often treated by raising the heel to relax the tendon. However, high-speed film shows that, at the instant of heel strike, tension in the calf muscles is not at its maximum and indeed, a few milliseconds later, one sees the contraction wave appear. It is, therefore, far more likely that the damage is caused by the shear waves that produce a whiplash effect in the soft tissue.

### **How Heel Strike Is Harmful**

Studies indicate that transient shock waves and high levels of acceleration may be detrimental to the normal body healing process and may contribute to musculoskeletal degeneration and other disorders:

- Contributing to the degenerative cartilage changes associated with osteoarthritis
- Aggravating pre-existing neuromuscular and skeletal disorders
- Loosening of prosthetic joints
- Be a factor in back and neck pain
- Pain beneath the heel
- Soft tissue sports injuries
- Lead to joint discomfort throughout the body
- Planter fasciitis
- Post-fracture pain
- Retardation of recovery from injuries to the spine and lower limbs, particularly those resulting from sporting activities

### **Cushioning Harmful Shock Waves**

The studies have shown that human flesh could have a remarkable ability to absorb kinetic energy. In fact shock wave readings as high as 5G at ankle level could become as low as 0.5G at teeth level.

**However, overuse, injury and normal aging severely diminish the effectiveness of the body's own ability to handle harmful impact shock.**

Conventional materials such as foam, soft rubber, silicon, sponge, felt and leather have been tried to cushion impact shock waves but were proven ineffective. Either they do not reduce the level of deceleration or because their wear characteristics rendered their life unacceptably short. One or two can actually increase reverberation quite substantially.

**Accordingly, extensive research and development was initiated by Dr. Hiles and Sorbothane a viscoelastic polymer was the result – a unique material that reproduces the molecular structure and physical characteristics of human flesh.**

### **The Sorbothane Difference**

When used as a heel insert or insole Sorbothane delays the deceleration peak and reduces it to an acceptable level. Similarly, the decay is also delayed and reverberation eliminated. Sorbothane is a material that has the ability to provide comfort and help protect the entire body from impact shock injuries. Sorbothane won't bottom out, breakdown or lose its effectiveness even after thousands of cycles.

### **Nike Studies Confirm Sorbothane® Absorbs Up To 94.7% Of Impact Shock**

Sorbothane is unique – it both reduces the force of the initial shock (the peak is a lot lower with Sorbothane) and also spreads the load over a longer period.

Sorbothane absorbs more energy than competitive materials and after compression it returns steadily to its original position. Sorbothane fully and smoothly will return to its original shape after a measured delay.

The delayed recovery rate of Sorbothane prevents the “backlash” of the shock waves.

### **How Sorbothane Acts In Viscoelastic Inserts**

The research, which revealed the damaging shock waves that are

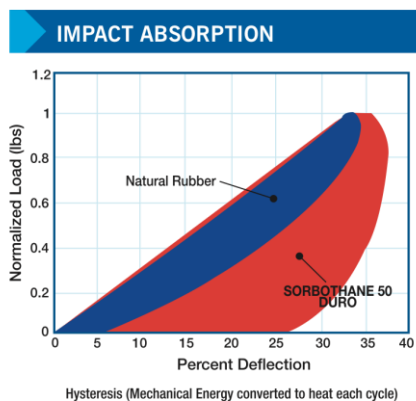
transmitted through the skeletal structure on heel strike, also indicated the desirable properties of a cushioned pad.

- Firstly, on initial impact of the heel on the ground, the pad has to deform readily and so spread the load over a wider area.
- Then, on compression by the body's weight, the pad has to become progressively stiffer in bringing to a halt the downward movement of the heel. During this deceleration, the pad has to dissipate the energy absorbed.
- Finally, the pad has to return to shape at a rate slow enough not to exert a significant upward pressure when the foot is on the ground but fast enough to regain its shape during the next step.

A material possessing these properties has therefore to act on the one hand like a viscous fluid and on the other like a resilient rubber. Viscoelastic Sorbothane exhibits both fluid and solid properties.

Sorbothane is a synthetic material that has many of the properties of the body's own energy-absorbing tissue and skin. It is soft and is readily deformed. It is capable of dissipating over 90% of the energy of deformation. Yet Sorbothane fully returns to shape on removing the deforming force, and at the desirable rate between heel deceleration and the period of a step.

Sorbothane has this combination of unique properties due to the deliberate molecular-engineering in its synthesis. A viscous liquid contains long-chain molecules with attractive forces between them, which have to be overcome by the deforming force. Conversely a resilient rubber is composed of a network of chains of low inter attraction, so quickly returning to shape on removing the deforming force. Sorbothane has been designed to be in between these. The polyurethane molecules exert a high damping action on being deformed but a loose network holds them together, which is yet sufficiently strong to return the material to original shape.



### Impact Absorption

The graph shows the high hysteresis necessary for efficient impact absorption. By comparing the area under the curves, it is clear that Sorbothane removes more of the impact energy from the system. Natural rubber is more elastic and returns energy to the system. High-energy return causes high rebound and increases the potential for damage.

## **Sorbothane Standards**



### **APMA - Ensuring Quality**

In 1986 Sorbothane® was granted the American Podiatric Seal of Acceptance. The APMA Seal of Acceptance and Seal of Approval are granted to products found to promote good foot health. The Seal of Acceptance is awarded to shoes, socks, insoles, materials and equipment.



### **100% Made In America**

Since the beginning - Sorbothane® insoles have been made in the USA. Highly recommended by doctors, sports medicine specialists and professional trainers - Sorbothane® Insoles have proven to be the best defense against foot pain and impact-related injuries.

### **Sorbothane Material Data Sheets –**

<http://www.sorbothane.com/technical-data-sheet.aspx>

**Sorbothane Insoles –** [www.insoles-sorbothane.com](http://www.insoles-sorbothane.com)

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