

## Versatility

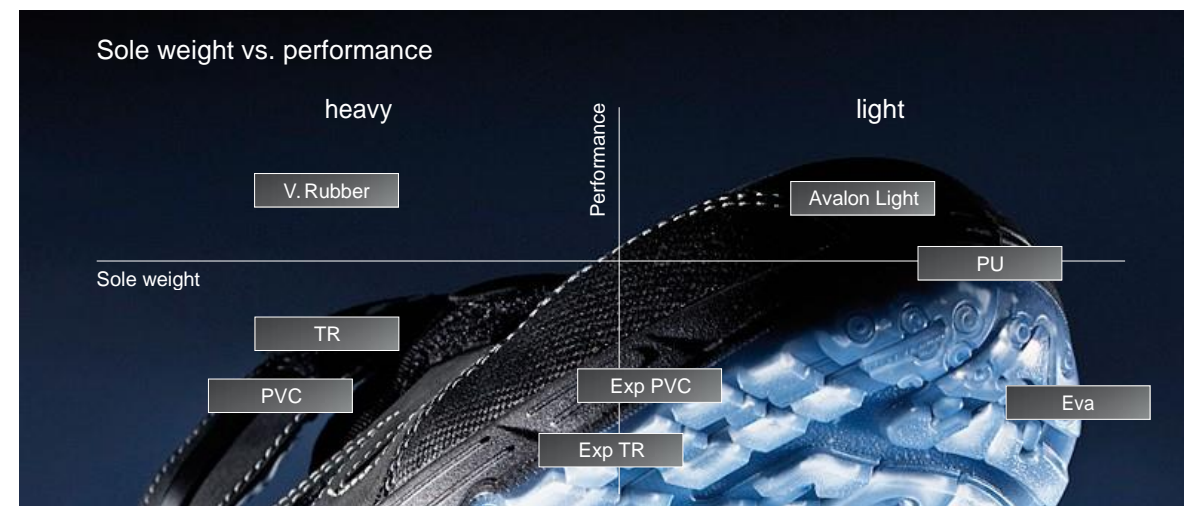
Polyurethanes can be formulated in different chemical combinations to create shoe systems that are light, tough, comfortable, flexible, insulating, waterproof, slip-resistant, hardwearing and shock absorbent – depending on requirements.

Add clear-cut production advantages; compatibility with leather, textiles and rubber; and the potential to achieve endless shapes, textures and colors; and you have a modern manufacturing material that can be manipulated for applications including outsoles, midsoles, inserts, sockliners, gels, airbags and other footwear accessories.

Huntsman Polyurethanes was one of the first companies to develop and launch fully water-blown polyether systems for the footwear industry, eliminating the use of ozone depleting CFCs and HFCs. Today, the company's footwear solutions remain environmentally friendly: they do not need physical blowing agents and are free from heavy metals and plasticizers.

Footwear technologies on offer include:

- Reactive polyurethanes: either polyester, polyether or hybrid system – all suitable for injecting into closed moulds or casting into open moulds.
- Thermoplastic polyurethanes (TPU): a material with good performance and abrasion resistance, typically used for high-end applications – and available across a wide hardness range.



In addition, dual density soles can be created combining the benefits of a hardwearing TPU outsole with the comfort and lightness of a low-density cushion two-component polyurethanes midsole.

Key benefits of reactive polyurethanes and TPUs:

- Wide range of densities (very low to compact)
- Full scope of hardnesses (low to hard)
- Very high production efficiency
- Versatility of colors and finish – including multi-layer production
- Speeds new developments and designs
- Easy adhesion to uppers
- Abrasion resistance
- Good flex performance
- Fully water-blown systems
- Free from heavy metals and plasticizers



# HUNTSMAN

Enriching lives through innovation

### About Huntsman

Huntsman is a global manufacturer and marketer of differentiated chemicals. Our operating companies manufacture products for a variety of global industries, including chemicals, plastics, automotive, aviation, textiles, footwear, paints and coatings, construction, technology, agriculture, health care, detergent, personal care, furniture, appliances and packaging. Originally known for pioneering innovations in packaging and, later, for rapid and integrated growth in petrochemicals, Huntsman approximately 12,000 employees and operates from multiple locations worldwide. The Company had 2010 revenues of approximately \$9 billion. For more information about Huntsman, please visit the Company's website at [www.huntsman.com](http://www.huntsman.com).

Huntsman Polyurethanes is a global leader in MDI-based polyurethanes, serving over 3,000 customers in more than 90 countries. We have worldscale production facilities in the US, the Netherlands and China, and 13 highly capable downstream formulation facilities which are located close to our customers, worldwide.

Working with a global enterprise, Huntsman customers can benefit from security of supply and assured product quality. Cross-fertilizing ideas, technical experts, based in regional development centers in Europe, Asia Pacific and the Americas, work closely together, sharing their expertise. Combining global intelligence with local knowledge they can help formulators establish new product applications and deliver growth through differentiation and innovation. Furthermore, as a supporter of Responsible Care – the international chemical industry initiative – Huntsman is committed to improving all aspects of environmental, health and safety activities. For more information on Huntsman Polyurethanes Footwear, please visit <http://www.huntsman.com/pu>



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## Polyurethanes Footwear





## Polyurethanes: the perfect partner

The material technologies that a footwear manufacturer chooses depends on the final physical and mechanical properties they want to achieve. Huntsman offers footwear solutions based on a number of polyurethane chemistries:

### Polyester-based systems

Huntsman Polyurethanes offers high quality, polyester-based liquid systems that can be personalized to suit different applications. Typically water-blown they can be used in both injection moulding and unit sole production, covering single and double density applications. Offering good strength, abrasion resistance, excellent processing benefits, and a rubber-like finish, they are well suited for safety footwear, high performance casual shoes and high productivity unit soles.

**DALTOREZ®: a range of customizable polyester polyols.**

### Polyether-based systems for the footwear industry

Water-blown polyether-based systems are suitable for unit sole processing. Producing high definition soles with fewer air bubbles and a rubber-like look and feel, they are appropriate for high- and low-end applications and popular in casual shoes, insoles and open sandals. Resistant to hydrolysis and microbial attack, and with very good cold flex properties, polyether-based systems are widely used in high humidity countries and cold climates.

**DALTOCEL®: a range of customizable polyether polyols.**

In addition, there are two brands that span both of these formulation options:

**SUPRASEC® and DALTOPED® - trade names for MDI that can be based on either polyether or polyester chemistry.**

### Hybrid technology

To meet special market needs, solutions combining the benefits of polyether and specific polyester properties can be tailor made.

For some people, shoes are desirable objects that help them make a fashion statement. For others they are simply a practical necessity. Whatever the motivation behind selecting shoes, one thing is certain: with the average person walking 7500 steps each day, modern footwear needs to be hardwearing and comfortable.

Infants with delicate feet require soft, supportive shoes that give them the confidence to take their first steps in the world, but are tough enough to withstand scuffs and scrapes. Adults need appropriate footwear for work and play, from smart shoes for the office and protective professional boots for industrial jobs to summer sandals and serious specialist sportswear. With different criteria to satisfy, creating successful shoes is complex and footwear manufacturers need to select the right materials.

Polyurethanes have been popular across the footwear industry for many years. First introduced to the sector by Huntsman, this flexible engineering plastic gives footwear companies the freedom to create innovative designs in step with fashion trends, modern manufacturing techniques and environmental concerns.

## AVALON® TPU for the footwear industry

Huntsman Polyurethanes provides a full range of TPU grades under the AVALON® brand. Known for their high durability and aesthetics, AVALON® TPUs can be supplied at a softness as low as 60 Shore A and a hardness up to 65 Shore D.

**AVALON® Crystal:** A range of transparent grades suitable for applications from sports plates to casual shoes and logos. AVALON® Crystal shows a high degree of transparency up to 6mm in thickness and is stabilized against premature color degradation from sunlight.

**AVALON® Perform:** Widely used in soccer plates, top-pieces and stabilizers, AVALON® Perform products exhibit exceptional abrasion resistance and low temperature performance, are easy to process and give long-term durability.

**AVALON® Soft:** A range of soft, durable injection mouldable materials suitable for unit soles or for combining with polyurethane midsoles to produce hardwearing dual density outsoles. AVALON® Soft can be used in almost every kind of footwear application from anti-static adjusted outsoles for safety shoes to all types and styles of casual shoe as well as inserts and logos.

**AVALON® Light:** A durable, good-looking and comfortable soling material with good slip resistance. Up to 50% lighter than rubber soles, AVALON® Light does not require external release agents and there is no need for post-mould washing or degreasing. AVALON® Light offers comfort through lightness and softness; durability; versatility to create unique designs; and anti-slip properties – attributes that have made it popular in the quality casual footwear arena.

**AVALON® COMPOUND:** Tailor-made compounds and blends suitable for sporting goods where enhanced properties can be used to provide extra performance.



## AVALON® Duo: The perfect combination

AVALON® Duo is the brand name for a system that combines the benefits of a hardwearing AVALON® TPU outsole with the lightness and comfort of a reaction moulded polyurethane midsole. During production, AVALON® TPU is cast or injected into the outsole mould. After a short cooling period the mould is opened and liquid polyurethane is applied to the fresh TPU surface. The upper can be incorporated at this stage to produce a shoe in one easy step or a unit sole can be produced for later assembly. This flexibility helps shoe producers create original, cutting-edge footwear designs and penetrate top end of casual and safety footwear markets.

**AVALON® Duo: for design, performance and comfort.**

### Applications

- Casual and fashion
- Safety and military
- Hiking boots
- Sports shoes

### Key Benefits

#### Design

Perfect surface definition  
Matt or glossy effects  
Wide color range  
Transparent grades available  
Rubber-like look and feel

#### Performance

Abrasion resistance  
Cold flex properties  
Slip resistance  
Good adhesion to upper  
Antistatic options

#### Comfort

Shock absorption  
Lightweight  
Insulation