smartLite®

Your most confident footprint

An impression

smartLite® is a registered trademark of Huntsman LLC.
smartLite® is a novel high quality thermoplastic soling material offering a unique combination of

- Lightness/comfort
- Performance
- Aesthetics
- Anti-slip
smartLite® soles can give a substantial contribution to the overall comfort of the final shoe, through their combination of weight, flexibility and cushioned support.

The microcellular structure acts as an insulation layer helping to maintain a more constant temperature underneath your foot.

smartLite® takes care of your feet.
Comfort

- Internal cell structure (magnified)
- Density 0.5 g/cc
smartLite® soles offer long lasting performance and durability at levels only normally associated with much heavier soling materials.

Abrasion resistance is similar to traditional rubbers, yet a smartLite® sole can weigh up to 50% less.

To date over 8 million pairs of shoes have been sold with no returns due to smartLite® performance.
Simulated wear: mass loss after 12000 cycles on concrete

<table>
<thead>
<tr>
<th>Material</th>
<th>Mass loss (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPU (65 ShA)</td>
<td>0.26</td>
</tr>
<tr>
<td><em>smartLite</em></td>
<td>0.37</td>
</tr>
<tr>
<td>PU</td>
<td>0.39</td>
</tr>
<tr>
<td>TR (60 ShA)</td>
<td>0.51</td>
</tr>
<tr>
<td>VR</td>
<td>0.77</td>
</tr>
<tr>
<td>PVC</td>
<td>1.00</td>
</tr>
<tr>
<td>TR (50 ShA)</td>
<td>1.11</td>
</tr>
</tbody>
</table>
Durability versus expanded materials

Specific Durability

- EVA
- Blown TR
- Blown PVC
- smartLite
Durability versus solid materials

- Leather
- EVA
- TR
- PVC
- VR
- smartLite

Specific Durability
smartLite® soles have superb aesthetics, coupled with a unique tactile feel.

The injection moulding process allows the material to closely mimic the surface texture of the mould, allowing designers freedom of choice for surface finish, and the possibility to combine a variety of finishes in the same mould.

Inserts in many types of material, including leather are readily incorporated allowing further design ideas to be exploited and making unique soles which are difficult to copy using alternative materials.
Aesthetics
Slip resistance

Independent testing shows smartLite® soles offer a unique benefit in terms of slip resistance.

smartLite® soles perform well on a variety of surfaces and surface conditions, however one unique property is that slip performance of a partially worn sole gives comparable results in dry conditions as well as wet. This means that you can feel more secure as you walk, even in the rain.

The microcellular structure maintains a high level of surface roughness throughout the lifetime of the sole, unlike some compact materials which can become polished and therefore more slippery as they wear.
Slip Resistance: SL and VR

- Surface of Men's walking boot
- 35x magnification
- High quality VR at 1.15 g/cc
- Approx. 3 months wear
- Surface roughness \( (R_a) \pm 3\mu m \)

- Surface of Men's walking boot
- 35x magnification
- smartLite® at 0.75 g/cc
- Approx. 3 months wear
- Surface roughness \( (R_a) \pm 18\mu m \)

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Slip Resistance: SL and VR

Slip Comparison

- Dry
- Wet
- % Retention

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### Slip Resistance: different materials

<table>
<thead>
<tr>
<th>Sample</th>
<th>Condition</th>
<th>Dry</th>
<th>Wet</th>
<th>Frosted Ice</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMARTLITE</td>
<td>New</td>
<td>0.70</td>
<td>0.52</td>
<td>0.46</td>
</tr>
<tr>
<td></td>
<td>Worn</td>
<td>0.88</td>
<td>0.77</td>
<td>0.45</td>
</tr>
<tr>
<td>TPU (65 ShA)</td>
<td>New</td>
<td>0.80</td>
<td>0.52</td>
<td>0.37</td>
</tr>
<tr>
<td></td>
<td>Worn</td>
<td>0.86</td>
<td>0.62</td>
<td>0.35</td>
</tr>
<tr>
<td>2K PU</td>
<td>New</td>
<td>0.62</td>
<td>0.60</td>
<td>0.37</td>
</tr>
<tr>
<td></td>
<td>Worn</td>
<td>0.77</td>
<td>0.72</td>
<td>0.42</td>
</tr>
<tr>
<td>VR</td>
<td>New</td>
<td>0.69</td>
<td>0.50</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>Worn</td>
<td>0.88</td>
<td>0.46</td>
<td>0.34</td>
</tr>
</tbody>
</table>

**Coeff of friction (clay quarry tile)**

- **New**: Highest retention
- **Worn**: Low retention
### Slip Resistance: different materials

<table>
<thead>
<tr>
<th>Sample</th>
<th>Condition</th>
<th>Coeff of friction (clay quarry tile)</th>
<th>Best result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Dry</td>
<td>Wet</td>
</tr>
<tr>
<td><strong>SmartLite</strong></td>
<td>New</td>
<td>0.70</td>
<td>0.52</td>
</tr>
<tr>
<td></td>
<td>Worn</td>
<td>0.88</td>
<td>0.77</td>
</tr>
<tr>
<td><strong>TR (60 ShA)</strong></td>
<td>New</td>
<td>0.88</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>Worn</td>
<td>0.90</td>
<td>0.62</td>
</tr>
<tr>
<td><strong>TR (50 ShA)</strong></td>
<td>New</td>
<td>1.00</td>
<td>0.63</td>
</tr>
<tr>
<td></td>
<td>Worn</td>
<td>0.97</td>
<td>0.60</td>
</tr>
<tr>
<td><strong>PVC</strong></td>
<td>New</td>
<td>0.77</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>Worn</td>
<td>0.78</td>
<td>0.62</td>
</tr>
</tbody>
</table>

- **Best result**: high Coeff of friction values, especially in dry conditions.
- **Highest values in dry**: but very low retention.
- **Very slippery**: low Coeff of friction values, especially in wet conditions.
Slip Resistance: different materials

Slip resistance

Coefficient of friction vs. Material type

- New smartLite®
- TPU
- 2K PU
- VR
- TR(60ShA)
- TR(50ShA)
- PVC

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Slip Resistance: different materials

<table>
<thead>
<tr>
<th>Material type</th>
<th>Coefficient of friction</th>
</tr>
</thead>
<tbody>
<tr>
<td>smartLite</td>
<td>0.8</td>
</tr>
<tr>
<td>TPU</td>
<td>0.6</td>
</tr>
<tr>
<td>2K PU</td>
<td>0.4</td>
</tr>
<tr>
<td>VR</td>
<td>0.8</td>
</tr>
<tr>
<td>TR(60ShA)</td>
<td>0.8</td>
</tr>
<tr>
<td>TR(50ShA)</td>
<td>0.8</td>
</tr>
<tr>
<td>PVC</td>
<td>0.6</td>
</tr>
</tbody>
</table>

smartLite® is a registered trademark of Huntsman LLC.
The unique features of smartLite® provide a range of more benefits to the customer:

- Reliable bonding to various upper materials
- Eco-friendly
- Excellent performance in cold environment
- Non-marking
- Antistatic, oil resistant, possible protection against micro-organisms, abrasion improver, flow improvers, ...
Reliable bonding to uppers

Even the best unit sole in the world is worthless if it cannot be reliably bonded to the upper.

smartLite® soles can be reliably bonded to upper materials, with minimal preparation.

Independent testing shows that bond strengths in excess of 10 N/mm force are possible with both traditional solvent based and water based adhesives.

Time consuming, expensive intermediate steps, e.g. halogenation of bonding surfaces, are not required.
Reliable bonding to uppers

Solvent Based Adhesive

- Results based on smartLite® at a density of 0.65 g/cc
- Standard leather upper
- Industry standard solvent based polyurethane adhesive
Reliable bonding to uppers

Water Based Adhesive

- Results based on smartLite® at a density 0.65 g/cc
- Standard leather upper
- Industry standard water based polyurethane adhesive
Many consumers, brands and moulders are acutely aware of the need to respect environmental issues and strive to use products and processes that help in this aim.

Independent testing of smartLite® products shows them to meet the criteria necessary to pass the relevant parts of the ‘European Eco-label for Footwear’.

Independent testing institutes confirm that no harmful residues are present in smartLite® soles.

Written attestation can be provided that none of the listed harmful substances (e.g. PCPs and Azo Dyes) are used in the manufacture of our products.

For more info : http://europa.eu.int/ecolabel.
Eco-friendly

smartLite® soles do not require the use of release agents or halogenation primers in the production process, again cutting down on the need to use hazardous chemicals.

smartLite® soles can be fully recycled in the production process, reducing the amount of waste.
Cold conditions: energy absorption

Material 30 min on cold plate (-17C) => T reduction
Material 30 min on hot plate (70C) => T increase

<table>
<thead>
<tr>
<th>Material</th>
<th>T reduction</th>
<th>T increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>smartLite</td>
<td>9.0</td>
<td>7.4</td>
</tr>
<tr>
<td>TR (60 ShA)</td>
<td>13.9</td>
<td>11.4</td>
</tr>
<tr>
<td>TPU (65 ShA)</td>
<td>13.8</td>
<td>7.7</td>
</tr>
<tr>
<td>VR (Vulcanised rubber)</td>
<td>6.2</td>
<td>3.2</td>
</tr>
<tr>
<td>PVC</td>
<td>13.9</td>
<td>5.4</td>
</tr>
<tr>
<td>PU</td>
<td>5.6</td>
<td>8.9</td>
</tr>
</tbody>
</table>
Cold conditions: flex performance

‘Bennewart’ type flex test at -25° C with a single incision made through the centre of the sole.

<table>
<thead>
<tr>
<th>Material</th>
<th>Cut growth (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>smartLite</td>
<td>0.0</td>
</tr>
<tr>
<td>TPU (65 ShA)</td>
<td>0.7</td>
</tr>
<tr>
<td>TR (50 ShA)</td>
<td>0.7</td>
</tr>
<tr>
<td>TR (60 ShA)</td>
<td>9.3</td>
</tr>
<tr>
<td>PVC</td>
<td>9.3</td>
</tr>
<tr>
<td>PU</td>
<td>10.5</td>
</tr>
<tr>
<td>VR</td>
<td>13.6</td>
</tr>
</tbody>
</table>
smartLite® soles perform very well with respect to marking of the standard flooring.

Independent test results show none to occasionally slight marking and all possible marks were found to be easily removable by dry wiping.

TR and PVC produce significantly more marking and leather as well as resin rubber produce levels of marking which cannot be easily removed.

smartLite® soles can be labelled as mark-resistant.
Commercialised Products

The following colour stable, phthalate-free and robust processing products with excellent flow characteristics for high performance footwear are on our range:

- **smartLite® 640**: ± 40 ShA - 0.60 g/cc - Children shoes
- **smartLite® 550**: ± 50 ShA - 0.50 g/cc – Midsoles
- **smartLite® 660**: ± 60 ShA - 0.60 g/cc - Single density soles
- **smartLite® 661**: ± 60 ShA - 0.60 g/cc - Single density soles requiring exceptional hydrolysis resistance (polyether-based)
- **smartLite® 680**: ± 80 ShA - 0.60 g/cc – sport shoes
- **smartLite® 681**: ± 80 ShA - 0.60 g/cc – sport shoes requiring exceptional hydrolysis resistance (polyether-based)
smartLite® is really a very versatile/flexible material.

As we enter other elastomer applications, flexibility will become more and more important.

- Injection moulding
- Extrusion
- Flow moulding
- Thermoforming
- Physical shaping
Ideal Injection Moulding
Machine Configuration

- Non-aggressive screw
- Barrel and nozzle temperature capability of up to 180°C
- Good temperature control
- Non-return valve
  (on hydraulics to retain pressure on screw after charging to avoid expansion in barrel and gas loss)
- Shut-off nozzle
  (not restricting the flow; to prevent gas escape through the nozzle and melt drool; hydraulically or pneumatically operated nozzles are preferred over the mechanically activated spring types)
- Mould temperature control between 15 and 50°C
  (Higher temperatures will increase the cooling time in the mould and can adversely affect the cell structure of the finished part. Too low a mould temperature can cause poor flow in the mould and a poor surface quality)
Virtual smartLite®

**Receive**
Electronic Mould Design
(Designers File Format)

**Simulate**
Mould Filling

**Optimise**
Mould by Simulation

**Deliver**
Optimised Mould Design

Optimise:
- Shot Weight
- Skin Thickness
- Density Distribution
- Gate Positions
- Runner Design
- Venting
Virtual smartLite®
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Mr Bart Van Edom, Product Manager

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