SATRA TECHNOLOGY

Your premier technical partner
Testing of elastomers used in the footwear industry.

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SATRA Technology
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SATRA Technology

- Shoe and Allied Trade Research Association – 1919

- 100 years of research and testing within the footwear industry

- Creation and development of test methods and industry standards

- Manufacturing machinery

- Continuing to diversify our areas of expertise (Safety products, Automotive, Candles, Furniture and Floorings)
Footwear in sport

Footwear plays a vital role:

- Protect the feet
- Influence performance

Requirements vary depending on:

- Contact surface
- Conditions and temperature
- Duration and intensity
- Required movement
• Many different components make up a shoe
• Variety of materials in one product
• Focus on the sole unit
Sole properties

Basic material properties:

• Hardness
• Density
• Strength
• Abrasion resistance

Sole design:

• Flexibility
• Flexing crack resistance
• Slip resistance
• Ground insulation
• Durability
Sole properties

Optional performance:

- Shock absorption
- Energy return
- Cushioning
- Floor marking resistance
- Water resistance
- Resistance to water damage

Practical considerations:

- Processability
- Ability to bond
- Reliability
- Cost
- Chemical compliance
- Sustainability
- Social responsibility
No one material is best for all circumstances, however some are more versatile than others.

Current materials commonly used because of their properties:

- Vulcanised rubber
- EVA
- PU
- TPU
- E-TPU

All exist in various grades
The role of testing

Product development
To make a decision on which sole materials will be used

Material developer
Wanting to evaluate new products and find a market

Product quality
Testing the final product, monitoring bulk production, due diligence

Basic materials tests:
- Hardness
- Density
- Strength
- Abrasion resistance
- Adhesive bond tests
Floor marking

• Uses a pendulum to strike the test piece across a standard flooring material

• Vinyl tile – Colour of the tile is dependent on the colour of the test piece

• The tile is assessed against a standard chart with examples of each severity

• Ease of removal is also considered
Flexing endurance

”Bata belt method” – Resistance to crack initiation and growth

The forepart (flexing area) of a sole unit is removed and attached to canvas belt.

Rotated around two rollers to create the repeated flexing action.

Any damage is assessed at various intervals up to 50,000 cycles.
Slip resistance

Determine the coefficient of friction between the footwear and underfoot surface

Replicate the phases of a typical walking step when slip is most likely to occur

- Heel
- Forepart
- Flat contact

Applicable to all footwear and surfaces, with or without contaminants
Whole shoe cushioning

A ‘foot’ assembly is compressed into the shoe bottom under typical body weight loads

Pressure exerted in the heel seat and forepart area

During compression, the work done (J) on the shoe bottom construction is calculated.

Materials classified as having low, medium or high cushioning properties
**Longitudinal stiffness:**

Footwear is flexed about a defined line (joint region)

Determine the force required to flex to an angle representing a 50 degree flex of the foot

A stiffness index is calculated from the peak force and maximum flexing angle

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**Torsional stiffness:**

Footwear is twisted at the heel along its ‘heel to toe’ axis

The torque required is used to calculate the stiffness value
Shock absorption

A striker of known mass, with a domed lower surface, is dropped onto the footwear from a defined height.

The test is used to determine:

- The peak deceleration for the falling mass \( (\text{ms}^{-2}) \)

- The maximum penetration of the striker into the material (mm)

- Energy return on rebound (%)
Dynamic fatigue and compression set

Test specimen repeatedly compressed at a constant rate for a fixed number of cycles

Compressive force is set appropriate to the end use of the footwear

The test is used to determine:

- Any damage assessed at regular intervals
- Change in thickness is measured (after 24-hour recovery period)
- Compression set (%)
Simulated walking

“Pedatron” machine

Polyurethane foot form attached to the ‘leg’ of the machine to create a cyclic walking action

Realistic forces applied during the contact phases of each step

The underfoot surface rotates incrementally while the forepart is in contact

Common uses:
- Determine abrasion resistance of sole
- Compression fatigue
- Any damage due to flexing
Rotational slip

Also using the Pedatron machine

A force platform (under any surface) is used to determine:

- Vertical force
- Horizontal force (both directions)
- Rotational (torque) forces
Water resistance

Whole footwear dynamic water resistance test

Realistic method of determining actual expected water resistance of footwear in wear

Footwear flexed at a constant rate whilst immersed in water at a defined level

Periodic inspections for water penetration and/or water damage.
Thermal rating

- Uses surface area of the foot, electrical energy expended to maintain temperature and calculates insulation value for whole footwear.

- Gives cold rating for different activity levels.

- Tests the whole shoe, under realistic conditions.

- Can be carried out with any combination of hose and shoe (with a closed upper).
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