R.STAT/S fibres: 
security and heat resistance in textiles

Stainless steel
for its electrical conductive
properties as well as
for its optimal thermal
behaviour (resists to
very high temperatures).

The problems

Electrostatic discharges
Static electricity is generated at the surface of two substances when they are separated thus creating severe separation of positive and negative charges accumulated at their surface. It creates a well-known “discharge”, the degree of which is dependent on speed, pressure, moisture content and temperature.

This discharge creates a spark whose effects are:
- **uncomfortable electrical shocks** when changing clothes, when getting out of the car, when holding a door knob after walking on a carpet…
- **electronic device malfunctions** involving further maintenance costs (computers, on board flight electronic devices…)
- **fires** (in « dry material » environment such as paper pulp, sawmills…) and even **explosions** in explosive environments (grain silos, petrol stations, flour mills, industries…)

Making material sufficiently conductive with the adding of antistatic/conductive fibres is the solution to neutralize static electricity.

Heat resistance
Some end-uses demand that textile materials resist to very high temperature while not altering the quality of production. Glass industry for example (car windows or glass articles) uses woven or knitted fabrics exclusively composed of stainless steel (moulds or gripping pliers are covered with stainless steel fabrics). Stainless steel fabrics are preferred to fibre glass fabrics: they resist to a higher temperature and offer an optimal glass quality while lasting longer.

The solution

Ultra thin stainless steel fibres (8µ to 22µ) with a high level of conductivity. The fineness of these fibres make them suitable for textiles. The most common type is alloy AISI 316L but other alloys are possible on request.

AISI 316L alloy (main constituents): Fe 68 % Cr 18 % Ni 12 % Mo 2 %.

**Linear electrical conductivity** (in Ω/cm):

<table>
<thead>
<tr>
<th>Material Type</th>
<th>10^6</th>
<th>10^4</th>
<th>10^2</th>
<th>1</th>
<th>10^4</th>
<th>10^6</th>
<th>10^8</th>
<th>10^10</th>
<th>10^12</th>
<th>10^14</th>
<th>10^16</th>
<th>10^18</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.STAT/S</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>.</td>
<td>.</td>
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<tr>
<td>Metal plated fibres</td>
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<td></td>
<td></td>
<td>1</td>
<td></td>
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<td>.</td>
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<tr>
<td>Synthetic fibres + metallic salt</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
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</tr>
<tr>
<td>Embedded or dispersed carbon fibres</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>.</td>
<td>.</td>
<td>.</td>
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</tbody>
</table>

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R.STAT/S fibres should be blended at a low rate that will be determined according to the construction of the textile material, according to its conditions of process and use and to the degree of static protection level expected. When an antistatic/conductive continuous yarn is used, the rate of introduction is of less importance than the way the antistatic/conductive yarn is introduced.

For thermal application, stainless steel is used in pure (glass industry) or blended with other heat resistant fibres (meta-aramid).

<table>
<thead>
<tr>
<th>dTex</th>
<th>Electrical conductivity in Ω/cm</th>
<th>Tensile strength in cN</th>
<th>Elongation</th>
</tr>
</thead>
<tbody>
<tr>
<td>8µ</td>
<td>4</td>
<td>150-170</td>
<td>7.5 +/- 10%</td>
</tr>
<tr>
<td>12µ</td>
<td>9</td>
<td>60-80</td>
<td>18 +/- 10%</td>
</tr>
<tr>
<td>22µ</td>
<td>30</td>
<td>10-30</td>
<td>55 +/- 10%</td>
</tr>
</tbody>
</table>

**R.STAT/S is available** (other product types on request):

- Broken staple fibre
  - 100 % steel 12µ
  - 50 % steel 12µ – 50 % PET

- Broken slivers
  - 2 to 6 gr/m
  - 100 % steel blends + steel on request

- Spun yarns
  - Nm 8 to Nm 15
  - 100 % steel blends on request

- Continuous filaments
  - 35 to 40 µ / 1 F
  - 12 µ 275 F x 2
  - other on request

**Behaviour** (indicative, only for fibre and not guaranteed for the finished product):

<table>
<thead>
<tr>
<th>Dyeing</th>
<th>No contra-indication according to our experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washing</td>
<td>&gt; 50 on fibre</td>
</tr>
<tr>
<td>Temperature</td>
<td>600°C</td>
</tr>
<tr>
<td>Sweat</td>
<td>No alteration in contact with alkali nor acid pH</td>
</tr>
<tr>
<td>Special care</td>
<td>Chlorine and sulfuric acid are prohibited</td>
</tr>
<tr>
<td>Remark</td>
<td>AISI 316L alloy complies with 94/27/CE guideline</td>
</tr>
<tr>
<td></td>
<td>(the more the alloy contains nickel, the more the passive layer is insulating and the less nickel is released)</td>
</tr>
</tbody>
</table>

**Applications**

- industrial non-wovens (filtration),
- protective clothing,
- smart textiles (heating, communicating…),
- electromagnetic shielding,
- carpets,
- glass industry (carglass, glassware…),
- burners, gaskets…

These examples are not exhaustive. Do not hesitate to inquire about your project and we’ll find for you the most suitable solution.

**Examples of products:**

<table>
<thead>
<tr>
<th>Composition</th>
<th>Product</th>
<th>Surface resistivity in Ω</th>
<th>Cross resistance in Ω</th>
</tr>
</thead>
<tbody>
<tr>
<td>98 % PET – 2 % R.STAT/S</td>
<td>Shoe insole / DIN 54345</td>
<td>10^2</td>
<td>10^2</td>
</tr>
<tr>
<td>50 % viscose – 30 % wool</td>
<td>Protective clothing</td>
<td>10^2</td>
<td>10^2</td>
</tr>
<tr>
<td>19 % PET – 1 % R.STAT/S</td>
<td>EN 1149</td>
<td>10^3</td>
<td>10^3</td>
</tr>
<tr>
<td>95 % PET – 5 % R.STAT/S</td>
<td>Filter felt / DIN 54345</td>
<td>10^2</td>
<td>10^2</td>
</tr>
</tbody>
</table>

**Norms**

Textile material including a suitable content of R.STAT/S fibres can pass the following norms:

- EN 1149 parts 1 (surface resistivity) and 2 (cross resistance): electrostatic properties for protective clothing.
- DIN 54345: electrostatic properties of textiles (floorings, non-wovens, fabrics), included part 5 (electrostatic properties of non-wovens for filter media).

These values are non contractual and just indicative. We reserve the right to complement or amend them. More information, based on assimilated experience, is available on request. The given examples are only guidelines for you to design your own products. Information will be given on the basis of your own specifications that must have been supplied to R.STAT and is not a guarantee by R.STAT. Control, certification and validation of products (under their final commercial form and under real conditions of use) including R.STAT’s technology lies with every user of R.STAT products.