FLUOROSINT® PTFE FAMILY OF ADVANCED FLUOROPOLYMER MATERIALS
Fluorosint® Enhanced PtFE Materials

Quadrant developed the Fluorosint® range of enhanced PtFE materials to fill the performance gaps where unfilled and low-tech, filled PtFE based polymers underperform. Each Fluorosint material was specifically developed to excel in demanding bearing and seal applications. While each of these materials possess the chemical resistance and compliance of PtFE, each material offers some special benefits that give the designer clear performance advantages.

Fluorosint 500
- Outstanding dimensional stability, approximating aluminum
- Low deformation under load

Fluorosint 207
- Food contact compliant composition (FDA* and 2002/72/EC**)
- Very good wear resistance
- Very low coefficient of friction

Fluorosint HPV
- Food contact compliant composition (FDA*)
- Excellent wear resistance
- Unmatched bearing performance

Fluorosint MT-01
- Very low deformation under load
- Good wear resistance
- Excellent dimensional stability

* U.S. Food and Drug Administration
** Directive of the European Union

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FLUOROSINT® 500

EXCEPTIONAL DIMENSIONAL STABILITY FOR PRECISE TOLERANCE CONTROL

Key benefits

FLUOROSINT® 500 Enhanced PTFE offers an ideal combination of stability and wear resistance for sealing applications where tight dimensional control is required. FLUOROSINT 500 also greatly reduces the risk of a catastrophic system failure by becoming a sacrificial wear surface. With a deformation under load 9 times lower than virgin PTFE, FLUOROSINT 500 allows designers to greatly improve the efficiency of systems without sacrificing the wear resistance and forgiving benefits of PTFE. The synthetic mica developed and manufactured by Quadrant delivers tolerance performance approximating that of aluminum.

Common applications

- Split and one-piece seals
- Valve seats
- Shrouds
- Slide bearings
- Wear strips
- Sacrificial, abradable seals
- Thrust washers

Application example

FLUOROSINT 500 has been used very successfully as a replacement for metal/aluminum seals and shrouds in compressors. In addition to the security a sacrificial part provides the system, FLUOROSINT 500 allows the introduction of abradable sealing technology where mating parts are allowed to «cut» their own running clearance and thus permitting significant gains in efficiency.

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**DEFORMATION UNDER COMPRESSIVE LOAD**

- FLUOROSINT MT-01
- FLUOROSINT 500
- FLUOROSINT HPV
- FLUOROSINT 207
- PTFE-GF25

Creep after 24 hours under a compressive stress of 13.8 MPa (2000 psi) at 50 °C - (%)

**COEFFICIENT OF LINEAR THERMAL EXPANSION**

- FLUOROSINT 500
- FLUOROSINT 207
- FLUOROSINT HPV
- FLUOROSINT MT-01
- PTFE
- ALUMINIUM

Coefficient of linear thermal expansion (CLTE) [10^-6 m/(m.K)]

Average value between 23 and 150 °C

Average value between 23 and 250 °C
FLUOROSINT® 207

LOWEST COEFFICIENT OF FRICTION OF FLUOROSINT GRADES

Key benefits

FLUOROSINT® 207 Enhanced PTFE is a significant performance upgrade for any designer using PTFE for applications where temperature resistance, chemical resistance and food contact compliance (FDA and 2002/72/EC) are all important. FLUOROSINT 207 lasts far longer than unfilled PTFE in wear applications and has a very low coefficient of friction. FLUOROSINT 207 works well against most mating surfaces.

Common applications

- Seals
- Mixers
- Pumps
- Appliances
- Bearings
- Valve seats

Application example

FLUOROSINT 207 replaces unfilled PTFE and low-tech, filled PTFE’s in wear and seal applications where either stability or wear resistance are causing failures. A commercial beverage filling system replaced virgin PTFE seals with FLUOROSINT 207 and improved fill accuracy associated with leaks caused by failed seals.

Test conditions:
- Rotating plastics test specimen Ø 28.58 mm (1.125") x Ø 25.4 mm (1") - see ASTM D 3702
- Stationary steel washer Ø 31.62 mm (1.245") x Ø 15.88 mm (0.625") - see ASTM D 3702
- Pressure: 1.72 MPa (250 psi)
- Sliding velocity: 0.102 m/s (20 ft/min)
- PV-value: 0.175 MPa.m/s (5000 psi.ft/min)
- Surface roughness of the AISI C-1018 steel (Rc = 20) mating surface: Ra = 0.40 µm (16 µ")
- Normal environment (air, 23 °C / 50 % RH)
- Unlubricated operation

Test conditions:
- Bushing Ø 17.65 x Ø 13.1 x 12.7 mm (Ø 0.695" x Ø 0.516” x 0.5")
- Pressure: 0.29 MPa (42.4 psi)
- Sliding velocity: 0.60 m/s (118 ft/min)
- PV-value: 0.175 MPa.m/s (5000 psi.ft/min)
- Surface roughness of the rotating AISI W-1 steel (HB 180-200) mating surface: Ra = 0.40 µm (16 µ")
- Total distance run: 431 km (after 200 h)
- Normal environment (air, 23 °C / 50 % RH)
- Unlubricated operation

DYNAMIC COEFFICIENT OF FRICTION

Measured on a ‘thrust washer’-tribo-system

WEAR RESISTANCE

Measured on a ‘journal bearing’-tribo-system
**FLUOROSINT® HPV**

**KEY BENEFITS**

FDA compliant FLUOROSINT® HPV is a high performance bearing grade of FLUOROSINT – optimized for high PV and very low wear factor. FLUOROSINT HPV was developed for bearing applications where other, low-tech PTFE formulations exhibit premature wear or simply cannot perform. FDA compliance gives food and pharmaceutical equipment manufacturers new design options and all benefit from its excellent load bearing and wear characteristics.

**COMMON APPLICATIONS**

- Bearings
- Commercial food equipment
- Wear guides
- High performance seals
- Thrust washers

**APPLICATION EXAMPLE**

FLUOROSINT HPV was specified by a manufacturer of commercial sausage production equipment as a replacement for a low-tech filled PTFE material. The old material would wear quickly and not properly stretch the product during filling. The premature wear caused tears in the product and required frequent replacement. An additional benefit of FLUOROSINT HPV – improved dimensional stability – allowed designers to remove a press fit metal part that was required to compensate for the low-tech material’s lack of dimensional control.

**LOAD BEARING CAPABILITY (LIMITING PV)**

Measured on a “thrust washer” tribos system

![Graph showing load bearing capability](image)

**STIFFNESS VERSUS TEMPERATURE**

Derived from DMA-curves

![Graph showing stiffness versus temperature](image)
Key benefits

FLUOROSINT® MT-01 is an extreme service grade developed specifically for applications where the benefits of PTFE-based materials also require strength, stiffness and stability. FLUOROSINT MT-01 delivers high mechanical performance at elevated temperature and as a result is often specified in seat, seal and wear applications where extreme conditions are present.

Common applications

· High temperature seals
· Linear guides
· Wear bands
· Ovens and dryers

Application example

FLUOROSINT MT-01 is widely specified in chemical processing equipment like the aggressive environment present during sour gas processing. FLUOROSINT MT-01 extends the temperature envelope of PTFE and provides remarkable stability for applications that see extremes. Seals, replaced monthly in oil recovery equipment have been replaced with FLUOROSINT MT-01 and now outlast other components.

Test conditions:
- Pressure: 3 MPa
- Sliding velocity: 0.33 m/s
- Surface roughness of the C35 steel mating surface: Ra = 0.70 - 0.90 µm
- Total distance run: 28 km
- Normal environment (air, 23 °C / 50 % RH)
- Unlubricated operation

Test conditions:
- Pressure: 3 MPa
- Sliding velocity: 0.33 m/s
- Surface roughness of the C35 steel mating surface: Ra = 0.70 - 0.90 µm
- Total distance run: 28 km
- Normal environment (air, 23 °C / 50 % RH)
- Unlubricated operation

WEAR RESISTANCE

DYNAMIC COEFFICIENT OF FRICTION

Measured on a plastics pin on rotating steel disk tribo system

Measured on a plastics pin on rotating steel disk tribo system
**PHYSICAL PROPERTIES OF THE FLUOROSINT® GRADES** (INDICATIVE VALUES*)

<table>
<thead>
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<th>Properties</th>
<th>Test methods</th>
<th>Units</th>
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<th>FLUOROSINT® 207</th>
<th>FLUOROSINT® HPV</th>
<th>FLUOROSINT® MT-01</th>
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<tbody>
<tr>
<td>Colour</td>
<td></td>
<td></td>
<td>ivory</td>
<td>white</td>
<td>tan</td>
<td>dark grey</td>
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<tr>
<td>Density</td>
<td>ISO 1183-1</td>
<td>g/cm³</td>
<td>2.32</td>
<td>2.30</td>
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<td>2.27</td>
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<td>Water absorption:</td>
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<td></td>
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<tr>
<td>– after 24/96 h immersion in water of 23°C (1)</td>
<td>ISO 62</td>
<td>mg</td>
<td>–</td>
<td>–</td>
<td>10 / 20</td>
<td>–</td>
</tr>
<tr>
<td>– at saturation in air of 23°C / 50% RH</td>
<td>ISO 62</td>
<td>%</td>
<td>–</td>
<td>–</td>
<td>0.07 / 0.15</td>
<td>–</td>
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<tr>
<td>– at saturation in water of 23°C</td>
<td>–</td>
<td>%</td>
<td>&lt; 0.1</td>
<td>&lt; 0.1</td>
<td>0.1 - 0.2</td>
<td>–</td>
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<tr>
<td>–</td>
<td>–</td>
<td>1.5 - 2.5</td>
<td>1 - 2</td>
<td>0.5 - 1</td>
<td>1.5 - 2.5</td>
<td>–</td>
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<td>Thermal Properties</td>
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<td>Melting temperature (DSC, 10°C/min)</td>
<td>ISO 11357-1/-3</td>
<td>°C</td>
<td>327</td>
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<td>327</td>
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<tr>
<td>Thermal conductivity at 23°C</td>
<td>–</td>
<td>W/(K.m)</td>
<td>0.77</td>
<td>–</td>
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<tr>
<td>Coefficient of linear thermal expansion:</td>
<td>–</td>
<td>m/(m.K)</td>
<td>50 x 10⁻⁶</td>
<td>85 x 10⁻⁶</td>
<td>75 x 10⁻⁶</td>
<td>60 x 10⁻⁶</td>
</tr>
<tr>
<td>– average value between 23 and 100°C</td>
<td>–</td>
<td>m/(m.K)</td>
<td>55 x 10⁻⁶</td>
<td>90 x 10⁻⁶</td>
<td>80 x 10⁻⁶</td>
<td>65 x 10⁻⁶</td>
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<tr>
<td>– average value between 23 and 150°C</td>
<td>–</td>
<td>m/(m.K)</td>
<td>85 x 10⁻⁶</td>
<td>155 x 10⁻⁶</td>
<td>135 x 10⁻⁶</td>
<td>100 x 10⁻⁶</td>
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<tr>
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<td>–</td>
<td>°C</td>
<td>130</td>
<td>100</td>
<td>80</td>
<td>95</td>
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<td>– method A: 1.8 MPa</td>
<td>ISO 75-1/-2</td>
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<td>130</td>
<td>100</td>
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<td>95</td>
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<td>Max. allowable service temperature in air:</td>
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<td>°C</td>
<td>280</td>
<td>280</td>
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<td>300</td>
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<td>– for short periods (2)</td>
<td>–</td>
<td>°C</td>
<td>260</td>
<td>260</td>
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<td>260</td>
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<td>– continuously : for min. 20,000 h (3)</td>
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<td>°C</td>
<td>20</td>
<td>-</td>
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<td>°C</td>
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<td>– «Oxygen index»</td>
<td>ISO 4589-1/-2</td>
<td>%</td>
<td>≥ 95</td>
<td>≥ 95</td>
<td>≥ 95</td>
<td>≥ 95</td>
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<td>– according to UL 94 (1.5 / 3mm thickness)</td>
<td>–</td>
<td></td>
<td>V-0 / V-0</td>
<td>V-0 / V-0</td>
<td>V-0 / V-0</td>
<td>V-0 / V-0</td>
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<tr>
<td>Mechanical Properties at 23 °C</td>
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<td>Tension test (6):</td>
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<tr>
<td>– tensile stress at yield (7)</td>
<td>ISO 527-1/-2</td>
<td>MPa</td>
<td>7</td>
<td>10</td>
<td>10</td>
<td>14</td>
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<tr>
<td>– tensile strength (7)</td>
<td>ISO 527-1/-2</td>
<td>MPa</td>
<td>7</td>
<td>10</td>
<td>10</td>
<td>14</td>
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<tr>
<td>– tensile strain at break (7)</td>
<td>ISO 527-1/-2</td>
<td>%</td>
<td>15</td>
<td>&gt; 50</td>
<td>&gt; 50</td>
<td>20</td>
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<tr>
<td>– tensile modulus of elasticity (8)</td>
<td>ISO 527-1/-2</td>
<td>MPa</td>
<td>1750</td>
<td>1450</td>
<td>1200</td>
<td>1900</td>
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<tr>
<td>– compressive stress at 1 / 2 % nominal strain (8)</td>
<td>ISO 604</td>
<td>MPa</td>
<td>12 / 19</td>
<td>10.5 / 15</td>
<td>10 / 14.5</td>
<td>11 / 17</td>
</tr>
<tr>
<td>Charpy impact strength – unnotched (10)</td>
<td>ISO 179-1/1TeU</td>
<td>kJ/m²</td>
<td>8</td>
<td>30</td>
<td>55</td>
<td>-</td>
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<tr>
<td>Charpy impact strength – notched</td>
<td>ISO 179-1/1TeA</td>
<td>kJ/m²</td>
<td>4.5</td>
<td>7.5</td>
<td>12</td>
<td>4</td>
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<td>Rockwell hardness (11)</td>
<td>ISO 2039-2</td>
<td>R 55</td>
<td>R 50</td>
<td>R 45</td>
<td>R 74</td>
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<tr>
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<td>IEC 60243-1</td>
<td>kV/mm</td>
<td>11</td>
<td>8</td>
<td>–</td>
<td>–</td>
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<tr>
<td>Volume resistivity</td>
<td>IEC 60093</td>
<td>Ohm.cm</td>
<td>&gt; 10¹⁰</td>
<td>&gt; 10¹¹</td>
<td>&gt; 10¹³</td>
<td>&lt; 10³</td>
</tr>
<tr>
<td>Surface resistivity</td>
<td>ANSI/ESD STM 11.11</td>
<td>Ohm/sq.</td>
<td>&gt; 10¹⁰</td>
<td>&gt; 10¹¹</td>
<td>&gt; 10¹³</td>
<td>&lt; 10³</td>
</tr>
<tr>
<td>Relative permittivity ε : at 100 Hz</td>
<td>IEC 60250</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
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<tr>
<td>Relative permittivity ε : at 1 MHz</td>
<td>IEC 60250</td>
<td>–</td>
<td>2.85</td>
<td>2.65</td>
<td>–</td>
<td>–</td>
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<tr>
<td>Dielectric dissipation factor tan δ : at 100 Hz</td>
<td>IEC 60250</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
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<tr>
<td>Dielectric dissipation factor tan δ : at 1 MHz</td>
<td>IEC 60250</td>
<td>–</td>
<td>0.008</td>
<td>0.008</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Note: 1 g/cm³ = 1,000 kg/m³; 1 MPa = 1 N/mm²; 1 kV/mm = 1 MV/m.

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**Legend:**

(1) According to method 1 of ISO 62 and done on discs Ø 50 x 3 mm.

(2) Only for short time exposure (a few hours) in applications where no or only a very low load is applied to the material.

(3) Temperature resistance over a period of min. 20,000 hours. After this period of time, there is a decrease in tensile strength – measured at 23°C – of about 50% as compared with the original value. The temperature values given here are thus based on the thermal-oxidative degradation which takes place and causes a reduction in properties. Note, however, that the maximum allowable service temperature depends in many cases essentially on the duration and the magnitude of the mechanical stresses to which the material is subjected.

(4) Impact strength decreasing with decreasing temperature, the minimum allowable service temperature depends on many cases essentially on the duration and the magnitude of the mechanical stresses to which the material is subjected. The values given here are based on unfavourable impact conditions and may consequently not be considered as being the absolute practical limits.

(5) These estimated ratings, derived from raw material supplier data and other publications, are not intended to reflect hazards presented by the materials under actual fire conditions. There are no «UL File Numbers» available for the FLUOROSINT® stock shapes.

(6) Test specimens: Type 1 B

(7) Test speed: 50 mm/min [chosen acc. to ISO 10350-1 as a function of the ductile behaviour of the material (tough or brittle)]

(8) Test speed: 1 mm/min

(9) Test specimens: cylinders Ø 8 x 16 mm

(10) Pendulum used: 4 J

(11) 10 mm thick test specimens

(12) Electrode configuration: Ø 25/Ø 75 mm coaxial cylinders ; in transformer oil according to IEC 60296 ; 1 mm thick test specimens.

- • This table, mainly to be used for comparison purposes, is a valuable help in the choice of a material. The data listed here fall within the normal range of product properties of dry material. However, they are not guaranteed and they should not be used to establish material specification limits nor used alone as the basis of design.

As a result of our internal continuous improvement programmes, of availability and gathering of new and/or additional technical data, of increasing knowledge and experience, as well as changing market requirements and revised internationally recognised material test standards, Quadrant Engineering Plastic Products is extending and updating its literature and technical information on a continuous basis. We therefore invite and recommend our customers to consult our website for the latest and up to date information on our materials.
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