HIGH PERFORMANCE IN POWDER FORM
Polyether Ether Ketone Powders

VESTAKEEP®
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EVONIK, THE CREATIVE INDUSTRIAL GROUP FROM GERMANY, IS ONE OF THE WORLD LEADERS IN SPECIALTY CHEMICALS, OPERATING IN THE NUTRITION & CARE, RESOURCE EFFICIENCY AND PERFORMANCE MATERIALS SEGMENTS.

The Resource Efficiency segment is led by Evonik Resource Efficiency GmbH and supplies high performance materials for environmentally friendly as well as energy-efficient system solutions.

Our VESTAKEEP® polyether ether ketone powder is part of our high temperature polymers product portfolio.

Evonik. Power to create.
VESTAKEEP® PEEK POWDERS are particularly suitable for applications with very high mechanical, thermal and chemical requirements.
Evonik markets its VESTAKEEP® compounds and powders worldwide. A proven quality management system—from development, through production, all the way to quality assurance—ensures the high quality of products entering the market.

Our system is certified to ISO 9001:2008 and ISO 14001:2009, and is constantly optimized. Over the years, numerous customers have tested this quality system and confirmed its superiority.

This brochure provides an overview of the properties and applications of VESTAKEEP® powders, which are available in various particle sizes and viscosities (molecular weights), for different processing methods, as well as processing instructions.

VESTAKEEP® PEEK is particularly characterized by the following material properties:

- Very high heat deflection temperature
- High stiffness
- Low water absorption and therefore high dimensional stability
- High hardness
- Good strength
- Excellent sliding friction behavior
- Very minimal abrasion
- Good electrical properties
- Excellent chemical resistance
- Excellent hydrolytic stability
- Good processability
- No tendency to stress cracks
VESTAKEEP® PEEK is polycondensed from the building blocks hydroquinone and 4,4'-difluorobenzophenone in a multi-stage process.

The base grades have a melt viscosity of 100 to 5000 Pas, measured at 400 °C and a shear rate of 1 s⁻¹.

VESTAKEEP® powders can be used in a wide range of applications, for example in electrical, electronic, and communications engineering, and also in the automotive, aviation and food industries.

They can be processed with a number of methods, such as compression molding, electrostatic powder spraying, flame spraying, and scattering. They can also be used as a suspension in aqueous as well as solvent-based systems.

Due to its chemical structure VESTAKEEP® PEEK features an outstanding chemical resistance.
DELIVERY

**Powder:**
in 10 kg boxes with moisture-proof PE liners. A pallet holds 25 boxes with a total weight of 250 kg.

**Fine powder:**
in 15 kg boxes with moisture-proof PE liners. A pallet holds 25 boxes with a total weight of 375 kg. We can also deliver in bulk packaging upon request.

Under normal storage conditions, storage time is practically unlimited as long as the packaging has not been damaged. You should avoid storing at temperatures above 45 °C.

Like other partially crystalline polyaryl ether ketones, unmodified VESTAKEEP® appears amber-colored in the melt and grayish in its solid crystalline state (natural colors). VESTAKEEP® PEEK is translucent in its solid, amorphous state and has a characteristic amber color.

The powders are available in the five viscosity series VESTAKEEP® 1000, 2000, 3000, 4000 and 5000 where 1000 indicates the lowest viscosity and 5000 the highest.

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<table>
<thead>
<tr>
<th>Physical and thermal properties and fire behavior</th>
<th>Test method</th>
<th>Unit</th>
<th>VESTAKEEP® 2000 P</th>
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<tbody>
<tr>
<td>Density</td>
<td>23 °C</td>
<td>ISO 1183</td>
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<tr>
<td>Melting range</td>
<td>DSC, 2nd heating</td>
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<td>Volume flow rate (MVR)</td>
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<td>ISO 1133</td>
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<td>Temperature of deflection under load</td>
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<td>ISO 75-1/2</td>
<td>°C</td>
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<tr>
<td></td>
<td>Method B: 0.45 MPa</td>
<td>ISO 75-1/2</td>
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<td>Linear thermal expansion</td>
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<tr>
<td>Flammability acc. UL94</td>
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<td>IEC 60695</td>
<td>V-0</td>
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<tr>
<td>Glow wire test</td>
<td>GWIT 2 mm</td>
<td>IEC 60695-2-12/13</td>
<td>°C</td>
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<td>GWFI 2 mm</td>
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<thead>
<tr>
<th>Mechanical properties</th>
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<td>Stress at yield</td>
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<td>MPa</td>
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<tr>
<td>Strain at yield</td>
<td>ISO 527-1/-2</td>
<td>%</td>
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<tr>
<td>Strain at break</td>
<td>ISO 527-1/-2</td>
<td>%</td>
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<tr>
<td>Tensile modulus</td>
<td>ISO 527-1/-2</td>
<td>MPa</td>
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<tr>
<td>CHARPY impact strength</td>
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<td>ISO 179/1eU</td>
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<td>-30 °C</td>
<td>ISO 179/1eU</td>
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<tr>
<td>CHARPY notched impact strength</td>
<td>23 °C</td>
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<td>-30 °C</td>
<td>ISO 179/1eA</td>
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</tbody>
</table>
Electrostatic spraying
In the EPS (electrostatic powder spraying) process, the powder is electrostatically charged by an electrical field of high field strength on the spray nozzle.

Flame spraying
In this process, the combustion of a gas/oxygen mixture generates the thermal energy to melt the powder and warm the surface of the substrate. A carrier gas—normally compressed air—serves as the medium for transporting the melted particles to the substrate surface.

The advantages of this process include low investment costs and the option of coating large parts on site, without an oven. VESTAKEEP® 2000 FS is best suited for this application because it has a sufficiently low melt viscosity.

Dispersion coating
Dispersions based on VESTAKEEP® fine powder can be used to coat metal surfaces. These can be processed by dipping or by spray gun. Dispersions are particularly suitable for the manufacture of thin layers and for geometries that cannot be electrostatically coated. No costly equipment is needed. Medium-viscosity VESTAKEEP® powder is especially suitable for dispersion coating. They have good flow properties and result in smooth surface coatings.

Pretreatment
No matter the coating process: The better the pretreatment, the better the adhesion. This is why the parts to be coated must be prepared by sandblasting and degreasing in suitable solvents prior to coating. This step removes impurities and prepares the surface of the metal for optimal adhesion.

Corundum or steel grit should be used as the blasting agent. Spherical blasting agents like glass pearls are not suitable because they do not roughen the surface. Blasted grease- and oil-free metal parts corrode very quickly, and should therefore be processed as soon as possible after blasting.

A primer for improving adhesion is not required. Zinc and iron phosphating should also be avoided. These conversion layers begin to disintegrate above 200 °C and generate a separating layer, which impairs adhesion.

Aftertreatment
Before cooling, the parts should be heated in an oven until the coating is evenly melted on them. The degree of crystallinity can be set through the cooling process. Water and sudden cooling result in amorphous and therefore transparent coatings. The crystallinity of amorphous layers can be increased by conditioning the coating. This is usually done at 200 °C in a circulating air oven. The amount of time required depends on the mass of the coated parts.

Concerning components with a large thermal mass, slow cooling rates can result in cracks in the coating. In these cases the suitable cooling rates should be determined empirically. Chilling in water can lead to thermal shock and should be avoided.
**Fiber composites**

To produce fiber composites, unidirectional fiber layouts or fabrics, glass, carbon or aramid fibers are impregnated with VESTAKEEP® as a matrix. Powder or dispersion coating processes are the preferred technologies. For the production of composites, we recommend the low-viscosity VESTAKEEP® powders of the 1000 and 2000 series. The particle size depends on the process. FP and UFP powders are preferred.

**Compression molding**

Compression molding produces molded parts by subjecting them to pressure in a mold. The properties of compression molded parts are different from those of injection-molded parts. Normally, pressed parts have a higher level of crystallinity, and are therefore more rigid and solid but also harder and more brittle.

The compression molding cycle includes:

- Compressing the polymer in a mold
- Heating the system above the melt temperature
- A holding phase for further compressing
- A cooling phase

P and FP powder grades are normally used in compression molding. If granulates would be used, the air inclusion would be too large, and with finer powders the molds are difficult to fill. Here, bridging can also cause air pockets, which results in porous components. By adding PTFE, graphite, nanoscale titanium oxide or silicon oxide, glass or carbon fibers, for example, certain properties such as surface hardness, frictional coefficient and abrasion resistance can be selectively improved.

To prevent bubble formation through moisture, the powder should be dried for 3 hours at 150 °C or overnight at 120 °C, either in the drying cabinet or in the mold prior to processing.

For easier demolding, small amounts (2 to 3%) of PTFE can be added to the powder. Before the mold is heated, the powder is compressed to allow air to escape. Processing parameters such as pressure, temperature, holding time, etc. depend on the quantity of powder, the surface area and geometry of the mold, and must be determined case by case.

To prevent stresses in the part, cooling should be slow and controlled and not exceed 40 K/hour. At approximately 140 to 150 °C, the part can be removed from the mold.
# VESTAKEEP® POWDERS

## PRODUCT OVERVIEW

### VESTAKEEP® POWDER GRADES

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<thead>
<tr>
<th>VESTAKEEP® POWDER</th>
<th>High viscosity</th>
<th>Medium viscosity</th>
<th>Low viscosity</th>
<th>Average particle size (d50) [μm]</th>
<th>Particle size distribution [μm]</th>
<th>Scattering powder</th>
<th>Compression molding</th>
<th>Flame spraying</th>
<th>Electrostatic spraying</th>
<th>Suspension</th>
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</table>

### KEY TO PRODUCT DESCRIPTION

- **P**: Powder
- **FP**: Fine powder
- **UFP**: Ultrafine powder

## VESTAKEEP® Easy Slide P

New PEEK powders for tribological coatings.
VESTAKEEP® powders are water-insoluble, solid polymers. Because of their high molecular weight, they are not absorbed through the skin, or through the respiratory or gastrointestinal tracts. VESTAKEEP® powders are, therefore, largely physiologically inert and do not cause systemic toxicity.

As in the case of other inert dusts, exposure to VESTAKEEP® dusts could possibly result in mechanical irritation in the upper respiratory passages and the mucous membranes of the eye. Product dust can remove the skin’s natural moisture, and this dryness can cause patchy irritation. Sensitization of the skin is not expected.

Steps must always be taken to ensure adequate ventilation and exhaust when processing thermoplastics.

Based on our best current understanding, VESTAKEEP® powders do not have any adverse effects on man, animals, plants, or microorganisms. For labeling in accordance with applicable legislation, as well as the water hazard classification, please consult the most recent safety data sheet.

VESTAKEEP® powders can be disposed of in accordance with local regulations. The EU safety data sheet for VESTAKEEP® contains more information. For environmental and economic reasons, recycling of the product is preferred.
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