

## What is PE-UHMW ESD black

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PE-UHMW, electrically conductive (ESD)

PE-UHMW ESD black is an ultra-high molecular weight polyethylene (PE-UHMW, PE 1000) from virgin material, made electrically conductive with conductive carbon black (surface resistivity  $\leq 10^6 \Omega$ ). It combines the extreme wear resistance, impact strength and sliding properties typical of PE 1000 with safe dissipation of electrostatic charges – for example in conveyor systems for bulk materials or in potentially explosive areas.

### Properties

In the sand slurry test, PE-UHMW ESD black shows a wear resistance that exceeds most metals and all other thermoplastics, does not break in the notched impact test and retains its toughness down to  $-150^\circ\text{C}$ . The coefficient of sliding friction of about 0.2 enables jerk-free dry running; water absorption is practically zero, the material is resistant to most acids, alkalis and solvents and physiologically harmless. The low volume resistivity ( $\leq 10^4 \Omega\cdot\text{cm}$ ) permanently prevents electrostatic charging and dust attraction.

PE-UHMW has low stiffness and strength (yield stress  $\approx 20 \text{ MPa}$ ), high thermal expansion and can only be used continuously up to  $80^\circ\text{C}$ ; it cannot be bonded and is not resistant to strongly oxidising acids. The conductive formulation is available in black only; food contact is only possible after separate confirmation.

### Advantages

- Electrically conductive ( $\leq 10^6 \Omega$ ), permanent and independent of humidity
- Highest wear resistance, no break in the notched impact test
- Very low friction, no stick-slip, practically no water absorption
- Service down to  $-150^\circ\text{C}$ , chemically resistant, UV-stabilised

### Disadvantages

- Low stiffness and strength, high thermal expansion
- Continuous service temperature only  $80^\circ\text{C}$ , cannot be bonded
- Not generally declared for food contact (see FDA declaration)

### Processing

PE-UHMW ESD black can be machined using all conventional cutting methods; sharp HSS or carbide tools with a large rake angle and good chip removal prevent smearing – because of the low thermal conductivity, heat build-up should be avoided. Cooling with compressed air or water is sufficient.

Because of the high thermal expansion, tolerances and installation clearances must be designed for temperature; bonding is only possible after surface pretreatment, mechanical joints (screwing, riveting) are preferable.

### Typical Applications

PE-UHMW ESD black is used wherever sliding and wear parts must also dissipate electrostatic charges – for example in conveyor technology for bulk materials and powders, in mechanical engineering, in the electrical industry and in potentially explosive areas.

- Linings of silos, hoppers and chutes for bulk materials
- Wear strips, chain guides and deflection elements in hazardous areas
- Guide and wear parts in electronics and packaging production

### Typical Properties

- Electrically conductive (surface resistivity  $\leq 10^6 \Omega$ )
- Highest wear resistance and impact strength

### Product Examples

- Silo and hopper linings
- Wear strips and chain guides
- Guide and wear parts

### Typical Industries

- Conveyor Technology
- Mechanical Engineering
- Electrical Industry
- Potentially Explosive Areas

- Very low friction, no stick-slip
- Service down to -150 °C, UV-stabilised

|                                                    | Test Method | Unit                 | Value             |
|----------------------------------------------------|-------------|----------------------|-------------------|
| <b>General Properties</b>                          |             |                      |                   |
| Density                                            | ISO 1183-1  | g / cm <sup>3</sup>  | < 0.96            |
| Molecular weight                                   | Average     | million g / mol      | > 5               |
| Water absorption (23 °C)                           | ISO 62      | %                    | < 0.01            |
| Flammability                                       | UL 94       |                      | HB                |
| <b>Mechanical Properties</b>                       |             |                      |                   |
| Yield stress                                       | ISO 527-2   | MPa                  | ≈ 20              |
| Elongation at break                                | ISO 527-2   | %                    | > 300             |
| Tensile modulus of elasticity                      | ISO 527-2   | MPa                  | > 700             |
| Notched impact strength                            | ISO 179     | kJ / m <sup>2</sup>  | no break          |
| Ball indentation hardness                          | ISO 2039-1  | MPa                  | > 30              |
| Shore hardness                                     | ISO 868     | scale D              | 61 – 63           |
| Abrasion resistance (sand slurry test)             | ISO 15527   | %                    | 110               |
| Coefficient of sliding friction                    | Average     |                      | ≈ 0.2             |
| <b>Thermal Properties</b>                          |             |                      |                   |
| Melting temperature                                | ISO 11357   | °C                   | 130 – 135         |
| Thermal conductivity (23 °C)                       | DIN 52612   | W / (m * K)          | 0.40              |
| Coefficient of linear thermal expansion (23–60 °C) | ISO 11359-2 | 10 <sup>-6</sup> / K | 200               |
| Service temperature, long term                     | Average     | °C                   | -150 ... 80       |
| Service temperature, short term (max.)             | Average     | °C                   | 90                |
| <b>Electrical Properties</b>                       |             |                      |                   |
| Volume resistivity                                 | IEC 60093   | Ω · cm               | ≤ 10 <sup>4</sup> |
| Surface resistivity                                | IEC 60093   | Ω                    | ≤ 10 <sup>6</sup> |