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Polyethylene (PE) [UHMW-PE1000]

Ultra-high-molecular-weight polyethylene (UHMWPE, UHMW) is a subset of the thermoplastic polyethylene. It has extremely long chains, with a molecular mass usually between 3.5 and 7.5 million amu. The longer chain serves to transfer load more effectively to the polymer backbone by strengthening intermolecular interactions. This results in a very tough material, with the highest impact strength of any thermoplastic presently made.

Standard Colours: Green / Black / White

Mechanical Properties		
Density DIN53 479	g/cm ³	0.94
Yield Stress DIN53 455	MPa	22
Elongation at break DIN53 455	%	350
Modules of elasticity resulting from tensile test DIN53 457	MPa	800
Modules of elasticity resulting from bending test DIN53 457	MPa	800
Flexural strength DIN53 452	MPa	27
Impact strength DIN53 453	KJ/m ²	o. B.
Notched-bar impact strength DIN 53 453	KJ/m ²	o. B.
Ball indentation Hardness H _{358/30} DIN53 456	MPa	40
Creep rate stress at 1% elongation DIN53 444	MPa	-
Sliding friction coefficient against steel (dry running) ³	-	0.29
Sliding wear against steel (dry running) ³	µm/km	0.45
Thermal Properties		
Melting temperature DIN53 736	°C	+133
Thermal conductivity DIN52 612	W/(k m)	0.38
Specific thermal capacity	J/(g K)	1.84
Coefficient of linear expansion	10 ⁻⁵ - K ⁻¹	18
Operating temperature range (long-term)	°C	-260 +50
Operating temperature range (short-term)	°C	+80
Fire behaviour after UL 94 IEC 60695	-	HB
Electrical Properties		
Dielectric constant DIN53 483	-	3
Dielectric loss factor DIN53 483	-	0.0004
Specific volume resistance DIN53 482	Ω-cm	>10 ¹⁶
Surface resistance DIN53 482	Ω	10 ¹⁴
Dielectric strength DIN53 481	KV/mm	44
Creep resistance DIN53 480	-	KA 3c KC > 600
Miscellaneous data		
Moisture absorption in natural Rubber until saturated DIN53 715	W(H ₂ O)%	<0.01
Water absorption until saturated DIN53 495	W _s %	<0.01
Specific properties		as PE-HMW, but more resistant at low friction values

UHMWPE is odourless, tasteless, and nontoxic. It embodies all the characteristics of high-density polyethylene (HDPE) with the added traits of being resistant to concentrated acids and alkalis, as well as numerous organic solvents. It is highly resistant to corrosive chemicals except oxidising acids; has extremely low moisture absorption and a very low coefficient of friction; is self-lubricating; and is highly resistant to abrasion, in some forms being 15 times more resistant to abrasion than carbon steel. Its coefficient of friction is significantly lower than that of nylon and acetal and is comparable to that of polytetrafluoroethylene (PTFE, Teflon), but UHMWPE has better abrasion resistance than PTFE.

Steelplast CC
Reg. No. 2010/113200/23
VAT No. 4240263444
P.O. Box 11099
Selcourt, 1567
www.steelplastsa.com

Johannesburg - Head Office
Cnr Innes & Shorten Roads,
Shop 6, Nuffield, Springs
Phone: +27 (0) 11 363-3722/23
Fax: +27 (0) 86 725 0725
E-mail: henkl@steelplast.co.za

Cape Town Branch
10 Garden Street, Hopefield
Western Cape
Phone: +27 (0) 22 723 1301
Fax: +27 (0) 86 563 6649
E-mail: annemarie@steelplast.co.za

Members:
Annemarie De Meyer
Laurens Van Zanten
Henk Lourens



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Areas of use:

- Electroplating industry
- General machine engineering
- Coal processing
- Packaging industry
- Conveying technology
- Paper industry
- Electrical industry

Applications:

- Sheaves, guide rollers
- Sprocket wheels and pinions
- Gears
- Chain guides
- Slides
- Suction plates
- Roller knife and scrapers
- Chute linings for silos
- Conveyor trough linings
- Abrasion protection strips



Sliding properties

PE-UHMW (PE 1,000; molar mass approx. 4,500,000 g/mol). Because of its high molar mass, it has very good wear resistance, bending strength and impact resistance and good noise absorption. Due to its excellent sliding properties and low sliding abrasion, it is the ideal material for lightly loaded components. Both PE-HMW and PE-UHMW are also available as regenerated material, although it must be noted that the respective physical properties are slightly reduced.

Chemical resistance

All PE types are resistant to acids, alkaline solutions, salts and salt solutions, alcohols, oils, fats, waxes and many solvents. Aromatics and halogenated hydrocarbons cause swelling. All PE types are not resistant to strong oxidising materials (e.g. nitric acid, chromic acid or halogens), and there is a danger of stress corrosion cracking.

Weathering effects

As a general rule, no PE types are resistant to UV rays. This does not apply to the black coloured types, which are resistant to UV rays also in combination with atmospheric oxygen.

Behaviour in fire

All PE types are rated as normal flammable. When the source of ignition is removed they continue to burn and form droplets. However, apart from carbon dioxide, carbon monoxide and water, only small quantities of carbon black and molecular constituents of the plastic develop as conflagration gases. The oxygen index (the oxygen concentration required for combustion) at 18% is low compared to other plastics.

Machining

In addition to the good welding properties of PE-HD and PE-HMW, all PE types can also be machined on machine tools. The semi-finished products can be drilled, milled, sawed, planed and turned on a lathe. It is also possible to cut a thread into the material or insert a threaded element. As a rule, no cooling or lubricating emulsion is necessary.

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