TIVAR® DS

QUADRANT ENGINEERING PLASTIC PRODUCTS

PRODUCT DATA SHEET

TIVAR DS is a modified PE-UHMW with extremely high molecular weight. The latter in combination with a particular manufacturing process result in a PE-UHMW grade with superior wear and abrasion resistance over TIVAR 1000.

Physical properties (indicative values ■)

PROPERTIES	Test methods	Units	VALUES
Colour	-	-	Yellow
Average molar mass (average molecular weight) - (1)	-	10^6 g/mol	9
Density	ISO 1183-1	g/cm³	0.93
Water absorption at saturation in water of 23 °C	-	%	< 0.1
Thermal Properties (2)			
Melting temperature (DSC, 10 °C/min)	ISO 11357-1/-3	°C	135
Thermal conductivity at 23 °C	-	W/(K.m)	0.40
Average coefficient of linear thermal expansion between 23 and 100 °	-	m/(m.K)	200 x 10^{-6}
Temperature of deflection under load:			
- method A: 1.8 MPa	ISO 75-1/-2	°C	42
Vicat softening temperature - VST/B50	ISO 306	°C	80
Max. allowable service temperature in air:			
- for short periods (3)	-	°C	120
- continuously : for 20,000 h (4)	-	°C	80
Min. service temperature (5)	-	°C	-200 (6)
Flammability (7):			
- "Oxygen Index"	ISO 4589-1/-2	%	< 20
- according to UL 94 (6 mm thickness)	-	-	HB
Mechanical Properties at 23 °C (8)			
Tension test (9):			
- tensile stress at yield (10)	ISO 527-1/-2	MPa	19
- tensile strain at yield (10)	ISO 527-1/-2	%	15
- tensile strain at break (10)	ISO 527-1/-2	%	> 50
- tensile modulus of elasticity (11)	ISO 527-1/-2	MPa	700
Compression test (12):			
- compressive stress at 1 / 2 / 5 % nominal strain (11)	ISO 604	MPa	6 / 10 / 16
Charpy impact strength - unnotched (13)	ISO 179-1/1eU	kJ/m²	no break
Charpy impact strength - notched	ISO 179-1/1eA	kJ/m²	100P
Charpy impact strength - notched (double 14° notch) - (14)	ISO 11542-2	kJ/m²	130
Ball indentation hardness (15)	ISO 2039-1	N/mm²	31
Shore hardness D (15)	ISO 868	-	58
Relative volume loss during a wear test in "sand/water-slurry" ; TIVAR 1000 = 100	ISO 15527	-	85
Electrical Properties at 23 °C			
Electric strength (16)	IEC 60243-1	kV/mm	45
Volume resistivity	IEC 60093	Ohm.cm	> 10^{14}
Surface resistivity	IEC 60093	Ohm	> 10^{12}
Relative permittivity ε_r : - at 100 Hz	IEC 60250	-	2.1
- at 1 MHz	IEC 60250	-	3.0
Dielectric dissipation factor tan δ: - at 100 Hz	IEC 60250	-	0.0004
- at 1 MHz	IEC 60250	-	0.0010
Comparative tracking index (CTI)	IEC 60112	-	600

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

Legend:

(1) This is the average molar mass of the PE-UHMW resins (irrespective of any additives) used for the manufacture of this material. It is calculated by means of the Margolies-equation $M = 5.37 \times 10^4 \times [\eta]^{1.49}$, with [η] being the intrinsic viscosity (Staudinger index) derived from a viscosity measurement according to ISO 1628-3:2001, using decahydronaphtalene as a solvent (concentration of 0.0002 g/cm³).

(2) The figures given for these properties are for the most part derived from raw material supplier data and other publications.

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

(4) Temperature resistance over a period of 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 value given here is 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.

(5) Impact strength decreasing with decreasing temperature, the minimum allowable service temperature is practically mainly determined by the extent to which the material is subjected to impact. The value given here is based on unfavourable impact conditions and may consequently not be considered as being the absolute practical limit.

(6) Because of its outstanding toughness, this material withstands even the temperature of liquid helium (-269°C) at which it still maintains a useful impact resistance without shattering.

(7) These estimated ratings, derived from raw material supplier data and other publications, are not intended to reflect hazards presented by the material under actual fire conditions. There is no 'UL File Number' available for TIVAR DS stock shapes.

(8) The figures given for these properties are average values of tests run on test specimens machined out of 20 - 30 mm thick plates.

(9) Test specimens: Type 1 B

(10) Test speed: 50 mm/min

(11) Test speed: 1 mm/min.

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

(13) Pendulum used: 15 J

(14) Pendulum used: 25 J

(15) Measured on 10 mm thick test specimens.

(16) Electrode configuration: ∅ 25 / ∅ 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. **However, they are not guaranteed and they should not be used to establish material specification limits nor used alone as the basis of design.**