Ultra High Molecular Weight Polyethylene

TIVAR® 1000 ASTL

MITSUBISHI CHEMICAL ADVANCED MATERIALS

PRODUCT DATA SHEET

TIVAR® 1000 ASTL, based on a PE-UHMW grade with extremely high molecular weight, has been specifically developed for tough anti-abrasion applications. TIVAR® 1000 ASTL shows a higher wear and abrasion resistance and a lower surface resistivity than TIVAR® 1000 antistatic. The additives used also render this material static dissipative and highly UV-resistant.

Physical properties (indicative values ▪)

PROPERTIES			
Colour	-	-	Black
Density	ISO 1183-1	g/cm³	0.95
Average molas mass (average molecular weight) (1)	-	10^6 g/mol	9
Water absorption:			
- after 24 immersion in water of 23 °C (2)	ISO 62	%	< 0.1
- at saturation in water of 23 °C	-	%	< 0.1
Thermal Properties (3)			
Melting temperature (DSC, 10 °C/min)	ISO 11357-1/-3	°C	135
Thermal conductivity at 23 °C	-	W/(K.m)	0.40
Coefficient of linear thermal expansion: - average value between 23 and 100 °C	-	m/(m.K)	200 x 10-6
Temperature of deflection under load:			
- method A: 1.8 MPa	ISO 75-1/-2	°C	42
Max. allowable service temperature in air:			
- continuously : for min. 20,000 h (4)	-	°C	80
Min. service temperature (5)	-	°C	-150
Flammability (6):			
- according to UL 94 (3 mm thickness)	-	-	HB
Mechanical Properties at 23 °C (7)			
Tension test (8): - tensile strength (9)	ISO 527-1/-2	MPa	21
- tensile strain at yield(9)	ISO 527-1/-2	%	15
- tensile strain at break (9)	ISO 527-1/-2	%	> 50
- tensile modulus of elasticity (10)	ISO 527-1/-2	MPa	800
Compression test (11):			
- compressive stress at 1 / 2 / 5 % nominal strain (10)	ISO 604	MPa	7 / 11.5 / 18
Flexural test (12): - flexural strength	ISO 178	MPa	17
- flexural modulus of elasticity	ISO 178	MPa	
Charpy impact strength - unnotched (13)	ISO 179-1/1eU	kJ/m²	no break
Charpy impact strength - notched	ISO 179-1/1eA	kJ/m²	90P
Charpy impact strength - notched (double 14°) - (14)	ISO 11542-2	kJ/m²	80
Shore hardness D (15)	ISO 868	-	61
Relative volume loss during a wear test in "sand/water-slurry" ; TIVAR®1000 = 100	ISO 15527	-	85
Dynamic Coefficient of Friction (-)	ISO 7148-2 (16)	-	
Wear rate	ISO 7148-2 (16)	μm/km	
Electrical Properties at 23 °C			
Electric strength (17)	IEC 60243-1	kV/mm	
Volume resistivity	IEC 60093	Ohm.cm	
Surface resistivity	ANSI/ESD STM 11.11	Ohm/sq.	< 10 E6
Relative permittivity ε_r : - at 1 MHz	IEC 60250	-	
Dielectric dissipation factor tan δ: - at 1 MHz	IEC 60250	-	

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) 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 $[\eta]$ 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) According to method 1 of ISO 62 and done on discs Ø 50 mm x 3 mm.
3) The figures given for these properties are for the most part derived from raw material supplier data and other publications.
4) 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 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) 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 these stock shapes.
7) Most of the figures given for these mechanical properties of the materials are average values of tests run on dry test specimens machined either out of plate 15-20 mm thick or rod diameter 40-50mm, the test specimens were then taken from the stock shape with their length in longitudinal direction (parallel to the extrusion direction).
8) Test specimens: Type 1 B
9) Test speed: either 5 or 50 mm/min [chosen acc. to ISO 10350-1 as a function of the ductile behaviour of the material (tough or brittle)
10) Test speed: 1 mm/min.
11) Test specimens: cylinders Ø 8 mm x 16 mm
12) Test specimens: bars 4 mm (thickness) x 10 mm x 80 mm ; test speed: 2 mm/min ; span: 64 mm.
13) Pendulum used: 4 J.
14) Pendulum used 25J.
15) Measured on 10 mm thick test specimens.
16) Test procedure similar to Test Method A: "Pin-on-disk" as described in ISO 7148-2, Load 3MPa, sliding velocity= 0,33 m/s, mating plate steel Ra= 0.7-0.9 μm, tested at 23°C, 50%RH.
17) Electrode configuration: ∅ 25 mm / ∅ 75 mm coaxial cylinders ; in transformer oil according to IEC 60296 ; 1 mm thick test specimens.

This table 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.

It has to be noted that reinforced and filled material shows an anisotropic behaviour (properties differ when measured parallel and perpendicular to the manufacturing direction).

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