Borotron® HM050 PE

High Molecular Weight Polyethylene

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PRODUCT DATA SHEET

Borotron® HM050 High Molecular Weight Polyethylene HMW-PE shapes are enhanced with 5.0% elemental boron, which makes this grade a superior performer in extreme shielding applications in nuclear and medical applications. The high hydrogen content of HMW-PE allows this grade to absorb thermal neurons, which are then absorbed by the added boron compound. For these reasons, Borotron® HM050 HMW-PE components are often favored as solutions in nuclear waste disposal and detection system, nuclear material storage and transportation, radiation therapy environments, and hot cell technology applications within the nuclear and medical technology markets.

		ISO*			ASTM*		
		Test methods	Units	Indicative Values	Test methods	Units	Indicative Values
Thermal Properties (1)	Melting temperature (DSC, 10°C (50°F) / min)	ISO 11357-1/-3	°C	135	ASTM D3418	°F	-
	Glass transition temperature (DMA, tan delta)	DMA	°C	-	DMA	°F	-
	Thermal conductivity at 23°C (73°F)	-	W/(K.m)	≥ 0.38	-	BTU in./(hr.ft².°F)	
	Coefficient of linear thermal expansion (-40 to 150 °C) (-40 to 300°F)				ASTM E-831 (TMA)	µin./in./°F	
	Coefficient of linear thermal expansion (23 to 100°C) (73°F to 210°F)	-	µm/(m.K)	135			
	Heat Deflection Temperature: method A: 1.8 MPa (264 PSI)	ISO 75-1/-2	°C	45	ASTM D648	°F	-
	Continuous allowable service temperature in air (20.000 hrs) (3)	-	°C	80	-	°F	-
	Min. service temperature (4)	-	°C	-20	-	°F	-
	Flammability: UL 94 (3 mm (1/8 in.)) (5)	-	-	HB	-	-	HB
	Flammability: Oxygen Index	ISO 4589-1/-2	%	<20			
Mechanical Properties (6)	Tensile strength	ISO 527-1/-2 (7)	MPa	21	ASTM D638 (8)	PSI	-
	Tensile strain (elongation) at yield	ISO 527-1/-2 (7)	%	7.00	ASTM D638 (8)	%	-
	Tensile strain (elongation) at break	ISO 527-1/-2 (7)	%	7	ASTM D638 (8)	%	
	Tensile modulus of elasticity	ISO 527-1/-2 (9)	MPa	1,600	ASTM D638 (8)	KSI	-
	Shear Strength	ASTM D732	MPa	-	ASTM D732	PSI	-
	Compressive stress at 1 / 2 / 5 % nominal strain	ISO 604 (10)	MPa	14/ 21 / 29			
	Compressive strength				ASTM D695 (11)	PSI	-
	Charpy impact strength - unnotched	ISO 179-1/1eU	kJ/m²	15.0			
	Charpy impact strength - notched	ISO 179-1/1eA	kJ/m²	5C			
	Charpy impact strength - double 14° notched	ISO 21304-2	kJ/m²	8			
	Izod Impact notched				ASTM D256	ft.lb./in	
	Flexural strength	ISO 178 (12)	MPa	-	ASTM D790 (13)	PSI	-
	Flexural modulus of elasticity	ISO 178 (12)	MPa	-	ASTM D790	KSI	-
	Relative volume loss during wear test "sand-slurry" : TIVAR® 1000=100	ISO 15527	-	350			
	Shore hardness D (14)	ISO 868	-	66	ASTM D2240	-	-
Electrical Properties	Electric strength	IEC 60243-1 (15)	kV/mm	-	ASTM D149	Volts/mil	-
	Volume resistivity	IEC 62631-3-1	Ohm.cm	10E13	IEC 60093	Ohm.cm	
	Surface resistivity	ANSI/ESD STM 11.11	Ohm/sq.	10E12	ANSI/ESD STM 11.11	Ohm/sq.	
	Dielectric constant at 1 MHz	IEC 62631-2-1	-	-	ASTM D150	-	-
	Dissipation factor at 1 MHz	IEC 62631-2-1	-	-	ASTM D150	-	-
Miscellaneous	Colour	-	-	White	-	-	White
	Density	ISO 1183-1	g/cm³	1.04			
	Specific Gravity				ASTM D792	-	-
	Water absorption after 24h immersion in water of 23°C (73°F)	ISO 62 (16)	%	< 0.1	ASTM D570 (17)	%	
	Water absorption at saturation in water of 23 °C (73°F)	-	%	-	ASTM D570 (17)	%	
	Wear rate	ISO 7148-2 (18)	µm/km	-	QTM 55010 (19)	In³.min/ft.lbs.hrx10^{-10}	-
	Dynamic Coefficient of Friction (-)	ISO 7148-2 (18)	-		QTM 55007 (20)	-	-
	Limiting PV at 100 FPM				QTM 55007 (21)	ft.lbs/in².min	-
	Limiting PV at 0.1 / 1 m/s cylindrical sleeve bearings	-	Mpa.m/s	- / -			
	Chemical Resistance	https://www.mcam.com/en/support/chemical-resistance-information/			https://www.mcam.com/en/support/chemical-resistance-information/		

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

NYP: there is no yield point

* 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 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. See the remaining notes on the next page.

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NOTES, SEE DATASHEET ON PAGE 1

-1 The figures given for these properties are for the most part derived from raw material supplier data and other publications.

-2 Values for this property are only given here for amorphous materials and for materials that do not show a melting temperature (PBI, PAI & PI). DMA settings, oscillation amplitude of 0.20 mm; a frequency of 1 Hz ; heating rate of 2°C/min

-3 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 (73°F)– 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.

-4 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.

-5 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.

-6 Most of the figures given for the mechanical properties are average values of tests run on dry test specimens machined out of rods 40-50 mm (1.5 - 2") when available, else out of plate 10-20mm (0.4 - 0.8"). All tests are done at room temperature (23° / 73°F)

-7 Test speed: either 5 mm/min or 50 mm/min [chosen acc. to ISO 10350-1 as a function of the ductile behaviour of the material (tough or brittle)] using type 1B tensile bars

-8 Test speed: either 0.2"/min or 2"/min or [chosen as a function of the ductile behavior of the material (brittle or tough)] using Type 1 tensile bars

-9 Test speed: 1 mm/min, using type 1B tensile bars

-10 Test specimens: cylinders Ø 8 mm x 16 mm, test speed 1 mm/min

-11 Test specimens: cylinders Ø 0.5" x 1", or square 0.5" x 1", test speed 0.05"/min

-12 Test specimens: bars 4 mm (thickness) x 10 mm x 80 mm ; test speed: 2 mm/min ; span: 64 mm

-13 Test specimens: bars 0.25" (thickness) x 0.5" x 5" ; test speed: 0.11"/min ; span: 4"

-14 Measured on 10 mm, 0.4" thick test specimens.

-15 Electrode configuration: Ø 25 / Ø 75 mm coaxial cylinders ; in transformer oil according to IEC 60296 ; 1 mm thick test specimens.

-16 Measured on discs Ø 50 mm x 3 mm.

-17 Measured on 1/8" thick x 2" diameter or square

-18 Test procedure similar to Test Method A: "Pin-on-disk" as described in ISO7148-2, Load 3MPa, sliding velocity= 0,33 m/s, mating plate steel Ra= 0.7-0.9 μm, tested at 23°C, 50%RH.

-19 Test using journal bearing system, 200 hrs, 118 ft/min, 42 PSI, steel shaft roughness 16±2 RMS micro inches with Hardness Brinell of 180-200

-20 Test using Plastic Thrust Washer rotating against steel, 20 ft/min and 250 PSI, Stationary steel washer roughness 16±2 RMS micro inches with Rockwell C 20-24

-21 Test using Plastic Thrust Washer rotating against steel, Step by step increase pressure, Test ends when plastic begins to deform or if temperature increases to 300°F.