

# Borotron™ UH030 UHMW-PE



## Ultra High Molecular Weight Polyethylene

Borotron™ UH030 UHMW-PE (ultra high molecular weight polyethylene) shapes are enhanced with 3.0% elemental boron for use in extreme shielding in nuclear and medical applications. The high hydrogen content of the polyethylene allows the material to absorb thermal neutrons, which are then absorbed by the added boron compound. For these reasons, Borotron™ UH030 UHMW-PE components are often favored as solutions in applications involving nuclear waste disposal and detection, nuclear material storage and transportation, radiation therapy and hot cell technology.

|                           |                                                                          | 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 δ) (2)                            |                                                         | °C        |                   |                                                         | °F                                      |                   |
|                           | Thermal conductivity at 23°C (73°F)                                      |                                                         | W/(K.m)   |                   |                                                         | 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)  | 185               |                                                         |                                         |                   |
|                           | Heat Deflection Temperature: method A: 1.8 MPa (264 PSI)                 | ISO 75-1/-2                                             | °C        | 42                | ASTM D648                                               | °F                                      |                   |
|                           | Continuous allowable service temperature in air (20,000 hrs) (3)         |                                                         | °C        | 80                |                                                         | °F                                      |                   |
|                           | Min. service temperature (4)                                             |                                                         | °C        | -75               |                                                         | °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       | 17                | ASTM D638 (8)                                           | PSI                                     |                   |
|                           | Tensile strain (elongation) at yield                                     | ISO 527-1/-2 (7)                                        | %         | 18                | ASTM D638 (8)                                           | %                                       |                   |
|                           | Tensile strain (elongation) at break                                     | ISO 527-1/-2 (7)                                        | %         | > 50              | ASTM D638 (8)                                           | %                                       |                   |
|                           | Tensile modulus of elasticity                                            | ISO 527-1/-2 (9)                                        | MPa       | 875               | ASTM D638 (8)                                           | KSI                                     |                   |
|                           | Shear Strength                                                           | ASTM D732                                               | MPa       |                   | ASTM D732                                               | PSI                                     |                   |
|                           | Compressive stress at 1 / 2 / 5 % nominal strain                         | ISO 604 (10)                                            | MPa       | 8 / 12.5 / 19     |                                                         |                                         |                   |
|                           | Compressive strength                                                     |                                                         |           |                   | ASTM D695 (11)                                          | PSI                                     |                   |
|                           | Charpy impact strength - unnotched                                       | ISO 179-1/1eU                                           | kJ/m²     | no break          |                                                         |                                         |                   |
|                           | Charpy impact strength - notched                                         | ISO 179-1/1eA                                           | kJ/m²     | 40P               |                                                         |                                         |                   |
|                           | Charpy impact strength - double 14° notched                              | ISO 21304-2                                             | kJ/m²     | 20                |                                                         |                                         |                   |
|                           | Izod Impact notched                                                      |                                                         |           |                   | ASTM D256                                               | ft.lb./in                               |                   |
|                           | Izod Impact double notched                                               |                                                         |           |                   | ASTM D4020                                              | 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 "sand-slurry" (ISO vsTIVAR®1000; ASTM vs1018 Steel) | ISO 15527                                               | Index=100 | 140               | ASTM D4020                                              | Index=100                               |                   |
|                           | Shore Hardness D (14)                                                    | ISO 868                                                 |           | 63                | ASTM D2240                                              |                                         |                   |
| Electrical Properties     | Electric strength                                                        | IEC 60243-1 (15)                                        | kV/mm     |                   | ASTM D149                                               | Volts/mil                               |                   |
|                           | Volume resistivity                                                       | IEC 62631-3-1                                           | Ohm.cm    | 10 <sup>14</sup>  | ASTM D257                                               | Ohm.cm                                  |                   |
|                           | Surface resistivity                                                      | ANSI/ESD STM 11.11                                      | Ohm       | 10 <sup>12</sup>  | ANSI/ESD STM 11.11                                      | Ohm                                     |                   |
|                           | Dielectric constant at 1 MHz                                             | IEC 62631-2-1                                           |           |                   | ASTM D150                                               |                                         |                   |
|                           | Dissipation factor at 1MHz                                               | IEC 62631-2-1                                           |           |                   | ASTM D150                                               |                                         |                   |
| Miscellaneous             | Color                                                                    |                                                         |           | White             |                                                         |                                         | White             |
|                           | Density                                                                  | ISO 1183-1                                              | g/cm³     | 0.98              |                                                         |                                         |                   |
|                           | 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/in².ft.lbs.hrX10 <sup>-10</sup> |                   |
|                           | Dynamic Coefficient of Friction (-)                                      | ISO 7148-2 (18)                                         |           | -                 | QTM 55007 (20)                                          |                                         |                   |
|                           | Limiting PV at 100 FPM (safety factor 4)                                 |                                                         |           |                   | QTM 55007 (21)                                          | ft.lbs/in².min                          |                   |
|                           | Limiting PV at 0.1 / 1 m/s cylindrical sleeve bearings                   |                                                         | MPa.m/s   |                   |                                                         |                                         |                   |
|                           | Chemical Resistance                                                      | www.mcam.com/en/support/chemical-resistance-information |           |                   | 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.

Borotron™ is a protected trademark of Mitsubishi Chemical Advanced Materials

[mcam.com](http://mcam.com)

# 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 & PI).
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 – 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 40-60 mm when available, else out of plate 10-20mm. 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 behaviour 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: Φ 25 / Φ 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 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.
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, a 4:1 safety factor has been applied to the posted value.

This product data sheet and any data and specifications presented on our website shall provide promotional and general information about the Engineering Plastic Products (the "Products") manufactured and offered by Mitsubishi Chemical Advanced Materials and shall serve as a preliminary guide. All data and descriptions relating to the Products are of an indicative nature only. Neither this data sheet nor any data and specifications presented on our website shall create or be implied to create any legal or contractual obligation.

Any illustration of the possible fields of application of the Products shall merely demonstrate the potential of these Products, but any such description does not constitute any kind of covenant whatsoever. Irrespective of any tests that Mitsubishi Chemical Advanced Materials may have carried out with respect to any Product, Mitsubishi Chemical Advanced Materials does not possess expertise in evaluating the suitability of its materials or Products for use in specific applications or products manufactured or offered by the customer respectively. The choice of the most suitable plastics material depends on available chemical resistance data and practical experience, but often preliminary testing of the finished plastics part under actual service conditions (right chemical, concentration, temperature and contact time, as well as other conditions) is required to assess its final suitability for the given application.

It thus remains the customer's sole responsibility to test and assess the suitability and compatibility of Mitsubishi Chemical Advanced Materials' Products for its intended applications, processes and uses, and to choose those Products which according to its assessment meet the requirements applicable to the specific use of the finished product. The customer undertakes all liability in respect of the application, processing or use of the aforementioned information or product, or any consequence thereof, and shall verify its quality and other properties.