TIVAR® Cestidur



TIVAR® Cestidur 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 | •) |
|-----------------|--------------|---------------------|----|
| i iivəicai | טו טטכו נוכט | tilidicative values | • |

| Temperature of deflection under load: | PROPERTIES | , | | |
|--|---|-----------------|-----------------------|-------------|
| Density | Colour | | | Grov |
| Average molas mass (average molecular weight) (1) | Colour | _ | _ | Oley |
| Average molas mass (average molecular weight) (1) | Density | ISO 1183-1 | g/cm³ | 0.93 |
| Water 24 immersion in water of 23 °C (2) ISO 62 % < 0.1 - at saturation in water of 23 °C (2) 1SO 62 % < 0.1 Thermal Properties (3) Melting temperature (DSC, 10 °C/min) ISO 11357-11/-3 °C 135 Thermal conductivity at 23 °C - - W/(K.m) 0.40 Coefficient of linear thermal expansion: - w/(K.m.) 200 x 10-4 Coefficient of flinear thermal expansion: - w/C 42 Temperature of deflection under load: - °C 42 match A3: I.8 MPa ISO 75-11/-2 °C 42 Max. allowable service temperature in air: - °C 80 - method A3: 1.8 MPa ISO 75-11/-2 °C 80 Min. service temperature (5) - °C 80 Min. service temperature (5) - - °C 80 Min. service temperature (5) - - *D 180 Hechanical Properties at 23 °C (7) *B *B *B | Average molas mass (average molecular weight) (1) | - | 10 ⁶ a/mol | 9 |
| - after 24 immersion in water of 23 °C (2) | | | 10 g/mor | |
| Assturation in water of 23 °C Control Co | | ISO 62 | % | < 0.1 |
| Melting temperature (DSC, 10 °C/min) | • • • | - | % | < 0.1 |
| 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: | | | | |
| Coefficient of linear thermal expansion: - average value between 23 and 100 °C Temperature of deflection under load: - method A: 1.8 MPa | . ,, | ISO 11357-1/-3 | °C | 135 |
| Coefficient of linear thermal expansion: - average value between 23 and 100 °C Temperature of deflection under load: - method A: 1.8 MPa | , , | - | W/(K.m) | 0.40 |
| - average value between 23 and 100 °C - m/(m.K) 200 x 10-1 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 -200 Flammability (6): - according to UL 94 (3 mm thickness) Mechanical Properties at 23 °C (7) Tension test (8): - tensile strength (9) ISO 527-1/-2 MPa 19 - tensile strain at yield(9) ISO 527-1/-2 % 15 - tensile strain at preak (9) ISO 527-1/-2 MPa 700 Compression test (11): - compressive stress at 1 / 2 / 5 % nominal strain (10) ISO 604 MPa 6 / 10 / 10 Flexural test (12): - flexural test (12): - flexural strength - unnotched (13) ISO 179-1/1eU k_J/m² no break (14) ISO 179-1/1eU k_J/m² no break (14) ISO 179-1/1eU k_J/m² 100P Charpy impact strength - notched (double 14°) - (14) ISO 1527 R Belative volume loss during a wear test in "sand/water-slurry"; ISO 178-2 (16) - Wear rate Electric strength (17) IEC 60243-1 k_V/mm 45 Volume resistivity IEC 60093 Ohm.cm > 10 E14 Surface resistivity IEC 60093 Ohm.cm > 10 E14 Surface resistivity IEC 60093 Ohm.cm > 10 E14 Surface resistivity IND ISO STM 11.11 Ohm/sq. > 10 E12 | · | | . / | |
| Temperature of deflection under load: - method A: 1.8 MPa ISO 75-11-2 °C 42 Max. allowable service temperature in air: - continuously: for min. 20,000 h (4) - °C 80 Min. service temperature (5) - °C -2000 Flammability (6): - according to UL 94 (3 mm thickness) HB Mechanical Properties at 23 °C (7) Tension test (8): - tensile strength (9) ISO 527-11-2 MPa 19 - tensile strain at yield(9) ISO 527-11-2 MPa 19 - tensile strain at threak (9) ISO 527-11-2 MPa 700 Compression test (11): - compressive stress at 1 / 2 / 5 % nominal strain (10) ISO 604 MPa 6 / 10 / 16 Flexural test (12): - flexural test (12): - flexural strength (13) ISO 178 MPa - flexural modulus of elasticity - flexural strength - unnotched (13) Charpy impact strength - unnotched (13) Charpy impact strength - notched - Shore hardness D (15) - ISO 868 - 58 Relative volume loss during a wear test in "sand/water-slurry"; ISO 15527 - 85 Dynamic Coefficient of Friction (-) ISO 7148-2 (16) - Wear rate - Iso 7148-2 | • | - | m/(m.K) | 200 x 10-6 |
| - method A: 1.8 MPa | • | | . / / | |
| - continuously : for min. 20,000 h (4) - °C - 200 Min. service temperature (5) - °C - 200 Flammability (6): - according to Ut. 94 (3 mm thickness) - ° - ° HB Mechanical Properties at 23 °C (7) Tension test (8): - tensile strength (9) ISO 527-1/-2 MPa 19 - tensile strength (9) ISO 527-1/-2 % 15 - tensile strain at yield(9) ISO 527-1/-2 % 50 - tensile strain at break (9) ISO 527-1/-2 MPa 700 Compression test (11): - compression test (11): - compressive stress at 1 / 2 / 5 % nominal strain (10) ISO 604 MPa 6 / 10 / 16 Flexural test (12): - flexural strength - unnotched (13) ISO 178 MPa - flexural modulus of elasticity (10) ISO 178 MPa - flexural modulus of elasticity (10) ISO 178 MPa - flexural test (12): - flexural strength - unnotched (13) ISO 179-1/1eU kJ/m² no break - flexural modulus of elasticity ISO 179-1/1eU kJ/m² no break - flexural strength - notched (double 14°) - (14) ISO 11542-2 kJ/m² 130 Shore hardness D (15) ISO 868 - S8 Relative volume loss during a wear test in "sand/water-slurry"; ISO 15527 - S8 TIVAR® 1000 = 100 ISO 7148-2 (16) - - wear rate ISO 7148-2 (1 | | ISO 75-1/-2 | °C | 42 |
| - continuously : for min. 20,000 h (4) - °C 80 Min. service temperature (5) - °C -200 Flammability (6): - - °C -200 Flammability (6): - - - HB Mechanical Properties at 23 °C (7) - HB Tension test (8): - - MPa 19 - tensile strength (9) ISO 527-1/-2 MPa 19 - tensile strain at yield(9) ISO 527-1/-2 % 15 - tensile strain at break (9) ISO 527-1/-2 MPa 700 Compression test (11): - - MPa 700 Compression test (11): - SO 178 MPa 6 / 10 / 16 Flexural sterngth ISO 178 MPa 6 / 10 / 16 Flexural strength (12): ISO 178 MPa MPa Charpy impact strength - unnotched (13) ISO 179-1/1eU kJ/m² 100P Charpy impact strength - notched (double 14°) - (14) ISO 11542-2 kJ/m² 130 | Max. allowable service temperature in air: | | | |
| Min. service temperature (5) - °C -200 Flammability (6): - - HB According to UL 94 (3 mm thickness) - - HB Mechanical Properties at 23 °C (7) - - HB Mechanical Properties at 23 °C (7) - - - HB Mechanical Properties at 23 °C (7) - - - - HB Mechanical Properties at 23 °C (7) - - - - HB Mechanical Properties at 23 °C (7) - <td></td> <td>-</td> <td>°C</td> <td>80</td> | | - | °C | 80 |
| - according to UL 94 (3 mm thickness) | | - | °C | -200 |
| Mechanical Properties at 23 °C (7) Tension test (8): - tensile strength (9) | Flammability (6): | | | |
| Tension test (8): - tensile strength (9) ISO 527-1/-2 MPa 19 - 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 700 Compression test (11): - compressive stress at 1 / 2 / 5 % nominal strain (10) ISO 604 MPa 6 / 10 / 16 Flexural test (12): - flexural strength ISO 178 MPa - flexural modulus of elasticity ISO 178 MPa Charpy impact strength - unnotched (13) ISO 178 MPa Charpy impact strength - notched 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°) - (14) ISO 11542-2 kJ/m² 130 Shore hardness D (15) ISO 868 - 58 Relative volume loss during a wear test in "sand/water-slurry"; ISO 15527 - 85 TIVAR®1000 = 100 ISO 7148-2 (16) pm/km Electric strength (17) IEC 60243-1 kV/mm 45 Volume resistivity IEC 60093 Ohm.cm > 10 E14 Surface resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 | - according to UL 94 (3 mm thickness) | - | - | НВ |
| Tension test (8): - tensile strength (9) ISO 527-1/-2 MPa 19 - 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 700 Compression test (11): - compressive stress at 1 / 2 / 5 % nominal strain (10) ISO 604 MPa 6 / 10 / 16 Flexural test (12): - flexural strength ISO 178 MPa Charpy impact strength - unnotched (13) ISO 178 MPa Charpy impact strength - notched ISO 179-1/1eU kJ/m² no break Charpy impact strength - notched (double 14°) - (14) ISO 11542-2 kJ/m² 100P Charpy impact strength - notched (double 14°) - (14) ISO 11542-2 kJ/m² 130 Shore hardness D (15) ISO 868 - 58 Relative volume loss during a wear test in "sand/water-slurry"; ISO 15527 - 85 TIVAR®1000 = 100 ISO 7148-2 (16) pm/km Electric strength (17) ISO 7148-2 (16) pm/km Electrics trength (17) IEC 60243-1 kV/mm 45 Volume resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 Surface resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 | Mechanical Properties at 23 °C (7) | | | |
| - tensile strain at yield(9) | | | | |
| - tensile strain at break (9) | - tensile strength (9) | ISO 527-1/-2 | MPa | 19 |
| - tensile modulus of elasticity (10) ISO 527-1/-2 MPa 700 Compression test (11): - compressive stress at 1 / 2 / 5 % nominal strain (10) ISO 604 MPa 6 / 10 / 16 Flexural test (12): - flexural test (12): - flexural strength - flexural modulus of elasticity ISO 178 MPa - flexural modulus of elasticity ISO 178 MPa - flexural modulus of elasticity ISO 179-1/1eU kJ/m² no break Charpy impact strength - notched (13) Shore hardness D (15) ISO 159-1/1eA kJ/m² 100P Charpy impact strength - notched (double 14°) - (14) ISO 11542-2 kJ/m² 130 Shore hardness D (15) | - tensile strain at yield(9) | ISO 527-1/-2 | % | 15 |
| Compression test (11): - compressive stress at 1 / 2 / 5 % nominal strain (10) ISO 604 MPa 6 / 10 / 16 Flexural test (12): - flexural test (12): - flexural strength - flexural modulus of elasticity ISO 178 MPa - flexural modulus of elasticity ISO 179-1/1eU Ly/m² No break Charpy impact strength - unnotched (13) ISO 179-1/1eU Ly/m² No break Charpy impact strength - notched ISO 179-1/1eA Ly/m² 100P Charpy impact strength - notched (double 14°) - (14) ISO 11542-2 Ly/m² 130 Shore hardness D (15) ISO 868 - 58 Relative volume loss during a wear test in "sand/water-slurry"; ISO 15527 - 85 TIVAR®1000 = 100 ISO 7148-2 (16) - wear rate ISO 7148-2 (16) - wear rate Flectric al Properties at 23 °C Electric strength (17) IEC 60243-1 Ly/mm 45 Volume resistivity IEC 60093 Ohm.cm > 10 E14 Surface resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 | - tensile strain at break (9) | ISO 527-1/-2 | % | > 50 |
| - compressive stress at 1 / 2 / 5 % nominal strain (10) ISO 604 MPa 6 / 10 / 16 Flexural test (12): - flexural strength ISO 178 MPa - 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 179-1/1eU kJ/m² 100P Charpy impact strength - notched (13) ISO 179-1/1eA kJ/m² 100P Charpy impact strength - notched (14) ISO 11542-2 kJ/m² 130 Shore hardness D (15) ISO 868 - 58 Relative volume loss during a wear test in "sand/water-slurry"; ISO 15527 - 85 TIVAR®1000 = 100 ISO 7148-2 (16) - 4 m/km Flectrical Properties at 23 °C Electric strength (17) IEC 60243-1 kV/mm 45 Volume resistivity IEC 60093 Ohm.cm > 10 E14 Surface resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 | - tensile modulus of elasticity (10) | ISO 527-1/-2 | MPa | 700 |
| Flexural test (12): - flexural strength - flexural modulus of elasticity Charpy impact strength - unnotched (13) Charpy impact strength - notched Charpy impact strength - notched (double 14°) - (14) Shore hardness D (15) Shor | Compression test (11): | | | |
| - flexural strength | - compressive stress at 1 / 2 / 5 % nominal strain (10) | ISO 604 | MPa | 6 / 10 / 16 |
| - 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 100P Charpy impact strength - notched (double 14°) - (14) ISO 11542-2 kJ/m² 130 Shore hardness D (15) ISO 868 - 58 Relative volume loss during a wear test in "sand/water-slurry"; ISO 15527 - 85 TIVAR®1000 = 100 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 45 Volume resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 Surface resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 | Flexural test (12): | | | |
| 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°) - (14) ISO 11542-2 kJ/m² 130 Shore hardness D (15) ISO 868 - 58 Relative volume loss during a wear test in "sand/water-slurry"; ISO 15527 - 85 TIVAR®1000 = 100 ISO 7148-2 (16) - - Dynamic Coefficient of Friction (-) ISO 7148-2 (16) - - Wear rate ISO 7148-2 (16) - - - Electrical Properties at 23 °C Electrical Ectric strength (17) IEC 60243-1 kV/mm 45 Volume resistivity IEC 60093 Ohm.cm > 10 E14 Surface resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 | - flexural strength | ISO 178 | MPa | |
| Charpy impact strength - notched ISO 179-1/1eA kJ/m² 100P Charpy impact strength - notched (double 14°) - (14) ISO 11542-2 kJ/m² 130 Shore hardness D (15) ISO 868 - 58 Relative volume loss during a wear test in "sand/water-slurry"; ISO 15527 - 85 TIVAR®1000 = 100 ISO 7148-2 (16) - - Wear rate ISO 7148-2 (16) - \mu/km Electrical Properties at 23 °C Electrical ength (17) IEC 60243-1 kV/mm 45 Volume resistivity IEC 60093 Ohm.cm > 10 E14 Surface resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 | - flexural modulus of elasticity | ISO 178 | MPa | |
| Charpy impact strength - notched (double 14°) - (14) ISO 11542-2 kJ/m² 130 Shore hardness D (15) ISO 868 - 58 Relative volume loss during a wear test in "sand/water-slurry"; ISO 15527 - 85 Dynamic Coefficient of Friction (-) ISO 7148-2 (16) - - Wear rate ISO 7148-2 (16) \mu/km - Electrical Properties at 23 °C Electric strength (17) IEC 60243-1 kV/mm 45 Volume resistivity IEC 60093 Ohm.cm > 10 E14 Surface resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 | Charpy impact strength - unnotched (13) | ISO 179-1/1eU | kJ/m² | no break |
| Shore hardness D (15) ISO 868 - 58 Relative volume loss during a wear test in "sand/water-slurry"; ISO 15527 - 85 TIVAR®1000 = 100 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 45 Volume resistivity IEC 60093 Ohm.cm > 10 E14 Surface resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 Surface resistivity Ohm/sq. > 10 E12 | Charpy impact strength - notched | ISO 179-1/1eA | kJ/m² | 100P |
| Relative volume loss during a wear test in "sand/water-slurry" ; ISO 15527 - 85 TIVAR®1000 = 100 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 45 Volume resistivity IEC 60093 Ohm.cm > 10 E14 Surface resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 | Charpy impact strength - notched (double 14°) - (14) | ISO 11542-2 | kJ/m² | 130 |
| TIVAR®1000 = 100 ISO 15527 - 85 Dynamic Coefficient of Friction (-) Wear rate ISO 7148-2 (16) Wear rate ISO 7148-2 (16) ISO 7148-2 (16) | Shore hardness D (15) | ISO 868 | - | 58 |
| Wear rate ISO 7148-2 (16) µm/km Electrical Properties at 23 °C W/mm 45 Electric strength (17) IEC 60243-1 kV/mm 45 Volume resistivity IEC 60093 Ohm.cm > 10 E14 Surface resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 | - | ISO 15527 | - | 85 |
| Wear rate ISO 7148-2 (16) µm/km Electrical Properties at 23 °C W/mm 45 Electric strength (17) IEC 60243-1 kV/mm 45 Volume resistivity IEC 60093 Ohm.cm > 10 E14 Surface resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 | Dynamic Coefficient of Friction (-) | ISO 7148-2 (16) | _ | |
| Electrical Properties at 23 °C Electric strength (17) IEC 60243-1 kV/mm 45 Volume resistivity IEC 60093 Ohm.cm > 10 E14 Surface resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 | * | , | um/km | |
| Electric strength (17) IEC 60243-1 kV/mm 45 Volume resistivity IEC 60093 Ohm.cm > 10 E14 Surface resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 | Electrical Properties at 23 °C | | | |
| Volume resistivity IEC 60093 Ohm.cm > 10 E14 Surface resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 | • | IEC 60243-1 | kV/mm | 45 |
| Surface resistivity ANSI/ESD STM 11.11 Ohm/sq. > 10 E12 | 5 () | | | |
| · | · | | | > 10 E12 |
| πelative permittivity ε _r at π iVIHZ IEC 60250 - 3.0 | Relative permittivity ε_r : - at 1 MHz | IEC 60250 | | 3.0 |
| Dielectric dissipation factor tan δ: - at 1 MHz IEC 60250 - 0.0010 | | | - | |

Note: $1 \text{ g/cm}^3 = 1 000 \text{ kg/m}^3 \cdot 1 \text{ MPa} = 1 \text{ N/mm}^2 \cdot 1 \text{ kV/mm} = 1 \text{ MV/m}$

TIVAR® is a registered trademark of Mitsubishi Chemical Advanced Materials

- Legend:

 1) This is the average molar mass of the PE-UHMW resins

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 3) This is the average molar mass of the PE-UHMW resins

 4) This is the average molar mass of the PE-UHMW resins

 4) This is the average molar mass of the PE-UHMW resins of the PE-U (irrespective of any additives) used for the manufacture of this material. It is calculated by means of the Margolies-equation $M=5.37\times10^4\,\mathrm{x}\,[\eta]^{1.49},$ 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).

 According to method 1 of ISO 62 and done on discs Ø 50 mm x 3 mm.
- The figures given for these properties are for the most part derived from raw material supplier data and other 3)
- part derived from raw material supplier data and other publications.

 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.
- on the duration and the magnitude of the mechanical stresses to which the material is subjected. 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. These estimated ratings, derived from raw material supplier data and other publications, are not intended to reflect hazards presented by the material under actual.
- 6) reflect hazards presented by the material under actual fire conditions. There is no 'UL File Number' available for these stock shapes. Most of the figures given for these mechanical properties

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- 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
- thick of 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). Test specimens: Type 1 B Test specimens: Type 1 B Test specimens: of 50 mm/min [chosen acc. to ISO 10350-1 as a function of the ductile behaviour of the material (tough or brittle) Test specificance: cityledges (2.8 mm x 16 mm).

- Test specimens: cylinders Ø 8 mm x 16 mm
 Test specimens: bars 4 mm (thickness) x 10 mm x 80 mm ; test speed: 2 mm/min ; span: 64 mm.
 Pendulum used: 4 J.
 Pendulum used 25J.
- 13) 14) 15)
- Measured on 10 mm thick test specimens
- weasured on 10 mm thick test specimens. 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 μ m, tested at 23°C, 50%RH.
- Electrode configuration: Ø 25 mm / Ø 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).

ta 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.

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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 as 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



web: www.polifluor.com email: ventas@polifluor.com

Fábrica y oficinas

Pg. Asteasu, Área G, parc. 99-100 20159 - ASTEASU (GUIPÚZCOA) Tfno.: 943 694119 (6 líneas)

Fax: 943 690362

DELEGACIONES:

08830 - SANT BOI DE LLOBREGAT C/ Dr. Josep Castells, 14A - Pg. Fonollar Tel. 93 3003052 - 629344962 Fax: 93 4850311

48003 - BILBAO C/ Monte Ereza, 15 Tel. 944 210701 - 944 210714 Fax: 944 447581

28005 - MADRID Pº Melancólicos, 75 Fax: 91 3669678

41010 - SEVILLA Tel. 629 775449

Tel 91 3663606 - 91 664103