

# MATERIAL DATASHEET

## ZX-200

20.04.2023



**ZEDEX®**  
Tribological Polymer Solutions

| Properties                                                 | Symbol              | Unit                | Standard           | Parameters                                               | Value |
|------------------------------------------------------------|---------------------|---------------------|--------------------|----------------------------------------------------------|-------|
| information                                                |                     |                     |                    |                                                          |       |
| material code                                              | -                   | -                   | internal Standard  | -                                                        | 612   |
| Standard / Sonder (STD/SO)                                 | -                   | -                   | -                  | -                                                        | Std   |
| colour                                                     | -                   | -                   | -                  | -                                                        | Beige |
| density                                                    | $\rho$              | kg/dm <sup>3</sup>  | ISO 1183           | -                                                        | 1,25  |
| mechanical                                                 |                     |                     |                    |                                                          |       |
| compressive modulus                                        | $E_c$               | MPa                 | DIN EN ISO 604     | 1 mm/min;<br>Specimen<br>50 x 10 x 4 mm                  | 1940  |
| elastic limit                                              | $\sigma_{yel}$      | MPa                 | internal Standard  | 5mm/min; 10 x 10 x 4 mm                                  | 41    |
| compressive stress at yield                                | $\sigma_{cy}$       | MPa                 | DIN EN ISO 604     | 5mm/min; 10 x 10 x 4 mm                                  | 82    |
| compressive strength                                       | $\sigma_m$          | MPa                 | DIN EN ISO 604     | 5mm/min; 10 x 10 x 4 mm                                  | 82    |
| compressive stress at 1% strain                            | $\sigma_{1\%}$      | MPa                 | DIN EN ISO 604     | 5mm/min; 10 x 10 x 4 mm                                  | 10    |
| compressive stress at 2% strain                            | $\sigma_{2\%}$      | MPa                 | DIN EN ISO 604     | 5mm/min; 10 x 10 x 4 mm                                  | 17    |
| compressive stress at 3,5% strain                          | $\sigma_{3,5\%}$    | MPa                 | DIN EN ISO 604     | 5mm/min; 10 x 10 x 4 mm                                  | 32    |
| compressive strength (0,01 h)                              | $\sigma_{M0,01}$    | MPa                 | internal Standard  | 3% Compression                                           | 25    |
| compressive strength (100 h)                               | $\sigma_{M100}$     | MPa                 | internal Standard  | 3% Compression                                           | 21    |
| compressive strength (10000 h)                             | $\sigma_{M1000}$    | MPa                 | internal Standard  | 3% Compression                                           | 11    |
| compressive stress at break                                | $\sigma_{mb}$       | MPa                 | DIN EN ISO 604     | 5mm/min; 10 x 10 x 4 mm                                  | k.Br. |
| elastic compression limit                                  | $\varepsilon_{yel}$ | %                   | Werknorm           | 5mm/min; 10 x 10 x 4 mm                                  | 4,8   |
| nominal compressive yield strain                           | $\varepsilon_{cy}$  | %                   | DIN EN ISO 604     | 5mm/min; 10 x 10 x 4 mm                                  | 20    |
| nominal compressive strain at compressive strength         | $\varepsilon_{cm}$  | %                   | DIN EN ISO 604     | 5mm/min; 10 x 10 x 4 mm                                  | 20    |
| nominal compressive strain at break                        | $\varepsilon_{cb}$  | %                   | DIN EN ISO 604     | 5mm/min; 10 x 10 x 4 mm                                  | k.Br. |
| modulus in tension (tensile modulus)                       | $E_t$               | MPa                 | DIN EN ISO 527     | 1mm/min; Specimen 1A                                     | 1550  |
| elastic limit                                              | $\sigma_{yel}$      | MPa                 | internal Standard  | 5mm/min; Specimen 1A                                     | 37,47 |
| tensile stress at yield                                    | $\sigma_y$          | MPa                 | DIN EN ISO 527     | 5mm/min; Specimen 1A                                     | 65    |
| tensile strength                                           | $\sigma_m$          | MPa                 | DIN EN ISO 527     | 5mm/min; Specimen 1A                                     | 65    |
| tensile stress at break                                    | $\sigma_b$          | MPa                 | DIN EN ISO 527     | 5mm/min; Specimen 1A                                     | 53    |
| elastic yield point                                        | $\varepsilon_{yel}$ | %                   | internal Standard  | 5mm/min; Specimen 1A                                     | 3,3   |
| yield strain                                               | $\varepsilon_y$     | %                   | DIN EN ISO 527     | 5mm/min; Specimen 1A                                     | 21    |
| elongation at maximum force                                | $\varepsilon_m$     | %                   | DIN EN ISO 527     | 5mm/min; Specimen 1A                                     | 21    |
| tensile elongation at break                                | $\varepsilon_b$     | %                   | DIN EN ISO 527     | 5mm/min; Specimen 1A                                     | 200   |
| modulus in flexure                                         | $E_f$               | MPa                 | DIN EN ISO 178     | 2mm/min; 64 mm span                                      | 1400  |
| outer fibre stress at 3,5% outer fibre strain              | $\sigma_{f3,5\%}$   | MPa                 | DIN EN ISO 178     | 2mm/min; 64 mm span                                      | 52    |
| flexural strength                                          | $\sigma_{fm}$       | MPa                 | DIN EN ISO 178     | 2mm/min; 64 mm span                                      | 65    |
| flexural stress at break                                   | $\sigma_{fb}$       | MPa                 | DIN EN ISO 178     | 2mm/min; 64 mm span                                      | k.Br. |
| elongation at flexural yield stress                        | $\varepsilon_{f,m}$ | %                   | DIN EN ISO 178     | 2mm/min; 64 mm span                                      | 7,5   |
| flexural elongation at break                               | $\varepsilon_{fb}$  | %                   | DIN EN ISO 178     | 2mm/min; 64 mm span                                      | k.Br. |
| creep modulus at 1% deformation after 1000h                | $E$                 | N/mm <sup>2</sup>   | DIN 53444          | -                                                        | -     |
| stress at 1% deformation after 1000h                       | $\sigma_{1\%}$      | N/mm <sup>2</sup>   | DIN 53444          | -                                                        | -     |
| creep resistance                                           | -                   | -                   | relative value     | -                                                        | -     |
| ball indentation hardness H358/30 (H132/30) [H49/30]       | HB                  | N/mm <sup>2</sup>   | DIN 2039           | Specimen Ø30 x 4 mm                                      | 88    |
| Shore A hardness                                           | -                   | Shore               | DIN 53505          | Ø30 x 6 mm                                               | -     |
| Shore D hardness                                           | -                   | Shore               | DIN 53505          | Ø30 x 3 mm                                               | 74    |
| impact strength Charpy not notched                         | -                   | kJ/m <sup>2</sup>   | EN ISO 179/1eU     | Span 64mm, Standard test specimen                        | -     |
| impact strength Charpy notched                             | -                   | kJ/m <sup>2</sup>   | EN ISO 179/1eA     | Span 64mm, Standard test specimen                        | 8     |
| loss tangent (1Hz)                                         | $\tan\delta$        | 1                   | internal Standard  | -                                                        | -     |
| fatigue strength at 20°C, 106 stress cycles, 1 Hz          | -                   | MPa                 | internal Standard  | -                                                        | -     |
| Poisson's ratio, 20°C                                      | $\nu$               | -                   | internal Standard  | -                                                        | 0,37  |
| thermal                                                    |                     |                     |                    |                                                          |       |
| max. continuous operating temperature stationary           | DGMX                | °C                  | RTI Index          | -                                                        | 140   |
| max. short-term op. temp. transient (3h)                   | KGMX                | °C                  | experience value   | -                                                        | 175   |
| min. Continuous operating temperature stationary           | DGMIN               | °C                  | ASTM D746 ISO 974  | Brittleness Temperature                                  | -40   |
| min. short-term op. temp. transient                        | KGMIN               | °C                  | internal Standard  | -                                                        | -     |
| max. continuous operating temp. for bushings when pressed  | -                   | °C                  | internal Standard  | -                                                        | -     |
| melting temperature                                        | $T_m$               | °C                  | DIN EN ISO 11357-1 | -                                                        | 221   |
| glass transition temperature                               | $T_g$               | °C                  | DIN EN ISO 11357-1 | -                                                        | -     |
| coefficient of thermal expansion up to 100°C, longitudinal | $\alpha$            | 10 <sup>-5</sup> /K | ISO E 830          | Heating rate 3°C/min, Static force 110mN                 | 10    |
| coefficient of thermal expansion up to 150°C, longitudinal | $\alpha$            | 10 <sup>-5</sup> /K | ISO E 831          | Heating rate 3°C/min, Static force 110mN                 | -     |
| Heat distortion temperature HDT/A 1,8 Mpa                  | HDT(A)              | °C                  | DIN EN ISO 75      | Heating rate 120°C/hour, span 65mm, specimen 80 x 10 x 4 | 93    |
| Heat distortion temperature HDT/B 0,45 Mpa                 | HDT(B)              | °C                  | DIN EN ISO 75      | Heating rate 120°C/hour span 65mm                        | 190   |
| thermal conductivity                                       | $\lambda$           | W/(m·K)             | DIN 52612          | specimen Ø6 x 10 mm                                      | 0,26  |
| specific heat capacity                                     | $c_p$               | kJ/(kg·K)           | DSC                | -                                                        | -     |
| fire behavior (3.2mm) UL94                                 | -                   | -                   | UL 94 HB           | -                                                        | HB    |
| limiting oxygen index                                      | %                   | LOI                 | DIN EN ISO 4589    | -                                                        | 21    |

| Properties                                             | Symbol   Unit      |               | Standard                                                             | Parameters                                                                                                                              | Value    |
|--------------------------------------------------------|--------------------|---------------|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|----------|
| electrical                                             |                    |               |                                                                      |                                                                                                                                         |          |
| volume resistivity                                     | R <sub>b</sub>     | Ω*cm          | IEC 60093                                                            | -                                                                                                                                       | 1,00E+15 |
| surface resistance                                     | R <sub>s</sub>     | Ω             | IEC 60093                                                            | -                                                                                                                                       | 1,00E+18 |
| penetration resistance                                 | E                  | kV/mm         | IEC 243                                                              | -                                                                                                                                       | -        |
| tracking resistance                                    | -                  | V             | IEC 112                                                              | -                                                                                                                                       | -        |
| dielectric constant (110Hz)                            | -                  | 1             | IEC 250                                                              | -                                                                                                                                       | -        |
| dissipation factor (110Hz)                             | tanδ               | 1             | IEC 112                                                              | -                                                                                                                                       | -        |
| pv values                                              |                    |               |                                                                      |                                                                                                                                         |          |
| max. surface pressure v=1m/min                         | p <sub>rel</sub>   | N/mm²         | Factory standard<br>Plain bearing<br>radial                          | Translation;<br>intermediate<br>medium air;<br>specimen Ø16 /<br>12 x 9mm;<br>Counter-Body:<br>X5CrNi189                                | 11,75    |
| max. surface pressure v=10m/min                        | p <sub>rel</sub>   | N/mm²         |                                                                      |                                                                                                                                         | 2,1      |
| max. surface pressure v=100m/min                       | p <sub>rel</sub>   | N/mm²         |                                                                      |                                                                                                                                         | 0,03     |
| max. surface pressure v=200m/min                       | p <sub>rel</sub>   | N/mm²         |                                                                      |                                                                                                                                         | -        |
| evolution of heat with v=1m/min                        | -                  | °C            |                                                                      |                                                                                                                                         | -        |
| evolution of heat with v=10m/min                       | -                  | °C            |                                                                      |                                                                                                                                         | -        |
| evolution of heat with v=100m/min                      | -                  | °C            |                                                                      |                                                                                                                                         | 40       |
| evolution of heat with v=200m/min                      | -                  | °C            |                                                                      |                                                                                                                                         | 48       |
| friction                                               |                    |               |                                                                      |                                                                                                                                         |          |
| μ static 20° C dry operation                           | μ <sub>stat.</sub> | 1             | Factory standard<br>inclined<br>plane                                | Factory standard<br>inclined plane<br>counter-body:<br>X5CrNi189; hard<br>chrome plated;<br>Rz 2μm; surface<br>pressure: 0.3-<br>4,7MPa | 0,178    |
| μ dynamic 20° C dry operation                          | μ <sub>dyn.</sub>  | 1             |                                                                      |                                                                                                                                         | 0,132    |
| μ dynamic 100° C dry operation                         | μ <sub>dyn.</sub>  | 1             |                                                                      |                                                                                                                                         | 0,09     |
| wear                                                   |                    |               |                                                                      |                                                                                                                                         |          |
| wear factor at 20°C                                    | -                  | mm³/100km     | Factory standard<br>periodic transla-<br>tory movement<br>under load | Translational;                                                                                                                          | -        |
| wear factor at 100°C                                   | -                  | mm³/100km     |                                                                      | Sliding speed:                                                                                                                          | -        |
| wear factor at 200°C                                   | -                  | mm³/100km     |                                                                      | 10.3 m/min;                                                                                                                             | -        |
| wear factor at 240°C                                   | -                  | mm³/100km     |                                                                      | Surface pressure:                                                                                                                       | -        |
| wear coefficient stationary                            | K                  | mm³/Nm        |                                                                      | 0.3 MPa;<br>Counter-Body:<br>X5CrNi189                                                                                                  | -        |
| available                                              |                    |               |                                                                      |                                                                                                                                         |          |
| tubes                                                  | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |
| sheets                                                 | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |
| rods                                                   | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |
| granules                                               | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |
| injection moulded parts                                | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |
| machined parts                                         | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |
| Welding rod                                            | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |
| filaments                                              | -                  | -             | -                                                                    | 1,75mm                                                                                                                                  | ✓        |
| precision                                              |                    |               |                                                                      |                                                                                                                                         |          |
| dimensional stability with moisture absorption         | -                  | -             | relative value                                                       | -                                                                                                                                       | Ⓢ        |
| water absorption 23°C / RMC 93%                        | -                  | %             | DIN EN ISO 62                                                        | -                                                                                                                                       | 0,5      |
| water absorption until an equilibrium moisture content | -                  | %             | DIN EN ISO 62                                                        | -                                                                                                                                       | 2,1      |
| dimensional stability with temperature variation       | -                  | -             | relative value                                                       | -                                                                                                                                       | Ⓢ        |
| high precision bushings (negative clearance)           | -                  | -             | -                                                                    | -                                                                                                                                       | -        |
| Alignment adjustment                                   | -                  | -             | relative value                                                       | -                                                                                                                                       | Ⓢ        |
| environmental influences                               |                    |               |                                                                      |                                                                                                                                         |          |
| suitable for use in water                              | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |
| resistance against hot water                           | -                  | °C            | -                                                                    | -                                                                                                                                       | 110      |
| resistance against dust, dirt, abrasive substances     | -                  | -             | relative value                                                       | -                                                                                                                                       | Ⓢ        |
| UV rays resistance                                     | -                  | -             | relative value                                                       | -                                                                                                                                       | -        |
| suitable for outdoor use                               | -                  | -             | relative value                                                       | -                                                                                                                                       | -        |
| resistance to chemicals                                | -                  | -             | relative value                                                       | -                                                                                                                                       | Ⓢ        |
| suitable for vacuum                                    | -                  | -             | -                                                                    | -                                                                                                                                       | -        |
| rate of desorption                                     | a <sub>10</sub>    | mbar¹/(s/cm²) | -                                                                    | -                                                                                                                                       | -        |
| sterilization                                          |                    |               |                                                                      |                                                                                                                                         |          |
| resistant against disinfectant                         | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |
| moist heat sterilization                               | -                  | -             | relative value                                                       | -                                                                                                                                       | -        |
| gamma-rays radiation sterilization                     | -                  | -             | relative value                                                       | -                                                                                                                                       | -        |
| chemical sterilization                                 | -                  | -             | relative value                                                       | -                                                                                                                                       | -        |
| UV-sterilization                                       | -                  | -             | relative value                                                       | -                                                                                                                                       | -        |
| adhesiveness/weldability                               |                    |               |                                                                      |                                                                                                                                         |          |
| glueable                                               | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |
| weldable                                               | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |
| wetting inhibiting substances                          |                    |               |                                                                      |                                                                                                                                         |          |
| Silicone-free                                          | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |
| PTFE-free                                              | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |
| conformities                                           |                    |               |                                                                      |                                                                                                                                         |          |
| ROHS / WEEE                                            | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |
| REACH                                                  | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |
| EU Nr. 10/2011                                         | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |
| FDA                                                    | -                  | -             | -                                                                    | -                                                                                                                                       | ✓        |

| Legend           |                   |
|------------------|-------------------|
| Ⓢ low            | k.Br. no break    |
| Ⓢ high           | n.d. not feasible |
| ✓ applicable     | - not determined  |
| ✗ not applicable | n.x. non-existent |
| Ⓢ limited        |                   |

Legal information  
All tests were carried out in a normal climate (23°C) (unless a different temperature is specified). The values given were determined from many individual measurements as average values and correspond to the state of our current knowledge. They serve only as information about our products and are intended as an aid to material selection. They do not constitute a legally binding guarantee of specific properties or suitability for specific applications. The tests were carried out on specimens of extruded semi-finished products. Since the properties of the plastics depend on the

processing (extrusion, injection molding) and also on the dimensions of the semi-finished products and the degree of crystallization, the actual property values of a particular product may deviate somewhat from the specifications. We will be pleased to provide you with information on deviating properties. For the design of constructions and the definition of material specifications, we will be pleased to provide you with the data applicable to your application upon request. Notwithstanding the above, the customer bears sole responsibility for thoroughly testing the suitability, performance, efficacy and safety of selected products in pharmaceutical, medical device or other end-use applications.

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