

Material Data Sheet: Z-PCABS

| Physical Properties | Metric | English | Comments |
|---------------------------|-------------------------------|-----------------------------------|---|
| Specific Gravity | 1.14 g/cm ³ | 9.514 lbs/gal | ASTM D792 |
| Density | 1.14 g/cm ³ | 9.514 lbs/gal | ISO 1183 |
| Moisture Absorption | 0.1% | 0.1% | 23°C / sat ISO 62 |
| Water Absorption | 0.1% | 0.1% | 23°C / 50% RH ISO 62 |
| Mold Shrinkage, flow | 0.5 – 0.7 % | 0.5 – 0.7 % | 3,2mm (0.125 inch) [5] SABIC Method |
| Melt Flow Rate | 8.5 g/10 min | 0.0187 lbs/10 min | ASTM D1238 |
| Mechanical Properties | Metric | English | Comments |
| Tensile Strength at Yield | 58 MPa Thickness 3.20 mm | 8200 psi Thickness 0.126 in | 50mm/min (2 inch/min); ASTM D638 |
| Tensile Strength at Break | 57 MPa Thickness 3.20 mm | 8100 psi Thickness 0.126 in | 50mm/min (2 inch/min); ASTM D638 |
| Tensile modulus | 2.21 GPa | 320 ksi psi | 1mm/min ASTM D790 |
| Elongation at Yield | 4.9 % | 4.9 % | 50mm/min (2 inch/min); ASTM D638 |
| Elongation at Break | 125 % Thickness 3.20 mm | 152 % Thickness 0.126 in | 50mm/min (2 inch/min); ASTM D638 |
| Flexural Strength | 86 MPa Thickness 3.20 mm | 12470 psi Thickness 0.126 in | 1.27mm/min (0.05 inch/min); ASTM D790 |
| Flexural Modulus | 2.39 GPa Thickness 3.20 mm | 347 ksi psi Thickness 0.126 in | 1.27mm/min (0.05 inch/min); ASTM D790 |
| Tensile Strength at Yield | 50 MPa Thickness 3.20 mm | 7250 psi Thickness 0.126 in | 50mm/min (2 inch/min); ISO 527 |
| Tensile Strength at Break | 45 MPa Thickness 3.20 mm | 6525 psi Thickness 0.126 in | 50mm/min (2 inch/min); ISO 527 |
| Tensile modulus | 2.25 GPa | 326 ksi | 1mm/min ISO 527 |
| Elongation at Yield | 4 % | 4 % | 50mm/min (2 inch/min); ISO 527 |
| Elongation at Break | >50 % Thickness 3.20 mm | >50 % Thickness 0.126 in | 50mm/min (2 inch/min); ISO 527 |

| Flexural Strength | 85 MPa Thickness 3.20 mm | 12325 psi Thickness 0.126 in | 1.27mm/min (0.05 inch/min); ISO 178 |
|-------------------------------|---|--|---|
| Flexural Modulus | 2.3 GPa Thickness 3.20 mm | 334 ksi Thickness 0.126 in | 1.27mm/min (0.05 inch/min); ISO 178 |
| Rockwell Hardness | 108 | 108 | ASTM D785 |
| Izod Impact, Notched | 54 J/cm Thickness 3.20 mm, Temperature -30.0 °C | 9.9 ft-lb/in Thickness 0.126 in, Temperature -22 °F | ASTM D256 |
| | 66 J/cm Thickness 3.20 mm, Temperature 23.0 °C | 12.1 ft-lb/in Thickness 0.126 in, Temperature 73.4 °F | ASTM D256 |
| | 35 kJ/m ² 80x10x3 mm, Temperature -30.0 °C | 6.4 ft-lb/in ² 80x10x3 mm, Temperature -30.0 °C | ISO 180/1A |
| | 50 kJ/m ² 80x10x3 mm, Temperature 23.0 °C | 9.3 ft-lb/in ² 80x10x3 mm, Temperature 23.0 °C | ISO 180/1A |
| Thermal Properties | Metric | English | Comments |
| Melting Point | 225 °C | 437 °F | ASTM D3418 |
| | 118 °C | 244 °F | B/50 ASTM D1525 |
| Vicat Softening Temperature | 118 °C | 244 °F | B/50 ISO 306 |
| | 122 °C | 252 °F | B/120 ISO 306 |
| Heat Distortion Temperature | 107 °C | 225 °F | 1.82 MPa, 3.2 mm unannealed ASTM D648 |
| | 124 °C | 255 °F | 0.45 MPa, 3.2 mm unannealed ASTM D648 |
| | 120 °C | 248 °F | 1.8 MPa, 80x10x4 sp = 64 mm ISO 75/Af |
| Thermal Expansion Coefficient | 7.2E-05 1/°C | 4.E-05 1/°F | -40°C to 40°C, flow ISO 11359-2 |
| | | | -40°C to 100°F, flow ASTM E831 |

The information presented are typical values intended for reference and comparison purposes only. They should not be used for design specifications or quality control purposes. Final properties of the material can be impacted (+/-) by part design, end-use conditions, test conditions, etc. Actual values will vary with build conditions. Product specifications are subject to change without notice.

The performance characteristics of these materials may vary according to application, operating conditions, or enduse. Each user is responsible for determining that the Zortrax material is safe, lawful and technically suitable for the intended application, as well as for identifying the proper disposal (or recycling) method consistent with applicable environmental laws and regulations. Zortrax makes no warranties of any kind, express or implied including but not limited to the warranties of merchantability, fitness for a particular use.

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Entered in the Register of Entrepreneurs of the National Court Register kept by the District Court in Olsztyn, VIII Commercial Division of the National Court Register, under KRS number 0000564079, with a share capital of PLN 6 962 500 paid in full.

Material Safety Data Sheet: Z-PCABS

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Supplier:

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In order:

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Material name: **PCABS (Polycarbonate-Acrylonitrile/Butadiene/Styrene polymer blend)**

Chemical type: **Thermoplastics**

Material trade name: : **Z-PCABS**

2. HAZARDS IDENTIFICATION

a. Threshold Limit - Not established**b. Effect of overexposure:**

- » Eye contact - Solid may cause irritation or corneal injury due to mechanical action
- » Skin Contact - Essentially non irritating to skin, mechanical injury only
- » Skin Absorption - Unlikely due to physical properties
- » Ingestion - Unlikely due to physical state
- » Inhalation - In case of breathing in small and non-ventilated room, fumes released from heated material may cause respiratory irritation
- » Chronic Effects - Not Available
- » Mutagenicity - Not Available

3. COMPOSITION / INFORMATION ON INGREDIENTS

- a. **ABS (Acrylonitrile-Butadiene-Styrene) - 55~65% CAS:9003-56-9**
- b. **PC (Polycarbonate) - 30~35% CAS: 111211-39-3**
- c. **Typical Stabilizer - 0~5%**
- d. **Typical lubricants - 0~2%**
- e. **Mineral oil - 0~4% CAS:8042-47-5**
- f. **Tallow - 0~4% CAS:67701-27-3**
- g. **Wax - 0~4% CAS:110-30-5**
- h. **Anti Oxydant - < 2%**

4. FIRST AID MEASURES

- a. Eye contact - Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor. Remove contact lenses, if present and easy to do.
- b. Skin contact - Essentially nonirritating to skin but rinse with copious water and soap . If skin irritation continues, consult a doctor. After contact with the molten product, cool rapidly with cold water. Do not pull solidified product away from the skin. Call a doctor immediately.
- c. Ingestion - Rinse out mouth and then drink plenty of water. Do not induce vomiting! If symptoms persist consult a doctor.
- d. Inhalation - In case of breathing, fumes released from heated material may cause respiratory irritation. In case of inhaling dense smoke, immediately remove a person to fresh air. If necessary, apply artificial respiration and seek medical attention immediately.
- e. Mutagenicity - Not Available.

5. FIRE FIGHTING MEASURES

- a. Flammable Properties
 - » Airborne dust may form flammable or explosive mixture with air
 - » Flash point - Not applicable
 - » Auto ignition Temperature - 500 - 580°C
- b. Extinguishing Media - Dry chemical, carbon dioxide, water spray and foam or water fog
- c. Special Fire Fighting Procedure - Keep people away. Isolate fire area and de unnecessary entry. Cool surroundings with water to localize fire zone. Soak thoroughly with water to cool and prevent re-ignition.
- d. Usual Fire and Explosion Hazards - Irritating gases and dense smoke
- e. Firefighting equipment - Protective firefighting clothing (including firefighting helmet, coat, pants, boots, and gloves), positive-pressure self-contained breathing apparatus (SCBA)

6. ACCIDENTAL RELEASE MEASURES

- a. Avoid formation of dust
- b. Do not breathe dust
- c. Keep away from ignition sources
- d. Avoid contact with eyes
- e. Danger of slipping on leaked/spilled product
- f. Environmental precautions - Do not allow to enter sewers/ surface or ground water
- g. Methods and material for containment and cleaning up - Allow to solidify. Pick up mechanically

7. HANDLING AND STORAGE

- a. Handling
 - » Avoid formation of dust
 - » Keep spools closed in dry container
 - » Avoid spools from getting wet
- b. Storage
 - » Keep spools in a dry and ventilated place » Avoid spools from getting wet

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

- a. Engineering Controls - General ventilation should be sufficient for most conditions. Local exhaust ventilation may be necessary for some operations
- b. Personal Protective Equipment:
 - » Eye / Face Protection - Use safety glasses. If there is a potential for exposure to particles which could cause mechanical injury to the eye
 - » Skin Protection - No Precautions other than clean body-covering clothing should be needed
 - » Respiratory Protection - For most conditions, no respiratory protection should be needed, however, if handling at elevated temperatures without sufficient ventilation, use an approved air-purifying respirator.
- c. Exposure Guideline - Although some of the additives used in this product may have exposure guidelines, these additives are encapsulated in the product and no exposure would be expected under normal handling conditions

9. PHYSICAL AND CHEMICAL PROPERTIES

- a. Appearance - Solid
- b. Odor - minimal
- c. Odor threshold - No data available
- d. pH - Not applicable
- e. Boiling Point - Not applicable
- f. Melting point - Not applicable
- g. Flash point - Not determined
- h. Flammability (solid, gaseous) - Combustible at constant flame of fire
- i. Ignition temperature - Not determined
- j. Decomposition temperature - Not determined
- k. Auto ignition temperature: 500 - 580°C
- l. Danger of explosion - Not determined
- m. Oxidizing properties - Not determined

- n. Vapor pressure - Negligible
- o. Density: > 1g/cm³ (> 8.345 lbs/gal)
- p. Evaporation rate - Negligible
- q. Solubility - Insoluble
- r. Miscibility - Insoluble
- s. Viscosity (dynamic/kinematic) - Not applicable

10. STABILITY AND REACTIVITY

- a. **Stability - Stable under normal condition**
- b. **Chemical stability**
- c. **Thermal decomposition / conditions to be avoided:**
 - » Avoid impact friction
 - » Avoid impact heat
 - » Avoid impact sparks
 - » Avoid impact electrostatic charges
- d. **Conditions to avoid - No further relevant information available**
- e. **Incompatible materials - Strong oxidizing agents**
- f. **Hazardous decomposition products:**
 - » Irritant gases/vapors
 - » Poisonous gases/vapors
 - » Smoke
 - » Carbon monoxide and carbon dioxide
 - » Hydrocarbons
 - » Hydrogen cyanide (prussic acid)
 - » Styrene
 - » Aldehyde
 - » Phenol
 - » Acrylonitrile
 - » Nitrogen oxides (NO_x)

11. TOXICOLOGICAL INFORMATION

- a. **LD/LC50 values that are relevant for classification:**
 - » Oral LD50 > 5000 mg/kg (rat)
 - » Dermal LD50 > 2000 mg/kg (rabbit)
- b. **Primary irritant effect:**
 - » On the skin: Dust particles may mechanically irritate the skin
 - » On the eye: Dust particles may mechanically irritate the eye
- c. **Sensitization - No sensitizing effects known**
- d. **Subacute to chronic toxicity - No data available**
- e. **Additional toxicological information - When used and handled according to specifications, the product does not have any harmful effects according to our experience and the information provided to us**
- f. **Carcinogenic categories:**
 - » IARC (International Agency for Research on Cancer) - None of the ingredients is listed
 - » NTP (National Toxicology Program) - None of the ingredients is listed

12. ECOLOGICAL INFORMATION

- a. **Environmental Fate:**
 - » Movement & Partitioning - No bioconcentration is expected because of the high molecular weight (MW> 1000). In the terrestrial environment, material is expected to remain in the soil. In the aquatic environment, material will sink and remain in the sediment
 - » Degradation & Persistence - This water insoluble polymeric solid is expected to be inert in the environment. Surface degradation is expected with exposure to sunlight. No appreciable biodegradation is expected
- b. **Ecotoxicity - Not Expected to be acutely toxic, but pellets, if ingested by waterfowl or aquatic life, may mechanically cause adverse effects**

13. DISPOSAL CONSIDERATIONS

- a. **Disposal : Do not dump into any sewers, on the ground, or into any body of water.**
All disposal methods must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with appliance laws are the responsibility solely of the waste generator.
- b. **For unused & uncontaminated product, the preferred options include sending to a licensed, permitted:**
 - » Recycler
 - » Reclaim
 - » Incinerator or other thermal destruction device

14. TRANSPORT INFORMATION

- a. UN-Number:
 - » DOT, ADR, IMDG, IATA – Not applicable
- b. UN proper shipping name:
 - » DOT, ADR, IMDG, IATA – Not applicable
- c. Transport hazard class:
 - » DOT, ADR, IMDG, IATA - Not applicable
- d. Environmental hazards - Not applicable
- e. Special precautions for user - Not applicable
- f. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code - Not applicable
- g. Transport/Additional information - Not dangerous according to the above specifications

15. REGULATORY INFORMATION:

- a. Safety, health and environmental regulations/legislation specific for the substance or mixture US EPA TSCA:
 - » CERCLA Section 103 (40CFR302.4) - Not Listed
 - » SARA Section 311/312 (40CFR370.21) - Not listed
 - » SARA Section 313 (40CFR372.65) - Not listed
 - » SARA Section 355 (extremely hazardous substances) - 107-13-1 Acrylonitrile
 - » TSCA (Toxic Substances Control Act):
 - 9003-56-9 Acrylonitrile/butadiene/styrene copolymer
 - 100-42-5 Styrene
 - 107-13-1 Acrylonitrile
 - » STATE REGULATIONS (California Proposition 65) - Not listed
- b. European regulations:
 - » EC NUMBER - Not assigned
 - » Directive 96/82/EC - does not apply
- c. Cancerogenicity categories:
 - » MAK (German Maximum Workplace Concentration) - 100-42-5 Styrene
- d. Product resp. its monomers are listed in:
 - » Toxic Substance Control Act TSCA (USA)
 - » Canadian Domestic Substance List DSL
 - » Existing and New Chemical Substance List ENCS (Japan)
 - » Korean Existing Chemicals List KECL
 - » Australian Inventory of Chemical Substances AICS (Australia)
- e. Chemical safety assessment - A Chemical Safety Assessment has not been carried out

16. OTHER INFORMATION:

Product should be handled, stored, and used in accordance with the generally accepted industrial hygiene practices and in conformity with all the applicable legal regulations.

The information provided herein is based on the knowledge possessed at this present time from the view point of safety requirements. It should, therefore, not be construed as guaranteeing specific properties.

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