

Material Data Sheet

TEPEX[®] *dynalite* 208-C200(x)/45% Carbon - TPU Consolidated Composite Laminate

| Property | | Method ISO | Units | Orientation | |
|----------------------------|-------------------------------------|--|--|--|----------------------------|
| | | | | Longitudinal | Transverse |
| Material | Reinforcement | Fibres Fabric Area weight Yarn Weight rate | g/m ² tex % | carbon twill 2/2 200 | |
| | Polymer | Polymer | | TPU | |
| | Laminate | Density Fibre content Thickness per layer | g/cm ³ % vol. mm | 1,47 45 0,25 | |
| Mechanical | Tensile | Modulus Strength Elongation Poisson's ratio | 527-4/5 527-4/5 527-4/5 527-4/5 | GPa MPa % | 48,5 710 1,5 - |
| | Flexural | Modulus Ultimate stress* | 178 178 | GPa MPa | 42,5 745 41,5 735 |
| | Charpy impact strength unnotched | 23°C -30°C | 179/1eU | kJ/m ² kJ/m ² | - - - |
| Thermal | Melting Temperature | per DSC | 3146 | °C | 190 |
| | Glass transition temperature | per DSC | 3146 | °C | - |
| | Heat deflection temperature | 1,80 MPa | 75-1/2 | °C | 185 |
| | Coefficient of thermal expansion | -30°C to 23°C 23°C to 80°C | ASTM E831 | E-6 1/K | - - |
| Relative temperature index | 20.000 h | IEC 216/1 | °C | 90 | - |

* 3-Point loading, span-to-depth ratio 16 to 1

These values are for this specific composition only, the characteristics of composites depend on the reinforcement level and the fibre orientation. Non-standard thickness may also alter some or all of these properties. The data listed here fall within the normal range of product properties, but they should not be used to establish specification limits nor used alone as basis of design.

This information corresponds to our current knowledge on subject. It is offered solely to provide possible suggestions for your own experimentations. It is not intended, however, to substitute for any testing you may need to conduct to determine for yourself the suitability of our products for your particular purposes. This information may be subject to revision as new knowledge and experience becomes available. Since we cannot anticipate all variations in actual end-use conditions. Bond-Laminates makes no warranties and assumes no liability in connection with any use of this information. Nothing in this publication is to be considered as a licence to operate under or a recommendation to infringe any patent right.

Caution: Do not use this product in medical applications involving permanent implantation in human body.

Processing guidelines for TEPEX[®] Carbon - TPU

1. Storage/handling

Storage time: unlimited

As the matrix material is sensitive to surface moisture the sheets will be delivered in sealed packages. In order to prevent moisture condensation on the cold sheet surface the sealed packages should be stored in the working area until a temperature equilibrium is reached. The material should be processed within 2 hours after opening of the sealing. Otherwise the material should be dried prior to processing (4 hours, 90°C). The use of dust masks and ventilation whilst cutting, milling, drilling etc. is advised. When processing carbon it is highly recommended to have carbon proof electrical cabinets to avoid electrical short cuts.

2. Heating

Forming temperature: between 210°C and 230°C

Forming temperature depends on the polymer to be used. In general the TEPEX[®] sheet should be heated ca. 20°C - 40°C above the melting temperature of the polymer. Heating cycles should be short to avoid polymer oxidation (surface colour browning). The preferred heating method is middle wavelength IR-heating. Best results are obtained when heating power is controlled as a function of the sheet temperature. Two sided heating should be applied starting from a material thickness of 1,0 mm. Contact heating is feasible but a release film should be applied. This release film will have to be moulded with the material to prevent distortion of the fabric during peeling of the release film in molten laminate status. Heating in a convection oven leads to excessive oxidation of the surface due to the length of the heat cycle and is therefore not recommended.

3. Sheet transfer

Sheet transportation: max. 2-3 sec.

The sheet should be transferred within seconds.

Circulation of cool air in the processing environment reduces the sheet temperature considerably and will lead to a reduction of fabric formability and wrinkles. Manual transfer is not recommended as it causes fabric distortion and polymer distribution caused by the sticky resin to gloves. For obtaining maximum processing stability an automatic transport of the sheet is recommended.

4. Press forming

Press speed: > 50 mm/s (1st step)

Closing speed: 5 mm/s (2nd step)

The recommended closing speed of the press is at least 50 mm/s and should be reduced to approx. 5 mm/s during the last part (10 mm) of the forming. Local clamping forces should be applied to prevent fabric wrinkling during moulding. The clamping forces and arrangements depend on the fabric type, the material thickness and the complexity of the part.

5. Cooling

Consolidation pressure: 5 bar - 100 bar

Extraction temperature: ≤ 110°C

The consolidation pressure varies over the surface of a formed part, depending on part geometry and tool material. The tool temperature should both guarantee good formability/flow and stable product extraction. Aluminium and steel can be used from 90°C up to 110°C; product extraction is then possible without any additional cooling cycle. The consolidation time depends on the material thickness, the tool temperature and the tool materials. Recommended for a laminate thickness of 2,0 mm and the aforementioned conditions is a cooling time of about 30 seconds.

When and where to apply TEPEX[®] Carbon - TPU

1. General description

Within the TEPEX[®] composite laminate, TPU distinguishes itself from alternative resin system by its specific physical properties. The TPU resin is tough which results in an excellent impact and fatigue behaviour and is applicable from -30°C up to 90°C constantly. In addition the TPU-Carbon laminate is easy to mould, obtaining an excellent surface quality.

The TPU-Carbon laminates can easily be bonded with common adhesive systems. An excellent adhesion is achieved when over moulding with injection moulding TPU grades

2. Application Areas

Typical application environments are sporting goods applications, helmet shells, cosmetic applications, footwear.