



HUNTSMAN

Enriching lives through innovation

Delivering peace of mind

TPU films for Safety
Glazing applications

Experts in elastomers

Our polyurethanes business division is a leading developer of polyurethane (PU) and thermoplastic polyurethane (TPU) materials. Combining global reach with decades of experience in material innovation, we are experts in urethane-based elastomers and have in-depth knowledge of their application across a vast range of industries.

A reliable partner for safety glazing producers

We are the developer and manufacturer of KRYSTALFLEX® TPU films, based on aliphatic elastomers, which are well known for their performance in safety glazing applications. Helping to set the standard for interlayer laminating films, our KRYSTALFLEX® TPU films are trusted to create impact resistant laminated glass that is tough enough for use in extreme environments.

Typical applications:

- Aerospace
- High-speed rail
- Military vehicles
- Antiballistic glazing
- Building security.

Film properties:

- Low temperature impact resistance
- Excellent adhesion to glass, polycarbonate (PC) and polymethylmethacrylate (PMMA)
- Moisture resistance
- Low lamination temperature compatible with PMMA
- Lamination possible, even with complex surfaces with double degree of curvature.

Our KRYSTALFLEX® TPU films are available in a variety of thicknesses (0.38 to 1.27 mm) and roll widths (0.6 to 2.0 m) - meaning we can find a solution to best suit your glazing application. We also offer a range of KRYSTALFLEX® PE 900 TPU edge seals available in widths ranging from 10 to 140 mm.



Infinite scope for innovation

KRYSTALFLEX® TPU films: Key products

| TYPICAL PROPERTIES | | | BASE PRODUCTS | | SPECIALTY PRODUCTS | | | |
|-------------------------------------|-------------------|-------------|--------------------|--------------------|--------------------|--------------------|--------------------|-----|
| | Unit | Test method | KRYSTALFLEX PE 399 | KRYSTALFLEX PE 499 | KRYSTALFLEX PE 429 | KRYSTALFLEX PE 501 | KRYSTALFLEX PE 505 | |
| GENERAL | | | | | | | | |
| Hardness | Shore A | ASTM D 2240 | 75 | 60 | 61 | 94 | 90 | |
| Hardness | Shore D | ASTM D 2240 | 34 | 15 | 18 | 53 | 40 | |
| Specific gravity | g/cm ³ | ASTM D 792 | 1.07 | 1.04 | 1.05 | 1.10 | 1.07 | |
| MECHANICAL | | | | | | | | |
| Tensile strength | psi | ASTM D 412 | 5800 | 2170 | 3780 | 7670 | 6380 | |
| Elongation @ break | % | ASTM D 412 | 420 | 680 | 600 | 380 | 360 | |
| Tensile stress @ 100% elongation | psi | ASTM D 412 | 550 | 310 | 450 | 1280 | 1080 | |
| Tensile stress @ 300% elongation | psi | ASTM D 412 | 2100 | 540 | 1010 | 4380 | 3620 | |
| Tear strength | pli | ASTM D 624 | 230 | 230 | 290 | 440 | 350 | |
| Flexural Modulus @ 23°C | psi | ASTM D 790 | 796 | 572 | 600 | 2290 | 2400 | |
| Flexural Modulus @ -29°C | psi | ASTM D 790 | 50355 | 889 | 2480 | 165810 | 105160 | |
| PEEL RESISTANCE TO GLASS | | | | | | | | |
| Lamination temperature | 85°C (185°F) | pli | ASTM D 3167 | 82 | 66 | 81 | n/a | n/a |
| | 91°C (195°F) | | | 90 | 105 | 138 | 53 | 39 |
| | 99°C (210°F) | | | 110 | 130 | 150 | 125 | 110 |
| | 113°C (235°F) | | | 140 | 140 | n/a | 146 | 145 |
| | 118°C (245°F) | | | 140 | n/a | n/a | 155 | 155 |
| | 127°C (260°F) | | | 135 | n/a | n/a | n/a | n/a |
| THERMAL | | | | | | | | |
| TMA melt range low | °C | Huntsman | 89 | 77 | 87 | 86 | 84 | |
| | °F | | 192 | 170 | 189 | 187 | 183 | |
| TMA melt range high | °C | | 132 | 112 | 130 | 123 | 125 | |
| | °F | | 270 | 234 | 266 | 253 | 257 | |
| GLASS TRANSITION TEMPERATURE | | | | | | | | |
| Tg (DMA) | °C | ASTM D 5026 | -49 | -51 | -63 | -58 | -64 | |
| | °F | | -56 | -60 | -81 | -72 | -83 | |

You can find further information about the complete range of film and sheet elastomers that we offer in our dedicated film and sheet brochure. Further technical data about individual products, along with best practice advice for handling and processing our TPU films, is available from our local sales representative or by visiting our online product finder tool:

<http://www.huntsman-tpu.com/>

Global elastomers experts

Committed to customers: We build partnerships with our customers and work across an international network of R&D and manufacturing locations to help solve complex challenges and deliver the highest levels of technical support and customer care.

Committed to quality: Wherever we are, whatever we are doing, we prioritize environmental, health and safety protection, and we are always rigorous about quality control and assurance.

Committed to innovation: We keep pace with the most innovative trends in plastics processing by using the latest equipment and making regular investments in our formulation, manufacturing and R&D capabilities.

Committed to sustainability: We create solutions that contribute to a more sustainable society by helping to conserve energy, preserve natural resources and reduce our overall carbon footprint.



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About Huntsman:

Huntsman Corporation is a publicly traded corporation headquartered in The Woodlands, Texas, in the United States of America. Huntsman is a global downstream, differentiated, and specialty chemicals company. For more than 50 years, we have been using science and ingenuity to innovate and create products that enable more sustainable and comfortable lives for millions of people around the world. In 2023, Huntsman had more than 6,000 associates working in nearly 60 manufacturing, research and development (R&D), and operations facilities in 25 countries. Through our three divisions, we produce approximately 6,250 products to serve a broad and diverse range of consumer and industrial end markets including aerospace, transportation, building and construction, consumer goods, energy and fuels, and food preservation.

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