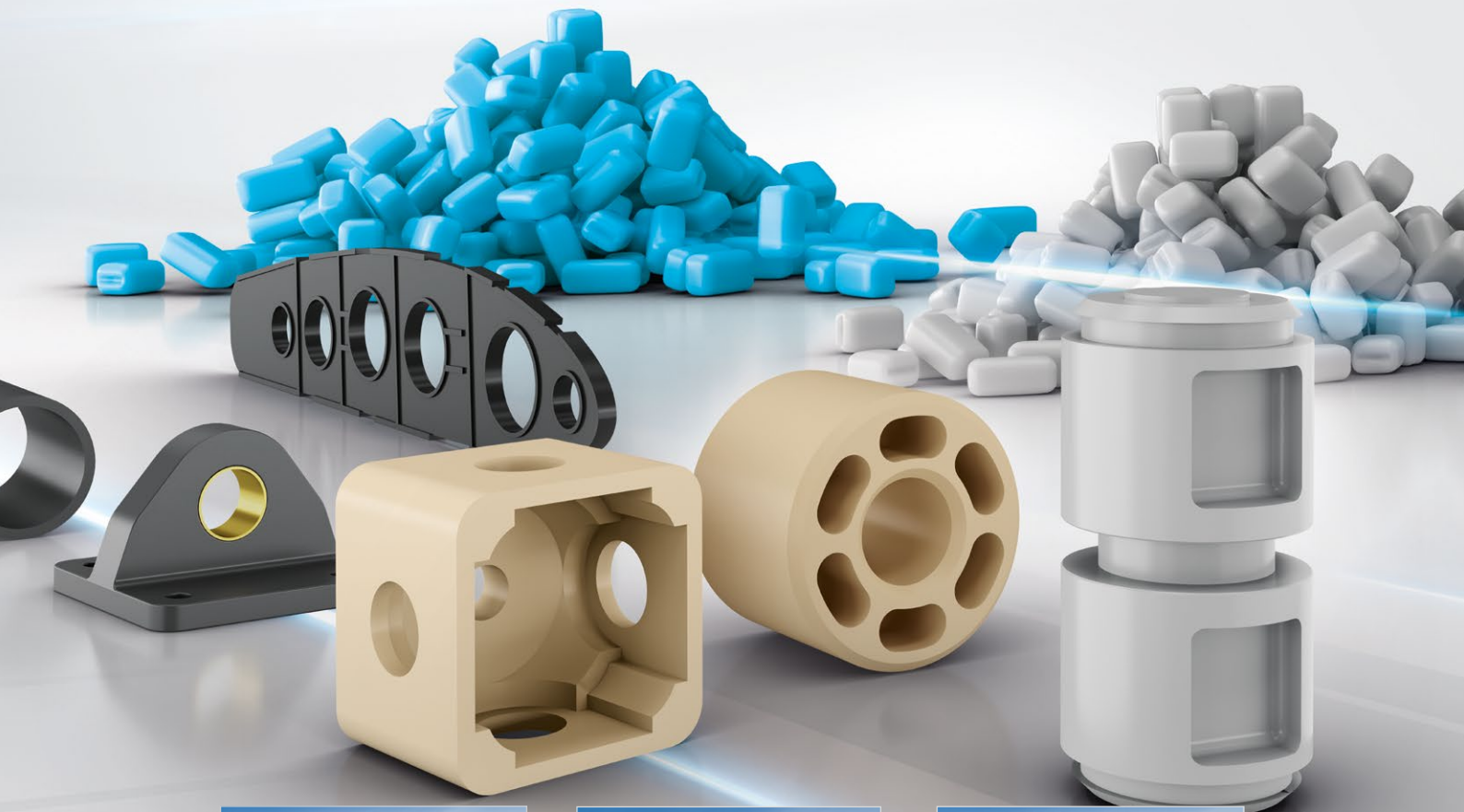




Engineered Performance Polymer Solutions

YOUR PARTNER TO DEVELOP ADVANCED
THERMOPLASTIC SOLUTIONS



Engineered Thermoplastics

High-performance materials and processes backed by decades of design and manufacturing expertise.

For over two decades, thermoplastic composites have been a proven solution for many engineering challenges, from reducing weight in aircraft to enabling advanced surgical robotics.

Previously expensive to produce, advancements in manufacturing processes, part simulation, and material development make thermoplastic composites viable for more varied applications every year. They offer greater design flexibility over thermosets and metal, making it easier to meet application requirements while optimizing the strength-to-weight ratio and physical properties.

By replacing metal structures with lighter thermoplastic composites in transportation applications, planes use less fuel or carry more cargo, and electric cars travel further on a single charge — decreasing environmental impact.

Trelleborg Sealing Solutions offers custom thermoplastic materials, compounds, and geometries to meet specific application requirements. Examples include products with enhanced corrosion and fire resistance or specialized compounds that can withstand challenging or niche conditions for longer. Our innovative manufacturing processes allow smaller and more complex shapes, leading to reduced-size components or multiple functions combined into one product.

With such a wide variety of options, choosing an experienced development partner like Trelleborg Sealing Solutions is essential. Take advantage of our expertise and resources to reduce time-to-market when developing new products and keep pace with accelerating innovation cycles.



Part consolidation and size reduction

Functional integration – combine seals, bearings and structures

Replace metal – reduce weight while retaining strength

Add functions, such as vibration damping and corrosion resistance

Reduce time-to-market

MATERIAL RANGE

Our material development teams have focused on several key areas:

Synergistic blends – creating unique solutions to complex challenges with a single or multiple materials

Extended service time – longer wearing, higher fatigue resistance, and greater chemical compatibility with reproducible results

Industry specific certifications and testing to global and regional industry standards, including:

- Oil and Gas: API, NORSOK M-710, ISO
- Food, Beverage and Water: FDA, NSF
- Healthcare and Medical: USP (87), USP (88)
- Customer-specific testing

KEY BENEFITS

Our thermoplastic composites make products that are:

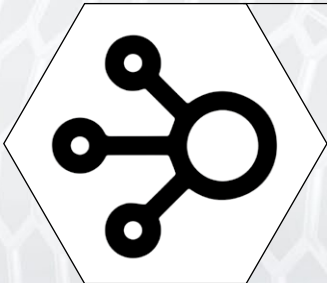
Lighter

Half the density of aluminum and a sixth of that of steel



Multi-functional

Add and enhance material properties or consolidate multiple parts into one



Sustainable

Contributes to fuel reduction, energy efficiency and sustainability



Stronger

Impact resistant with high strength to replace structural elements



FIND OUT MORE:

Contact your local Customer Solution Center to discuss your project requirements.



Application Expertise

Engineers are on-hand to assist with the design and specification of new products. Our teams use in-depth experience in product and process development, working with you from the earliest stages to rapidly build a successful solution to today's engineering challenges.

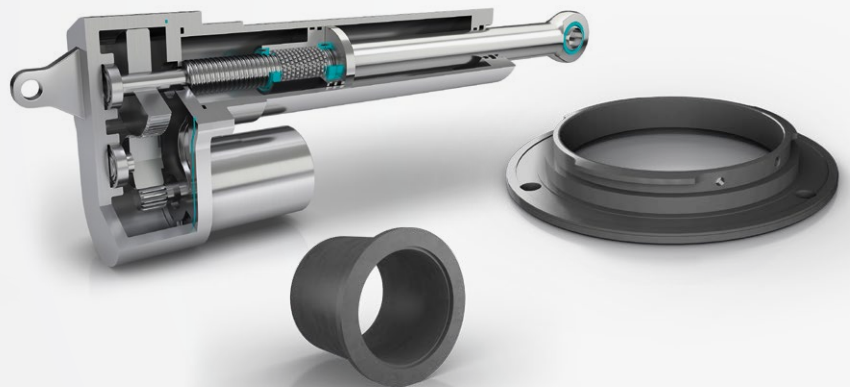
REDUCING WEIGHT IN INDUSTRIAL, CONSUMER & SURGICAL ROBOTICS



HYDRAULICS AND ACTUATION

Trelleborg Sealing Solutions manufactures a wide range of thermoplastic components, from scrapers and gears, to bushings and piston rings. Our solutions withstand high pressures and loads to give long service life.

- **Low friction** – for smoother movement and reduced wear
- **Consolidate functions** – combine into a single component
- **Add or enhance properties** – such as damping and wear



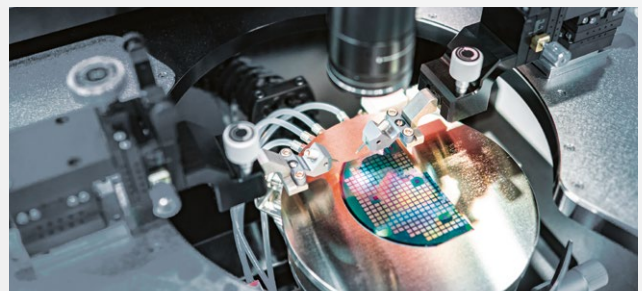
RESISTING EXTREME OIL & GAS ENVIRONMENTS

Resins, such as PEEK, PEKK and PPS, deliver exceptional performance in extreme service conditions against many process chemicals.



INCREASING PRODUCTIVITY IN SEMICONDUCTOR PRODUCTION

Components support integrated circuit production, from base wafers to product packaging. Materials resist chemicals and improve wear with cleanroom production.



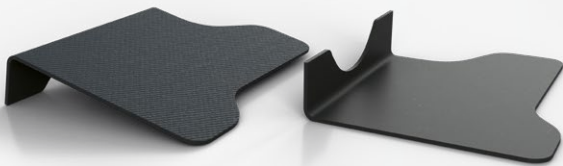
LIGHTWEIGHTING AND MEETING SPECIAL AEROSPACE & AUTOMOTIVE REQUIREMENTS



STRUCTURAL

Manufactured using the latest techniques, structural components can take many shapes and forms to reduce the footprint of components and reduce weight — an effective way to make aircraft and other vehicles more efficient.

- **Light** – up to 40% lighter than aluminium, 55% lighter than titanium and 70% lighter than steel
- **Strong** – resilient and highly resistant to impact
- **Reduce assembly steps** – lowering total cost of ownership



ENGINES

High specification materials can replace metallic components to reduce weight without compromising on resilience. They withstand high temperatures and resist harsh chemical environments to improve product lifetime.

- **Heat resistant** – from -40 °C to +260 °C / -40 °F to +500 °F
- **Media compatible** – materials to support all common fluids, including oils, coolant and fuels
- **Lightweight** – save fuel and increase efficiency

INTERIORS

Thermoplastics offer engineers wide latitude in their designs. Excellent strength-to-weight ratios and easy manufacturability allow new shapes for aesthetics or to increase aircraft capacity.

- **Reduce frame sizes** – fit more seats and more passengers
- **Bespoke interior trim/accents** – wide range of colors and meeting smoke and fire safety requirements



Design & Manufacturing Expertise



Guide Bushing

Additional features can be integrated into a product. For example, lubrication channels can be added to permit fluids to reach critical components, increasing application lifetime by reducing wear.

Control Valve

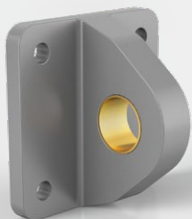
Materials can be tailored to reduce creep, tolerate high heat or provide chemical stability.

Valve Body

Custom-molded thermoplastics enable cost-effective products with high heat, UV and chemical resistance.

High Temperature Bearing

Custom-formed materials resist heat and reduce wear with low friction for smooth operation. Complex shapes are possible using additive manufacturing techniques.



Fastening/Insert Molding

Integrating mounting features reduces assembly effort and overall component size. The resulting products are lightweight, strong and long-lasting.



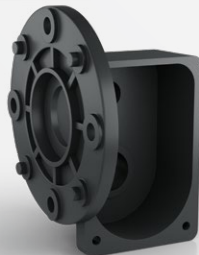
Multi-component

Thermoplastic connectors provide excellent performance in extreme conditions. Simultaneous and secondary over-molded covers meet a diverse range of needs.



Bonded Products

Trelleborg uses specialized techniques to enhance adhesion and bonding. Thermoplastics, metals and elastomers can be combined to integrate different properties and features within the same component, consolidating parts, simplifying assembly and adding additional features.



Motor Mount and Housing

Additive manufacturing enables Trelleborg to create highly customizable structural components. Their strength can support the weight of robotic arms and keeps them steady in operation.

HIGH-PERFORMANCE THERMOPLASTICS TECHNOLOGY AND DEVELOPMENT CENTER

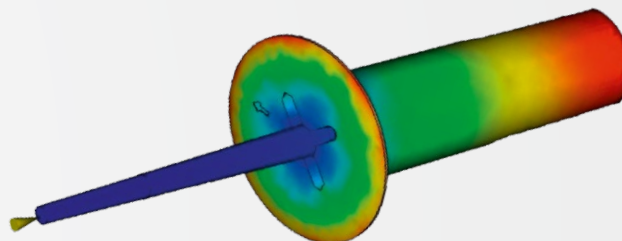
Our core values – customer focus, performance, innovation, and responsibility – are long-term commitments.



Specially for thermoplastics, we offer:

- Custom polymer blending – material optimization for: wear resistance, temperature profiles, strength and electrical properties
- Lubrication additives, including PTFE, graphite and MoS2
- AI and Computation Engineering optimized design services – revolutionizing product development
- Material characterization and analytical assistance
- Customer application testing and support

Our Advanced Technology Center develops high-performance, novel compounds with complementary design and processing competence. The center focuses on custom materials and products, combining both areas of expertise. We develop and refine our portfolio of materials, capabilities, and products to ensure we can support our customers, whatever their requirements.



MATERIALS

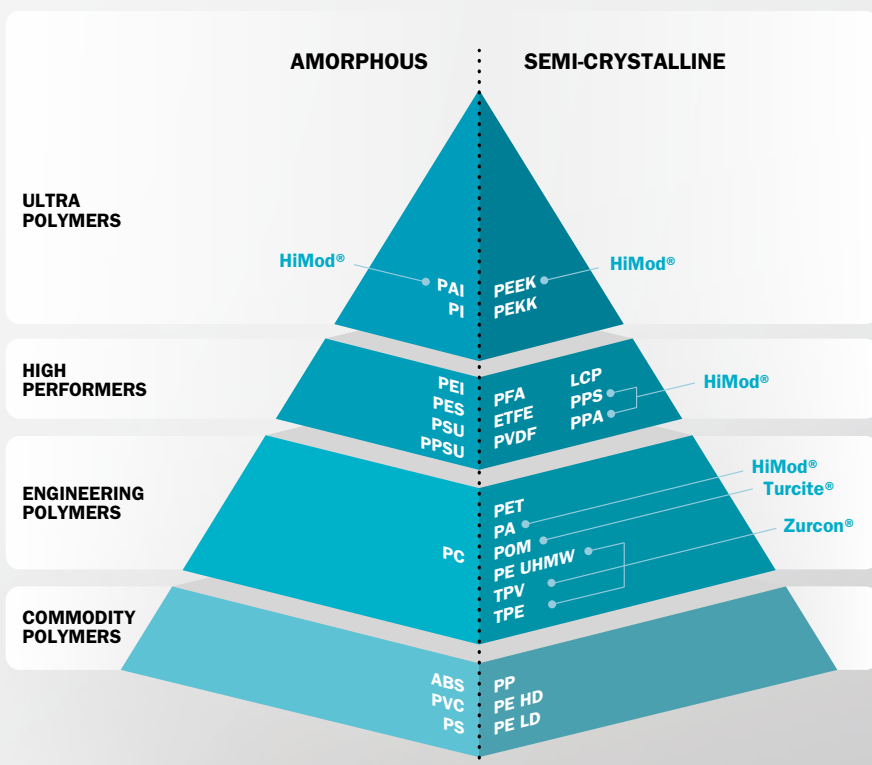
This is a sample of the materials that are available. Contact your local Customer Solution Center to discuss your specific requirements.

AMORPHOUS

- | | |
|--------------------------------|---|
| PAI: Polyamide-Imide | PC: Polycarbonate |
| PI: Polyimide | ABS: Acrylonitrile Butadiene Styrene |
| PEI: Polyetherimide | PVC: Polyvinyl Chloride |
| PES: Polyethersulfone | PS: Polystyrene |
| PSU: Polysulfones | |
| PPSU: Polyphenylsulfone | |

SEMI-CRYSTALLINE

- | | |
|---|---|
| PEEK: Polyetheretherketone | PE UHMW: Polyethylene Ultra High Molecular Weight |
| PEKK: Polyether-ketone-ketone | TPV: Thermoplastic Vulcanizate |
| PFA: Perfluoroalkoxy copolymer | TPE: Thermoplastic Elastomer |
| ETFE: Ethylene-tetrafluoroethylene | PP: Polypropylene |
| PVDF: Polyvinylidene fluoride | PE HD: Polyethylene High Density |
| LCP: Liquid Crystal Polymer | PE LD: Polyethylene Low Density |
| PPS: Polyphenylene Sulfide | HiMod®: Trelleborg proprietary materials modified for improved performance |
| PPA: Polyphthalamide | |
| PET: Polyethylene Terephthalate | |
| PA: Polyamide | |
| POM: Polyoxymethylene | |



Trelleborg is a world leader in engineered polymer solutions that seal, damp and protect critical applications in demanding environments. Its innovative solutions accelerate performance for customers in a sustainable way.

Trelleborg Sealing Solutions is a leading developer, manufacturer and supplier of precision seals, bearings and custom-molded polymer components. It focuses on meeting the most demanding needs of aerospace, automotive and general industrial customers with innovative solutions.

WWW.TRELLEBORG.COM/SEALS



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If you'd like to talk to Trelleborg Sealing Solutions, find your local contact at: www.trelleborg.com/seals/worldwide