UltraCOMP™ Engineered Thermoplastics

Technical Bulletin

No. 5264B1-USA

Extreme temperature, chemical and pressure resistance for increased equipment productivity.

Parker's UltraCOMP™ Engineered Thermoplastics are formulated for use in extreme temperature, pressure and chemical environments. Their excellent fatigue resistance and stability in high temperature environments make them the material of choice where other materials fail.

Features

- High temperature capability
- Strength and wearability
- Chemical resistance
- Wear resistance
- Hydrolysis resistance
- Radiation resistance
- Low flammability
- Low smoke and toxic gas emission
- Electrical insulation properties
- Purity with low ppm extractables

High Temperature Benefits of UltraCOMP™

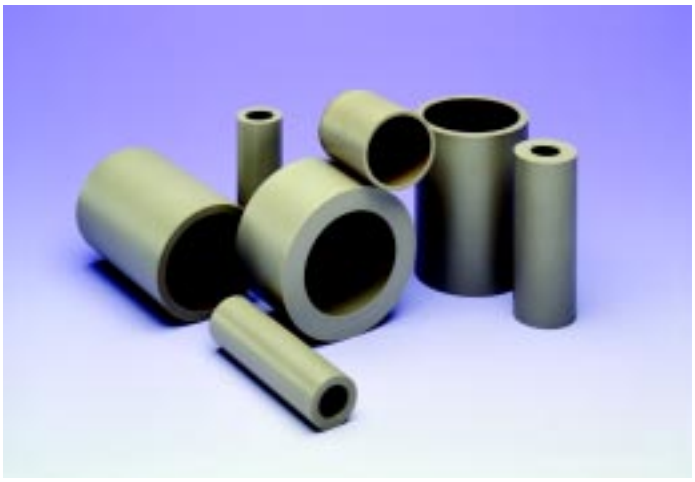
UltraCOMP HTP (4685) is a homogenous engineered thermoplastic material specified for use in extreme conditions spanning multiple industries. Its excellent tensile strength facilitates its successful use as back-up rings and anti-extrusion devices. With a melt temperature of over 600 °F, UltraCOMP can be used at continuous operating temperatures of -65° up to 500° F. In addition, UltraCOMP's elongation properties (>60% per ASTM D638) allow it to be flexed and twisted without breaking.

Strength and Wear Resistance

UltraCOMP's superior strength and wear resistance properties make it an ideal alternative to metal or metal alloys. In applications where weight, metal-to-metal wear or corrosion issues exist, UltraCOMP can significantly extend equipment life.

Chemical Compatibility

In harsh chemical operating environments such as those encountered in energy, oil & gas, industrial, chemical processing and semiconductor processes, UltraCOMP outlasts traditional thermoplastic materials (see Bulletin EPS 5262 for UltraCOMP chemical compatibility data).



Availability

UltraCOMP is available in injection molded custom machined geometries, and tube stock sizes ranging up to 12 inches OD in lengths up to 4 inches and cross-sections up to 1/2" (see Bulletin EPS 5263 for tube sizes and availability).

Four UltraCOMP Formulations

UltraCOMP is available in four compound formulations:

- UltraCOMP HTP (4685) Virgin
- UltraCOMP CF (4737) 30% Carbon fiber filled
- UltraCOMP GF (4686) 30% Glass filled
- UltraCOMP CGT (4738) 10%Carbon/ 10% Graphite/ 10% PTFE filled

Broad Range of Industry Applications

UltraCOMP's unique blend of thermal, chemical, mechanical, electrical properties and low extractables make it ideal for a broad range of applications in energy, oil & gas, semiconductor, industrial, automotive, medical and other industries. Typical applications include:

- Net molded and custom machined geometries
- Thin wall cross-section profiles
- Thrust washers
- Bearings
- Lapping rings
- PIP rings (bi-directional seal)
- Piston rings
- Nozzles & wands
- Electronic connectors
- Vee-ring adapters
- Valve seats and gates
- Back-up rings and other anti-extrusion devices
- Autoclavable grips & medical instrument components

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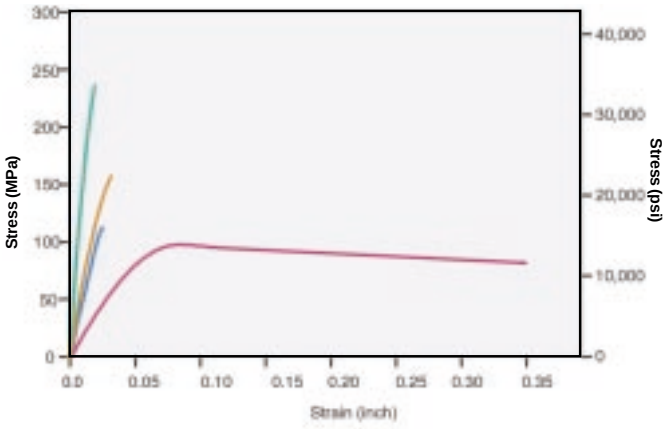
Mechanical Properties

UltraCOMP™ Engineered Thermoplastics are injection molded, and exhibit superior mechanical properties of tensile strength, flexural strength, creep and fatigue resistance.

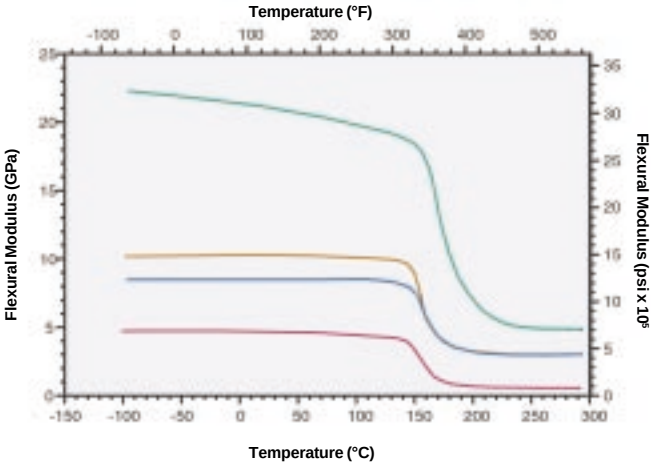
KEY
- UltraCOMP™ HTP (4685)
- UltraCOMP™ CF (4737)
- UltraCOMP™ GF (4686)
- UltraCOMP™ CGT (4738)

Figure 1: Stress vs. Strain Curves



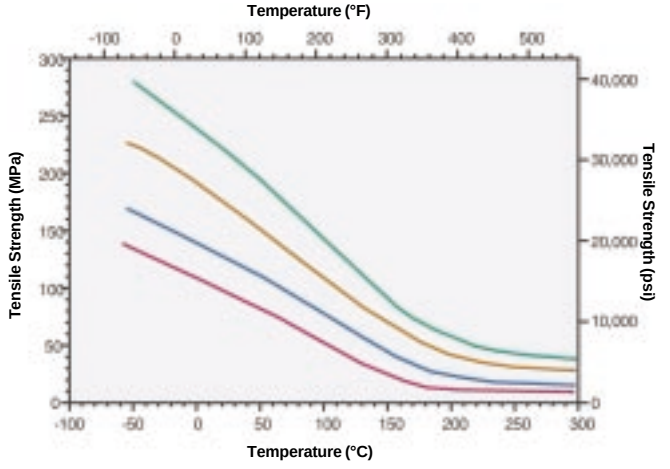
The tensile properties of UltraCOMP materials exceed those of typical engineered thermoplastics. A comparative tensile plot of UltraCOMP compounds is shown above where stress is defined as the applied force divided by the original cross-sectional area, and the strain is the extension per unit length of the sample.

Figure 2: Flexural Modulus vs. Temperature



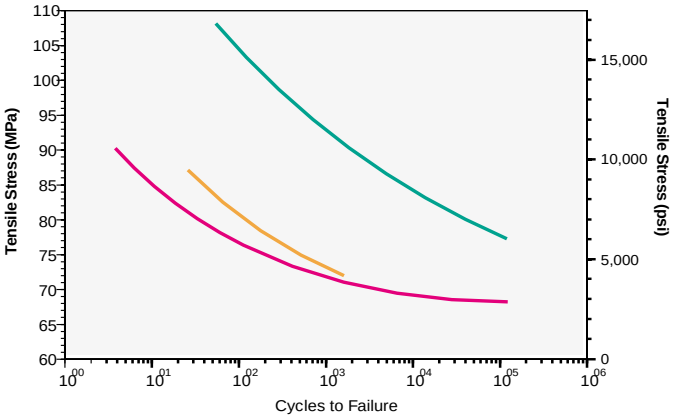
UltraCOMP thermoplastics maintain their structural characteristics and resist deformation at increased temperatures. By utilizing fillers, UltraCOMP alloys exhibit increased strength.

Figure 3: Tensile Strength vs. Temperature



UltraCOMP materials are used to form structural components that operate continuously at high temperatures. The above graph depicts tensile strength versus temperature for UltraCOMP materials and demonstrates a high retention of mechanical properties over a wide temperature range.

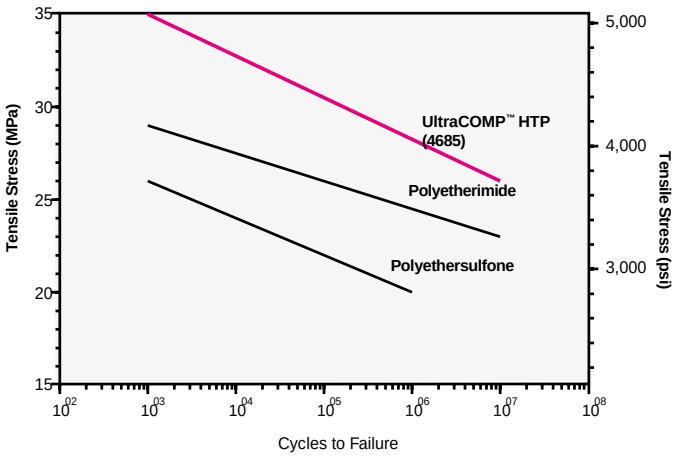
Figure 4: Fatigue Stress vs. Cycles to Failure



UltraCOMP's fatigue resistance is enhanced by reinforcement with glass and carbon fibers. UltraCOMP CF and UltraCOMP GF feature the optimum level of reinforcement for superior fatigue resistance and mechanical performance.

*Graphs 1-7 courtesy of Victrex plc. The information contained in this publication (and otherwise supplied) is based on general experience and is given in good faith. Data within the publication is subject to variances associated with testing standards followed. Application-specific testing is recommended for all UltraCOMP™ polymer components.

Figure 5: Comparative Fatigue Stress vs. Cycles to Failure

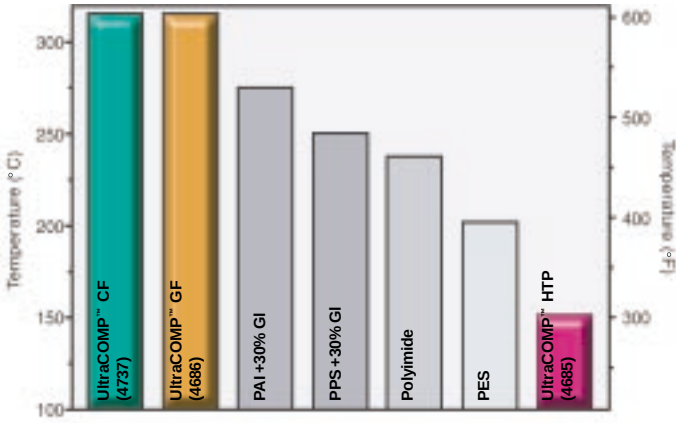


When compared to similarly reinforced thermoplastics, UltraCOMP clearly outperforms.

Thermal Properties

Figure 6: Comparative Heat Distortion Temperatures

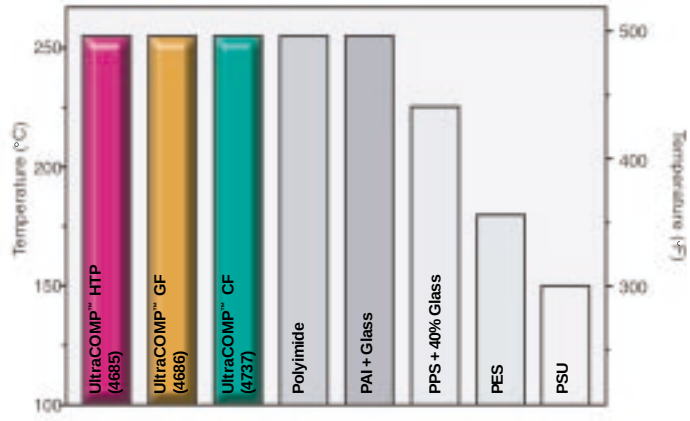
Short Term Effects (per ASTM D648)



Measured Heat Distortion Temperatures (HDT, ASTM D648) of UltraCOMP materials as compared with other engineered thermoplastics, illustrate UltraCOMP's superior thermal properties.

Figure 7: Comparative Relative Thermal Index (RTI)

Long Term Effects (per UL 746B)



Comparative Relative Thermal Index (RTI) testing, per Underwriters Laboratories (UL 846B) of UltraCOMP with other polymeric materials show UltraCOMP's retention of mechanical properties after 100,000 hours conditioning.

Electrical Insulation Properties

UltraCOMP's excellent thermal and electrical resistance make it effective for use in electrical insulation. UltraCOMP HTP exhibits high values for volume resistance over a wide temperature range. Special considerations, such as changes in electrical properties with temperature, humidity, differing component geometries and time, must be carefully tested and evaluated when designing for operating conditions.

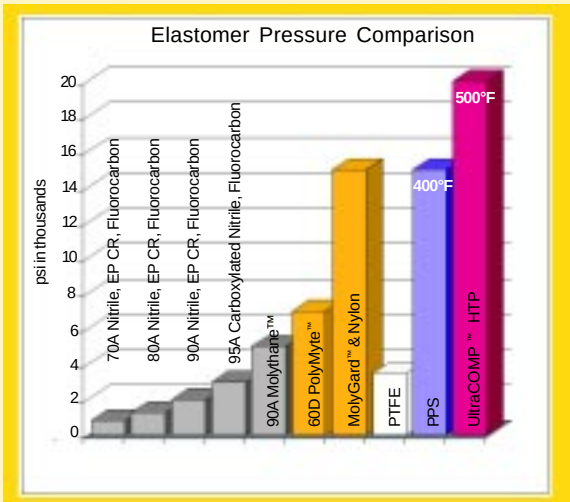
Chemical and Environmental Compatibility

- **Chemical Resistance:**
  UltraCOMP materials are insoluble to most chemicals. Their low moisture absorption properties, also make them highly desirable in applications exposed to steam.
- **Hydrolysis Resistance:**
  UltraCOMP's ability to continuously operate in or be frequently sterilized by steam make it ideal for some medical applications.
- **Radiation Resistance:**
  Their energetically stable chemical structure allows UltraCOMP components to successfully operate in or be sterilized by high doses of ionizing radiation.

UltraCOMP™ for High Temperatures and Pressures: Seals and Extrusion Resistance

A major feature of UltraCOMP is its ability to resist high temperatures and pressures. This chart illustrates the relative extrusion resistance of the major sealing families of elastomers. The highest temperature rated family, the Fluorocarbons, has the least favorable wear resistance and extrusion resistance properties. When the combination of high pressure and temperature occur together, Parker's UltraCOMP HTP thermoplastic material must be used with the elastomer in the sealing system. The elastomer families serve to be resilient as the primary part of the seal and UltraCOMP HTP serves to provide an anti-extrusion function to back up and protect the less extrusion-resistant elastomers.

Parker UltraCOMP anti-extrusion rings are designed to function on the low pressure side of the sealing elements. In seal applications with continuous use temperatures as high as 500°F, and at pressures as high as 20,000 psi, most compounds will soften and may extrude out of metal clearances. UltraCOMP HTP will bridge the extrusion gap.



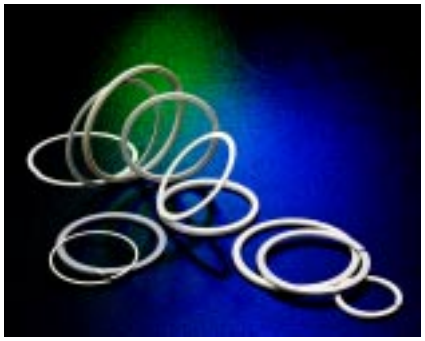
*Typical Physical Properties**

	UltraCOMP HTP (Virgin)	UltraCOMP GF 30% Glass filled	UltraCOMP CF 30% Carbon fiber filled	UltraCOMP CGT 10% Carbon 10% Graphite 10% PTFE filled
Compound Number	***4685***	***4686***	***4737***	***4738***
Hardness (Rockwell R)	126	124	124	-
Density (g cm^3) Crystalline	1.32	1.51	1.41	1.44
Tensile Strength (Kpsi/MPa)	14.0/97	22.6/156	32.4/224	20.4/141
Elongation (%) Break	>60	2.7	2.0	2.5
Flexural Modulus (Kpsi/MPa)	595/4099	1,450/9997	2,929/2019	1,175/8098
Compressive Strength (Kpsi/MPa)	17.1/118	31.1/215	34.8/240	21.7/150
Shear Strength (Kpsi/MPa) 73°F (23°C)	7.6/53	14.1/97	14.1/97	-
Melting Temperature (°F)/(°C)	644/340	644/340	644/340	644/340
Glass Transition Temp (°F)/(°C)	289/143	289/143	289143	289/143
Typical Crystallinity (%)	35	30	30	30
Water Absorption (%) 24hr@73°F (23°C)	0.5	0.11	0.06	0.06

Typical Industry Specific Applications

Industrial

UltraCOMP™ Anti-Extrusion Devices, Machined Geometries, Back-ups



Automotive

UltraCOMP™ Piston Rings, Molded Geometries, Valve Seats

Semiconductor

UltraCOMP™ CMP Retainer Rings, Custom Geometries & Devices

Energy, Oil & Gas

UltraCOMP™ PIP Rings, Anti-Extrusion Devices, Back-up Rings, Bearings

Technical Support

Parker product engineers are available to address temperature, pressure, chemical compatibility and all other considerations, from design to delivery. Contact us at: (801) 972-3000.

*Typical physical properties per Victrex, plc.

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