THERMOPLASTIC COMPONENTS

Arlon® XT-Series

for Hydrogen & CCUS Applications

Meets the Extreme Challenges of CO_2 & H_2 Applications

As the hydrogen and CCUS markets scale, they need materials that can withstand increasingly aggressive pressures and temperatures while extending service life—requirements that many conventional polymers, such as PPS, PEI, and even standard PEEK, fail to meet.

Arlon 3000XT®: First Cross-Linked PEEK

Originally engineered to surpass the performance limits of standard PEEK in extreme Oil & Gas downhole environments, Arlon 3000XT® is the industry's first cross-linked PEEK. Choose your grade for an unmatched performance:

- **Arlon 3000XT® (Virgin Grade):** Designed for applications where standard PEEK, PTFE, or PSU reach their limits. Key benefits include lower hydrogen permeation, higher glass transition temperature (Tg), and improved mechanical stability at elevated temperature.
- **Arlon® 3160XT (Glass-Filled Grade):** Specifically engineered for high-pressure valve seats and backup rings. This grade provides a 20x improvement in creep resistance over standard glass-filled PEEK, ensuring long-term sealing integrity.
- **Arlon® 3555XT (Lubricated Grade):** Optimized for hydrogen reciprocating compressors. It addresses the high thermal and mechanical loads of piston rings and rider bands by offering a high PV limit and superior wear resistance at elevated temperatures and pressures compared to traditional materials.

Features and Benefits

- Higher glass transition and effective use temperature compared to standard virgin or filled PEEK (above 260°C based on operating conditions)
- Better mechanical properties retention above Tg and also at cryogenic temperatures
- Extended flame resistance
- Excellent chemical resistance to H_2 & CO_2
- Very low hydrogen diffusion coefficient: 1.47 x 10^{-10} m^2/sec at 900 bar (13,053 psi) and 30°C (86°F)
- Reduced swelling in acidic or alkaline environments
- Exceptional creep resistance at high pressure and high temperature
- Superior tribological properties at high pressure and high temperature

Applications

- H_2 & CO_2 pressure relief valve and safety valve seats
- Backup rings for extreme pressure and temperature applications
- Electrolyzer cell frames and fuel cell compression end plates
- Piston rings, rider bands, rod packing rings for reciprocating compressors
- Secondary seals for gas seals

Availability

- Ability to make injection molded finished parts to industry standard tolerances
- Stock shapes for machined parts
  - Extruded rod: 3″ (76 mm) diameter
  - Extruded sheet: 30″ wide x 1″ thick (762 x 25 mm)
  - Extruded tube: 10″ outside diameter x 0.5″ thick (254 x 13 mm)
- Other product configurations available on request (larger dimensions, film capabilities...)

Arlon® XT-Series Typical Properties

Room Temperature Properties

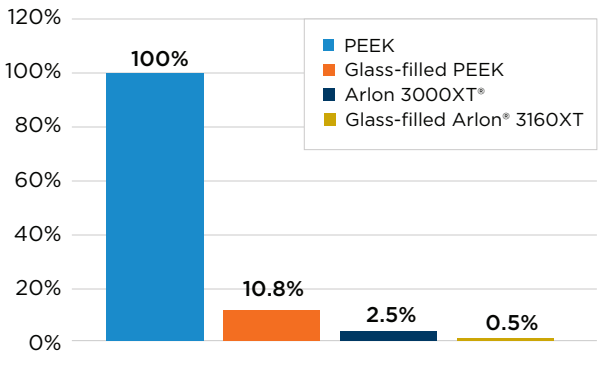
Property	Method	Unit	Unfilled PEEK	Arlon 3000XT®	Standard 30% Glass-Filled PEEK	Arlon® 3160XT
General						
Color			Tan	Black	Tan	Black
Specific Gravity	ASTM D792		1.30	1.29	1.53	1.51
Shore D Hardness	ASTM D2240	pt	87	88	88	90
Tensile						
Tensile Yield Strength	ASTM D638-T1	psi [MPa]	15,600 [108]	17,100 [118]	No Yield	No Yield
Tensile Break Strength	ASTM D638-T1	psi [MPa]	14,100 [97.2]	16,900 [116]	26,000 [179]	26,400 [182]
Tensile Modulus (Elastic)	ASTM D638-T1	psi [GPa]	595,000 [4.10]	559,000 [3.85]	1,700,000 [11.7]	1,580,000 [10.9]
Tensile Modulus (0.5% Secant)	ASTM D638-T1	psi [GPa]	615,000 [4.24]	580,000 [4.00]	1,720,000 [11.9]	1,610,000 [11.1]
Tensile Elongation at Break	ASTM D638-T1	%	>40	8-15	2.2	2.5
Flexural						
Flexural Strength	ASTM D790	psi [MPa]	25,300 [175]	23,300 [161]	34,100 [235]	32,400 [223]
Flexural Strain at Measurement *(Break)	ASTM D790	%	5.00	5.00	2.90*	2.80*
Flexural Modulus	ASTM D790	psi [GPa]	600,000 [4.13]	628,000 [4.33]	1,590,000 [11.0]	1,460,000 [10.1]
Shear						
Shear Strength (Axial)	ASTM D732	psi [MPa]	12,400 [85.5]	15,300 [106]	16,400 [113]	16,900 [117]
Shear Strength (Transverse)	ASTM D732	psi [MPa]	12,400 [85.5]	15,300 [106]	12,700 [87.6]	13,000 [89.7]
Compressive						
Compressive Strength at Max Load *(Break)	ASTM D695	psi [MPa]	19,900 [137]	22,000 [152]	36,100* [249]	37,400* [258]
Compressive Modulus	ASTM D695	psi [GPa]	592,000 [4.08]	525,000 [3.62]	996,000 [6.87]	939,000 [6.47]
Impact						
Impact Strength (Unnotched)	ASTM D4812	Ftlb/in [J/m]	No Break	38 [2,020]	20 [1070]	16 [855]
Impact Strength (Notched)	ASTM D256	Ftlb/in [J/m]	1.38 [73.7]	1.64 [87.6]	1.7 [90.9]	1.0 [53.4]
Thermal						
DMA, Glass Transition Temperature (Annealed Tensile Bar)	ASTM D7028	°F [°C]	302 [150]	336 [169]	298 [148]	329 [165]
DSC, Melting Temperature (1st heat, annealed Tensile Bar)	ASTM D3418	°F [°C]	649 [343]	666 [352]	653 [345]	667 [353]
Heat Deflection Temperature	ASTM D648 @ 264 psi (1.83 MPa)	°F [°C]	338 [170]	>572 [>300]	>572 [>300]	>572 [>300]

High Temperature Properties (500°F [260°C])

Property	Method	Unit	Unfilled PEEK	Arlon 3000XT®	Standard 30% Glass-Filled PEEK	Arlon® 3160XT
Tensile (500°F [260°C])						
Tensile Strength @ Yield	ASTM D638-T1	psi [MPa]	2,600 [17.9]	No Yield	No Yield	No Yield
Tensile Strength @ Break	ASTM D638-T1	psi [MPa]	No Break	5,380 [37.1]	7,600 [52.4]	11,000 [75.8]
Tensile Modulus (Elastic)	ASTM D638-T1	psi [GPa]	38,700 [0.267]	88,100 [0.607]	519,000 [3.57]	680,000 [4.68]
Tensile Elongation at Break	ASTM D638-T1	%	>80%	>25%	6.0	4.8
Flexural (500°F [260°C])						
Flexural Strength @ 5.00% Strain	ASTM D790	psi [MPa]	2,300 [15.9]	3,740 [25.8]	11,200 [77.2]	16,500 [113]
Flexural Modulus	ASTM D790	psi [GPa]	50,300 [0.347]	90,200 [0.622]	446,000 [3.08]	540,000 [3.72]
Shear (500°F [260°C])						
Shear Strength (Axial)	ASTM D732	psi [MPa]	3,300 [22.8]	6,880 [47.4]	5,690 [39.2]	7,650 [52.7]
Shear Strength (Transverse)	ASTM D732	psi [MPa]	3,300 [22.8]	6,880 [47.4]	3,930 [27.1]	5,600 [38.6]
Compressive (500°F [260°C])						
Compressive Strength at Max Load	ASTM D695	psi [MPa]	2,590 [17.8]	5,500 [37.9]	7,040 [48.5]	11,800 [81.4]
Compressive Strength at Break	ASTM D695	psi [MPa]	—	—	7,020 [48.4]	11,800 [81.4]
Compressive Modulus	ASTM D695	psi [GPa]	63,500 [0.438]	132,000 [0.910]	253,000 [1.74]	346,000 [2.39]
Compressive Strain at Break	ASTM D695	%	>15	>10	5.0	5.9
Creep						
Compressive Extrusion Distance 3 hours @ 500°F [260°C], 35,000 psi [241 MPa] (Less is better)	ATG ME0014 (Custom Test)	in [µm]	>0.100 [>2,540]	0.0032 [82.3]	0.0140 [356]	0.00069 [17.5]

Creep Resistance

Compressive Creep, 3 Hours @ 500°F, 35,000 psi
(260°C, 241 MPa) (Lower Is Better)



Flame Resistance

Test Conditions

- UL 2596 test standard
- Flame temperature: 1,200°C (2,192°F)
- Exposure time: 20s x 10 times
  - 15 sec. to torch flame
  - 5 sec. to torch flame + grit

Test Results

38% increase in time to failure and 18% reduction in surface temperature at the point of breach with Arlon® 3160XT compared to standard PEEK

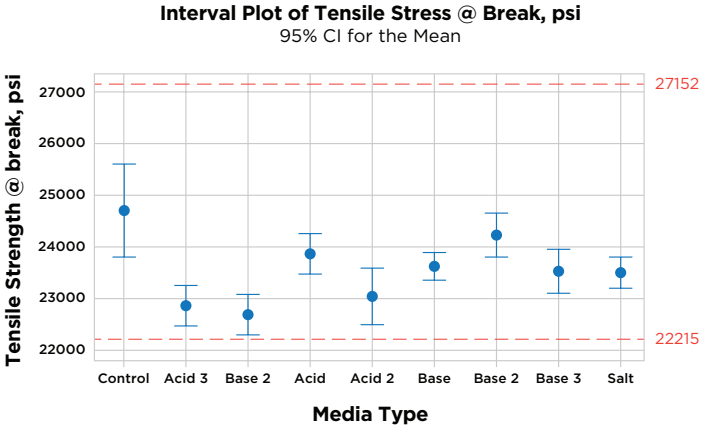
Chemical Resistance

Test Conditions

- 7-day screening (40+ permutations)
- Temperature: Ambient to 90°C (194°F)
- Tested pH:
  - 0.6 (strong acids)
  - 7 (neutral salt)
  - 14.5 (strong bases)

Test Results

- The results showed excellent retention of tensile strength, and linear swelling (width) after aging (Compass +/- 10% criteria bars added for reference)
- No test exceeded +/- 10% change vs. control ("A" ratings, under these conditions and Compass Guidelines)



Individual standard deviations are used to calculate the intervals

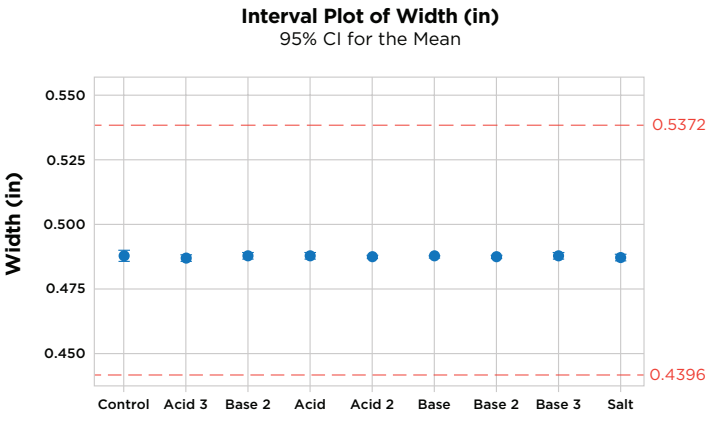
sCO2 Exposure Test Results

Test Conditions

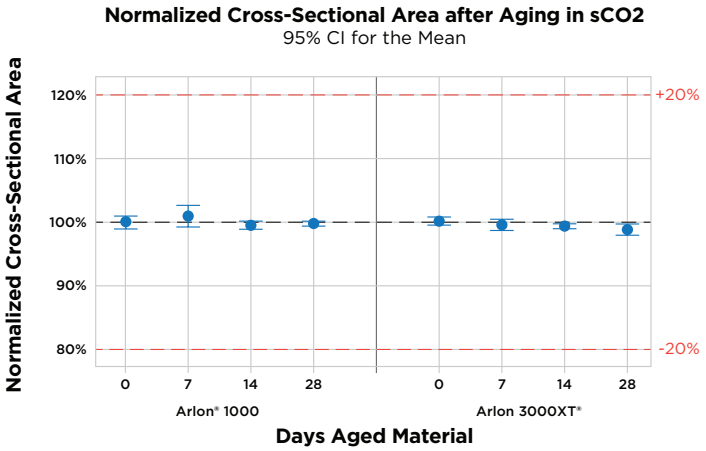
- Test standard: modified ISO 23936-2 Annex A
- Test media: 100% CO_2
- Test temperature: 150°C (302°F)
- Test pressure: 200 bar (2,900 psi)
- Test duration: 7, 14, 28 days
- Test samples: ASTM D638 Type IV dog bones

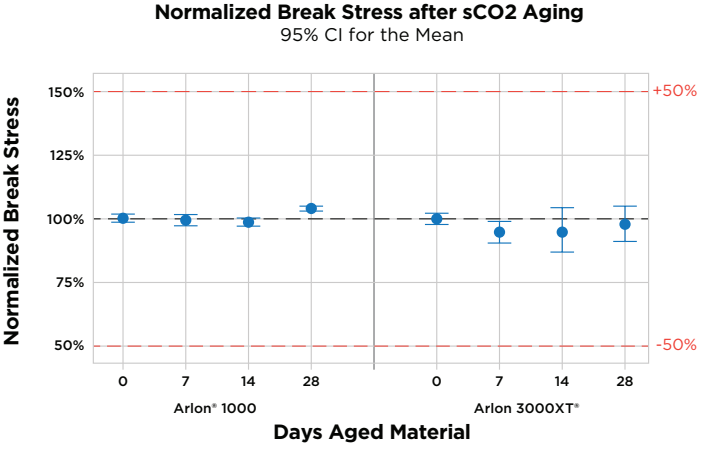
Test Results

Arlon 3000XT® passed fluid ageing exposure to 100% CO_2 with limited dimensional and mechanical properties changes.



Individual standard deviations are used to calculate the intervals





Greene Tweed
1930 Rankin Road, Houston, TX 77073 USA | Phone: (+1) (281) 765-4500
gtweed.com