

## AF800 Range of Peek Materials for Oil and Gas Industry Utilising Genuine Victrex Peek Polymers

In most applications, it is a combination of three or more of these properties that dictates the use of **AF800 Peek Materials**:

- High temperature resistance
- Good electrical properties
- Very low creep
- High dynamic fatigue
- Insensitive to Rapid Gas Decompression (RGD)
- Excellent hydrolysis resistance
- High wear resistance
- High erosion resistance
- Ease of processing and machining
- Excellent chemical resistance
- High mechanical strength

### Comparison with Other Thermoplastic Polymers used in Offshore and Onshore Service

	HDPE	PA11	PVDF	PPS	AF801 PEEK™
S.G.	0.95–0.98	1.03	1.78	1.36	1.32
Melting point (°C)	130–135	188	160–170	285	343
Deflection temp at 264psi		36–55	104	104	156
Flexural modulus (MPa)	700–1000	300–1300	800–2000	3200	4100
Tensile strength (MPa)	20–30	25–30	37–48	70	105
Shore D hardness	55–70	32–61	75–77	93	99 (Rockwell M)

AF800 PEEK™ materials are used in a wide range of oil and gas applications due to the unique combination of properties and range of compounds and unfilled polymers

Typical applications:

- Logging tools
- Seals and backup rings
- Connectors
- Compressor components
- Pumps (surface and submersible)
- Plugs and packers
- Composites
- Cables and wireline
- Tubes and pipes
- Insulating components

### Seals, Back-up Rings and Packings

Effective sealing throughout the oil production process is needed for differential pressures of up to 20,000 psi.

Typical sealing materials such as elastomers and fluoropolymers display:

- good temperature and chemical resistance
- poor mechanical properties
- suffer high levels of creep (extrusion)

The advantages of AF800 PEEK materials

- It has the right combination of properties to be used as a back-up ring or packing to the PTFE/elastomer seal:
  - high temperature resistance
  - chemically resistant
  - mechanical barrier to ‘extrusion’

AF800 PEEK can also be used itself as a direct sealing material

- AF800 ductility offers advantages in assembly as the seals are often scarf cut to allow the ring to be opened and clipped around the fitting
- High performance, spring energised seals
- PEEK is used for support, non-extrusion and sealing elements where pressures may exceed 1035 bar at temperatures up to 230°C
- Seal assemblies utilised in various valves and chokes as stem packing or face seals and are used to contain high pressure production fluids (and gas) at the wellhead

### Down Hole Electrical Connectors

- One of the most important parts of any drilling/production system is the transmission of both power and data between the operating environment and the surface, this is achieved through systems of connectors
- Connectors must be insulated with a material capable of running at temperatures up to 200°C, in very aggressive chemical environments and at a differential pressure of 20,000 psi without suffering from ‘extrusion’ and loss of electrical properties
- Historically made from glass, ceramic or metal composite which gives:
  - assembly problems
  - different materials give problems with jointing and differential thermal expansion
  - high tooling costs/design modifications very costly

## Properties

Property	Standard	Unit	AF801 PEEK™ 450G	AF816 PEEK™ HT
Tensile strength	ISO 527	MPa	100	111
Elongation at break	ISO 527	%	100	20
Secant modulus	ISO 527	GPa	3.6	3.8
Flexural strength	ISO 178	MPa	131	185
Flexural modulus	ISO 178	GPa	3.9	4.1
Izod impact strength (notched)	ISO 180	kJ/m <sup>2</sup>	6.4	7
Hardness (Rockwell)	ASTM D785	R	126	108
Thermal expansion	ASTM D696	10-5/°C	4.7	4.7
Limiting oxygen index		%	35	40
Density	ISO 1183	g/cm <sup>3</sup>	1.32	1.3
HDT	ISO	75°C	152	165
RTI	UL 746B	°C	260	260
Glass transition	DSC	°C	143	157
Melting point	DSC	°C	343	373

## Electrical Properties

Dielectric strength (50 µm film)	190 kV/mm
Comparative tracking index	150 V 450G <b>AF801</b> 170 V 450GL30 <b>AF802</b>
Dielectric constant nearly independent of temperature and frequency	
Excellent electrical insulation properties above 200°C	
Electrical applications at high temperatures and aggressive environments	

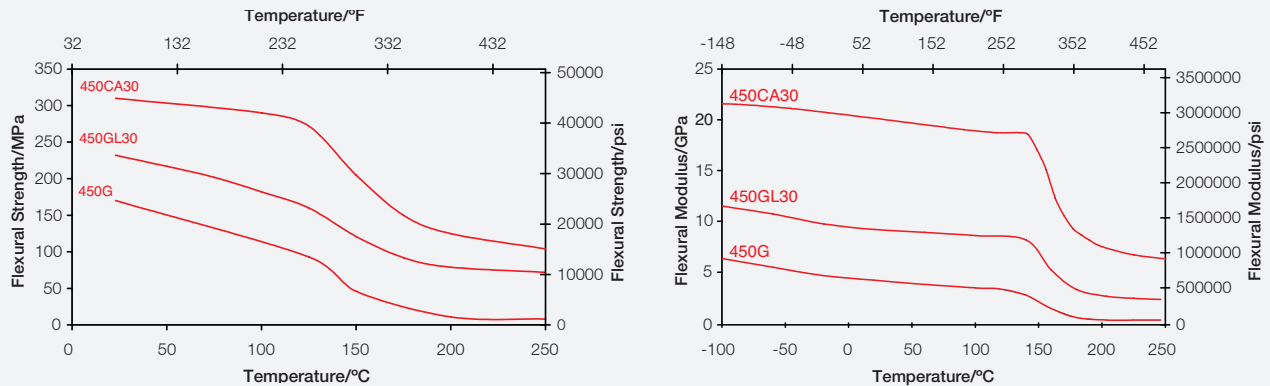
AF800 PEEK materials retain a high electrical strength in the varied and aggressive conditions of oil exploration and production.

## High Temperature Performance

- Continuous Use Temperature (CUT) of 260°C
- Glass Transition Temperature of 143°C
- Heat deflection temperature (HDT)
  - Unfilled materials 160°C
  - Carbon-fibre and glass-fibre reinforced materials 310°C
- No loss in tensile strength after ageing at 200°C for one year

## Mechanical Properties

- Excellent high temperature mechanical properties
- High levels of strength and stiffness at very high temperatures
- Flexural modulus of 5 GPa and flexural strength of 100 MPa at 250°C for **AF804**



## Chemical Resistance

- Excellent chemical resistance to hydrocarbons, bases, acids, organic and inorganic reagents even at high temperatures
- AF800 PEEK materials are not subject to explosive decompression following high pressure exposure to oil field gases
- Exceptional hydrolysis resistance. AF800 PEEK components retain a high level of mechanical properties when continuously conditioned in water or brine at elevated temperatures and pressures

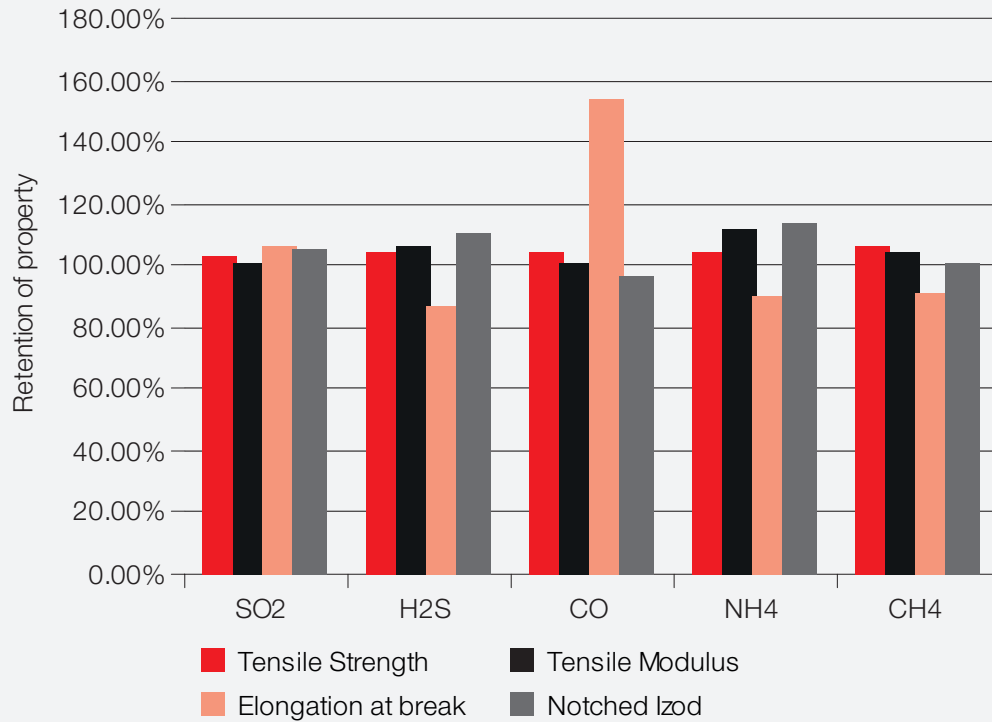
## Rapid Gas Decompression (RGD)

Polymer	Temperature (°C)	Pressure (PSI)	Decompression Rate (PSI/min)	Gas	% Change in Volume
AF801	175	14600	2500	90/10 CH <sub>4</sub> /CO <sub>2</sub>	3.58
			500		3.27
AF816			5000		3.37
			15000		3.12
AF801	200		2500		5.65
AF816					4.70

Data measured and compiled by MERL Ltd (UK).

In NO case was any cracking observed in these specimens following decompression.

### Resistance of AF801 PEEK 450G for Various Gases



Samples were aged for 7 days at 200°C.

### Wear Resistance

- Excellent friction and wear properties
- Specially formulated tribological grades which exhibit outstanding wear resistance over wide ranges of pressure, velocity, temperature and counterface roughness
- Excellent resistance to abrasion in sand slurry environments

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