

P84® Polyimide Fibres

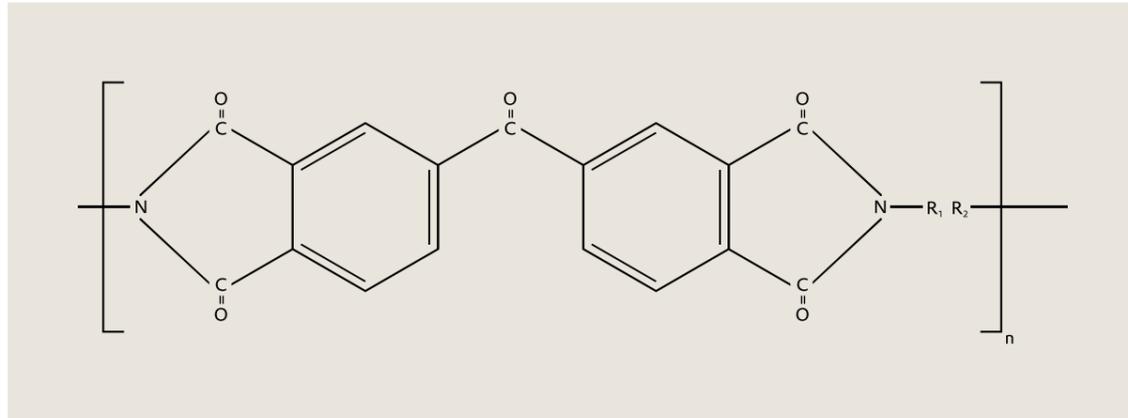
PROPERTIES, TECHNICAL DATA
AND PRODUCT RANGE

P84®



P84® FIBRE CHARACTERISTICS

CHEMICAL STRUCTURE



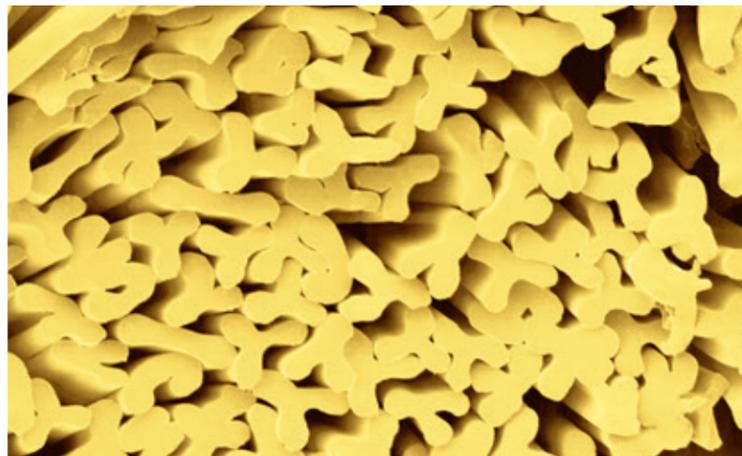
The P84® fibre is a polyimide based fibre with a typical textile character. Polyimides are known to be used in a wide range of operating temperatures starting from cryogenic applications and ending at high temperature applications at the limits of polymer based materials.

The thermal stability is based on the aromatic backbone of the polymer. The fibres do not melt. Despite their halogen free structure they exhibit a high LOI of 38 %, which means the P84® fibres are classified as non flammable.

P84® fibres have a rather unique cross section offering the highest specific surface of all available standard textile fibres.

CROSS SECTION OF P84® FIBRES

The unique multilobal cross section offers up to 90 % more surface area compared to conventional round fibres and is the key advantage of P84®. This increased surface area results in the highest filtration efficiency of conventional fibres, even for sub micron particles.



The fibres meet the requirements of all common textile processing steps. Besides standard grades, micro denier fibres are part of the production range.

PRODUCT RANGE

P84® fibres are available as staple fibres and multifilament yarn.

STAPLE FIBRE

Available Types: 0.6, 1.0, 1.3, 1.7, 2.2, 3.3, 5.5 and 8.0 dtex

Cut Lengths (Standards): 53, 60, 80 mm

Special Cut Lengths: 2.5–120 mm

Bales: 150 kg and 200 kg

Colour: natural golden yellow

FILAMENT YARN

Available Type: 1060 dtex, 480 single threads

Twist: 80 t/m

Packaging: 12 cones, 3.5 kg each

Colour: natural golden yellow

P84® FIBRE CHARACTERISTICS

The shown values together with the shape of the tension/elongation curve (see diagram) demonstrate that P84® is a typical textile fibre.

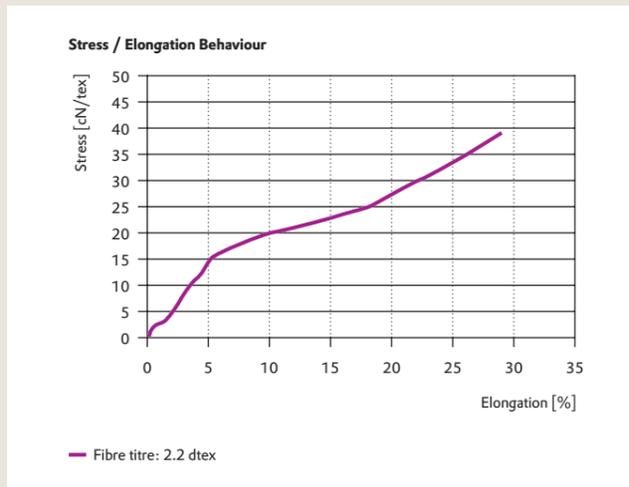
P84® Fibre Characteristics

Tenacity (dry)	38 cN/tex	4.3 g/den
Elongation	30 %	
Shrinkage (@240 °C, 15 min.)	< 3 %	
Density	1.41 g/cm ³	88 lb/ft ³
Limiting Oxygen Index (LOI)	38 %	
Glass Transition Temp. (T _g)	315 °C	599 °F
Moisture Gain at 20 °C (60 % rel. hum.)	3 %	

P84® FIBRE CHARACTERISTICS

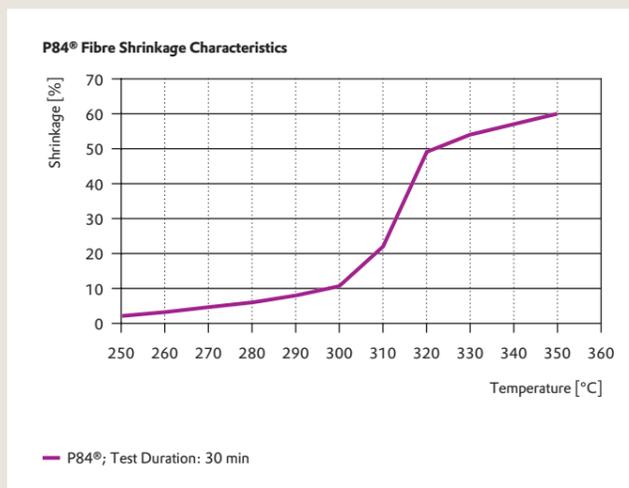
P84® STRESS / ELONGATION BEHAVIOUR

As P84® fibres show a typical textile character the fibre can be processed on standard carding and needling equipment. According to the data, which show a low modulus and a relatively high elongation, P84® is very well suited for textile applications and can be processed using standard textile equipment. The irregular lobed cross section and the crimp are responsible for the bulkiness and the volume of the fibre.



P84® FIBRE SHRINKAGE CHARACTERISTICS

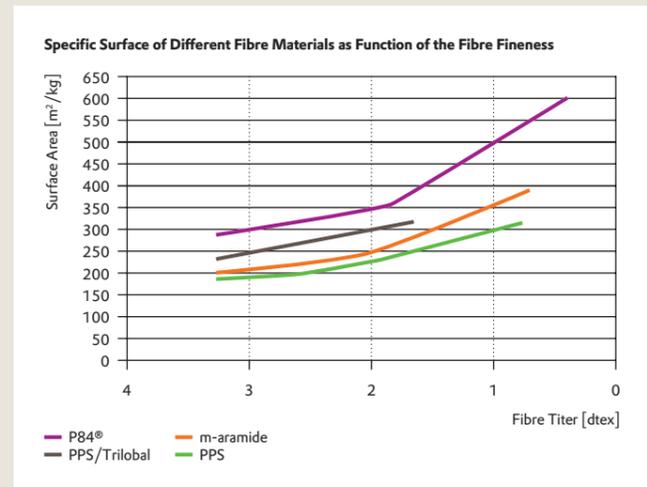
During the manufacturing process, the fibres are stretched and the polymer molecules are getting oriented to a certain extent. When exposing the fibres to temperatures near the glass transition temperature, a reorientation of the molecules takes place and the fibres shrink. The diagram shows the significant increase of the shrinkage after 30 minutes exposure at 315 °C (599 °F) and beyond.



SPECIFIC SURFACE AREA

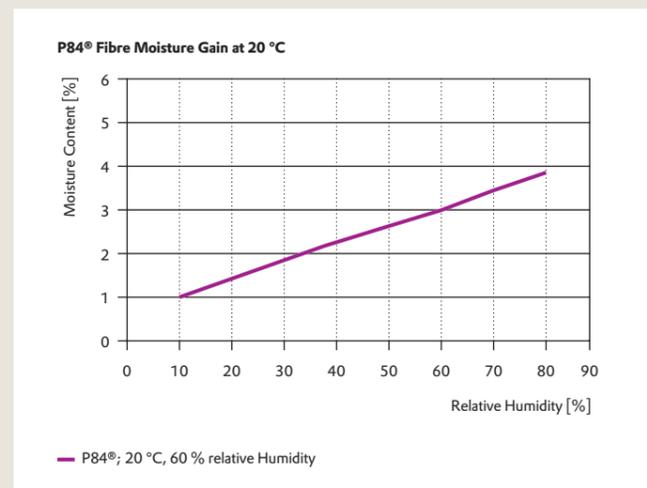
The large surface area primarily depends on the cross section and on the fibre titer (fineness).

All other fibres with same titer do not meet the specific surface area values of P84®.



P84® FIBRE MOISTURE GAIN AT 20 °C

At standard conditions of 20 °C (68 °F) and 60 % relative humidity, the moisture gain of P84® fibres is 3 %.



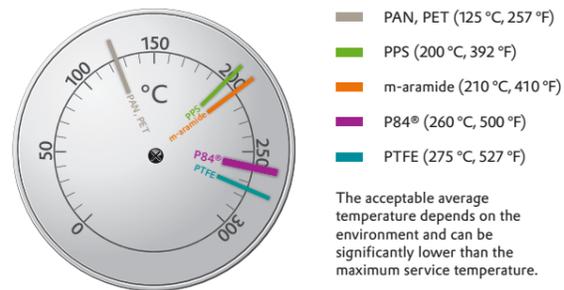
P84® FIBRE CHARACTERISTICS

SERVICE TEMPERATURES

The aromatic backbone ensures temperature stability over a wide range of operating conditions. The peak temperature for the P84® fibre is limited to 260 °C. This is well below the glass transition temperature of 315 °C. Chemical decomposition starts beyond 450 °C without formation of significant amounts of harmful substances. The acceptable average temperature

in the actual application depends on the composition of the environment and the expected service life.

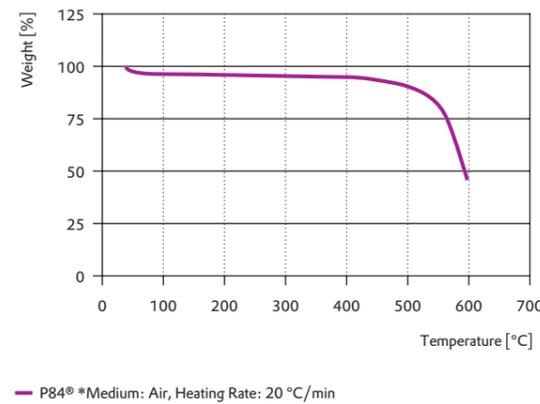
Max. Service Temperatures of Different Fibre Materials



SHORT TERM TEMPERATURE STABILITY OF P84®

When exposed to high temperatures, P84® degrades the same way as many other organic polymers, leaving a carbon structure. However, the decomposition temperature is extremely high, as shown in the diagram.

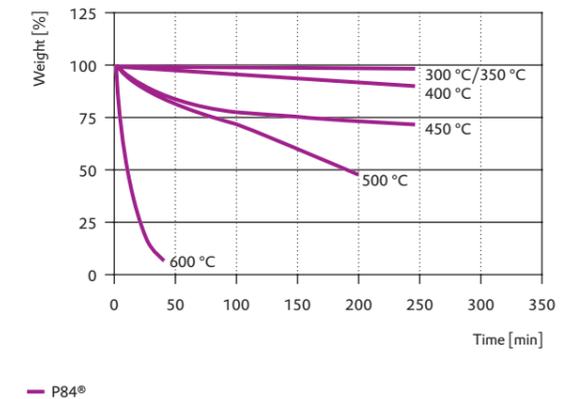
Short Term Temperature Stability of P84®



P84® FIBRE ISOTHERMAL WEIGHT LOSS

The weight loss of P84® is recorded versus time at different temperatures. Up to a temperature of 350 °C (662 °F) the weight loss is below 3 % and corresponds to the moisture content of the fibre.

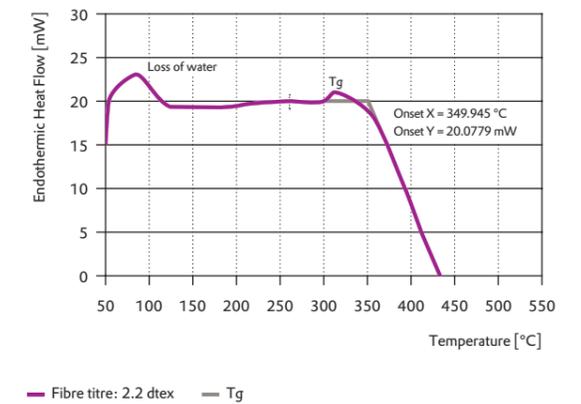
P84® Fibre Isothermal Weight Loss



DIFFERENTIAL SCANNING CALORIMETRY (DSC) - DIAGRAM OF P84® IN AIR

This diagram shows, whether a material consumes or generates thermal energy during a defined temperature program. Especially changes of the structure and melting temperatures can be detected by using this method. P84® has no peaks indicating crystalline regions or melting behaviour, only a glass transition temperature is observed.

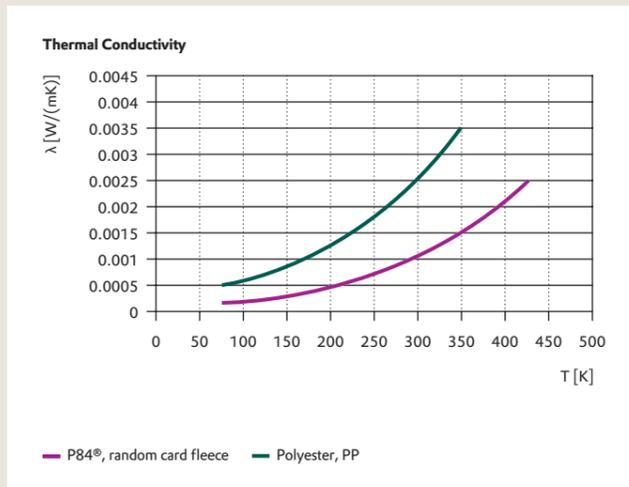
Differential Scanning Calorimetry (DSC) - Diagram of P84® in Air



P84® FIBRE CHARACTERISTICS

THERMAL CONDUCTIVITY

The very low thermal conductivity of P84® fibres is used to design fleece constructions for insulating cryogenic processes.



CHEMICAL PROPERTIES OF P84®

P84® provides good chemical stability to all common solvents, such as alcohols, ketones, chlorinated hydrocarbons and a wide range of other chemicals. It also offers high resistance to fats, oil and fuel. In addition, P84® fibres have a proven record of good resistance in a broad range of the pH-scale.

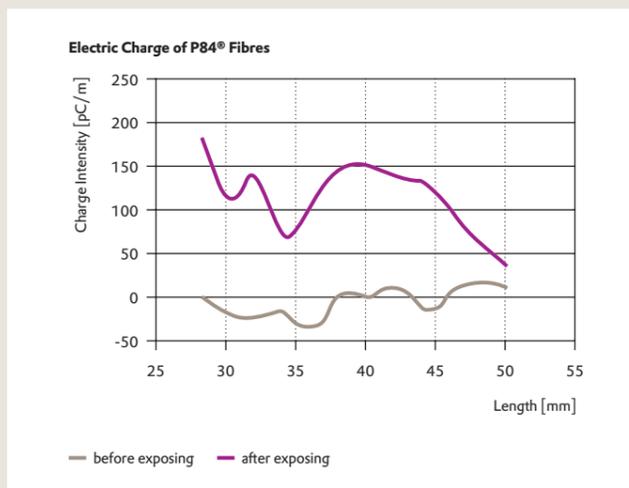
Chemical Properties of P84®

Chemicals	Concentration [%]	Temp. [°C/°F]	Time [hrs.]	Effect on tenacity
Sulphuric acid	10	20/68	100	no
Nitric acid	10	20/68	100	no
Hydrochloric acid	20	50/122	24	minimal
Hydrobromic acid	37	20/68	100	no
Hydrofluoric acid	40	20/68	100	no
Acetone	100	20/68	1000	no
Benzene	100	20/68	1000	no
Perchloroethylene	100	70/158	168	no

no = 0 to 15 % Loss in tenacity, minimal = 16 to 30 % Loss in tenacity

ELECTRIC CHARGE OF P84® FIBRES

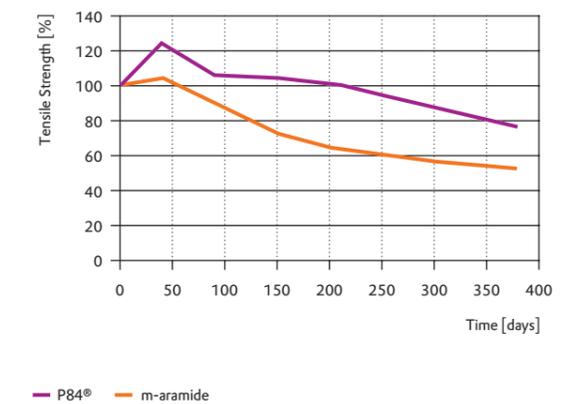
The diagram shows the electric charge along the length of a P84® fibre before and after exposing to an electric field using a corona charge of 20 kV. All fibres have either positive or negative charges due to functional groups of the polymer and electrostatic excess charges.



OXIDATIVE AGING

Fibres exposed to air at high temperatures are deteriorated by oxygen. The experimental results shown in the chart were carried out at 210 °C (410 °F) and show superior performance of P84® compared to m-aramides.

Loss of Tensile Strength of Needle Felts due to Oxidative Aging

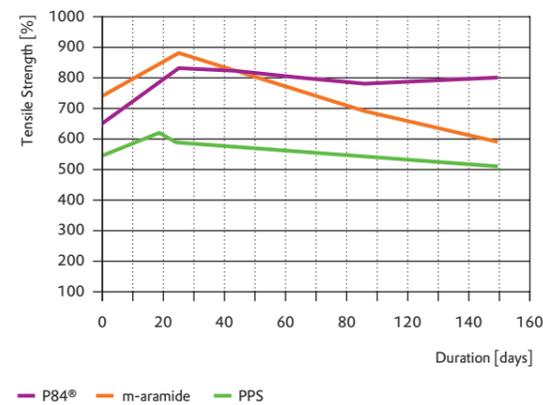


P84® FIBRE CHARACTERISTICS

HYDROLYSIS STABILITY

Even at extremely high moisture contents, P84® outperforms many of its competitors available for high temperature filtration applications.

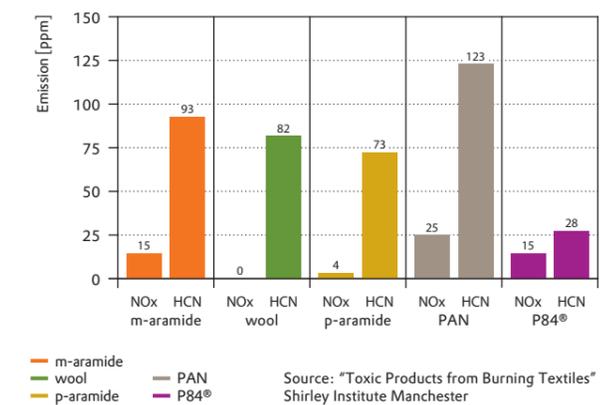
Hydrolysis Stability of Filter Fabrics @ 50 vol % Moisture, 170 °C



EMISSION OF TOXIC GASES DURING DEGRADATION

Testing performed by the Shirley Institute demonstrated that P84® fibres generated the lowest emissions of toxic HCN (cyanic acid) gas. Actual emissions depend on environmental conditions, like available oxygen.

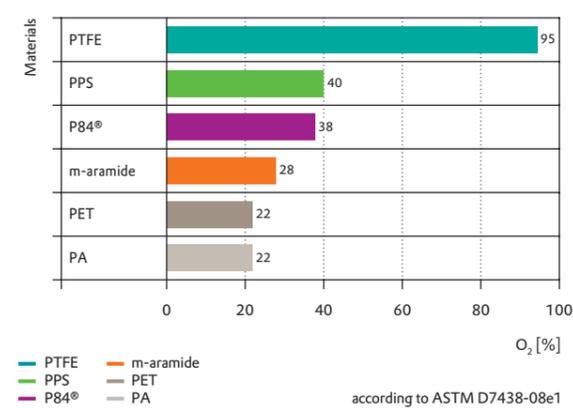
Emission of Toxic Gases during the Degradation of Fibres



LIMITING OXYGEN INDEX (LOI) OF FIBRES

The LOI indicates the level of oxygen needed to keep the material burning after ignition. P84® is classified as non flammable in atmospheric conditions.

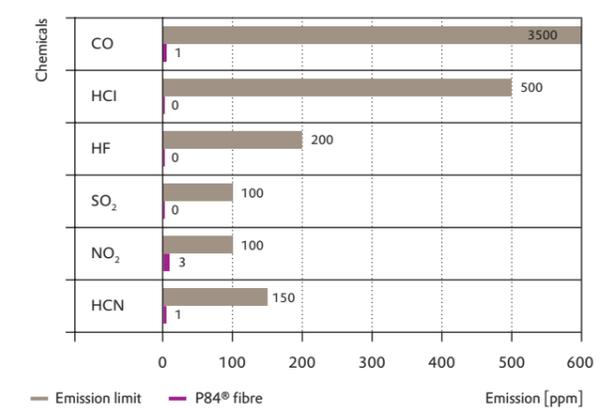
Limiting Oxygen Index (LOI) of Fibres



TOXIC EMISSIONS

According to ATS 1000.001 which limits the toxic emissions for aircraft interior, P84® shows excellent performance.

Toxic Emissions acc. to ATS 1000.001 or BSS 7239



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