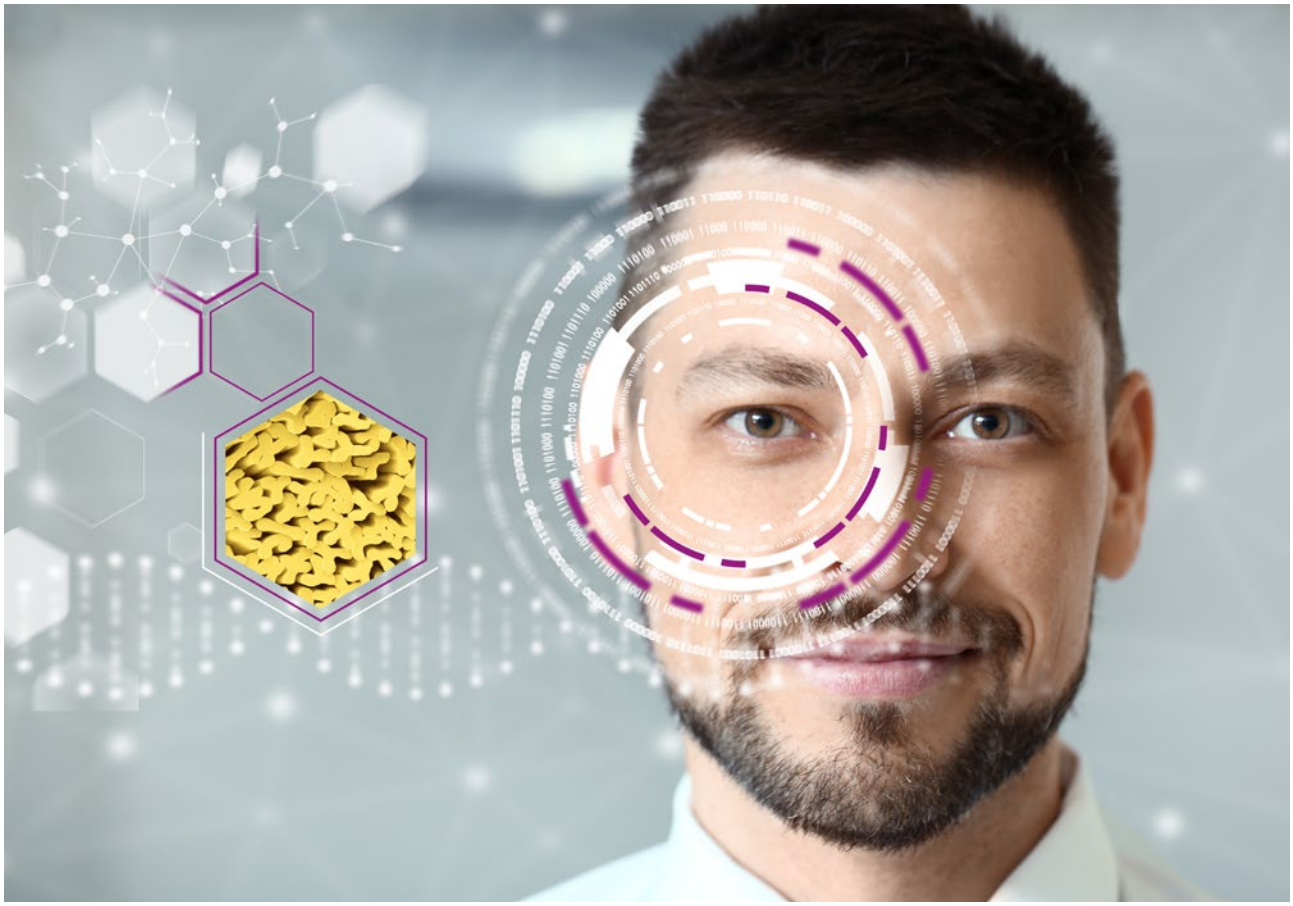
P84®

Focus on P84®

Top performance polyimide fibres



EVONIK
Leading Beyond Chemistry

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Properties and applications

Product range

P84®

Staple fibre

Multi filament

P84® HT

P84® fibre product range

Unique cross section offers outstanding properties

P84® and P84® HT are available as multifilament and staple fibre with different fineness and cut length. The irregular cross section and high specific surface area of both P84® qualities are beneficial in several applications. From high efficiency exhaust gas filtration to light weight materials for sound absorption and thermal insulation. With special cut lengths, starting at 2.5 mm, Evonik can supply the right quality for various applications: composites, paper, woven and non-woven materials.

PRODUCT RANGE

P84® and P84® HT Staple fibre	
Available types (dtex)	1.0, 1.3, 1.7, 2.2, 3.3, 5.5
Cut tenghts (Standards)	53, 60, 80 mm
Special cut lenghts	2.5 – 120 mm
Bales	1.0 dtex up to 1.7 dtex = 150 kg 2.2 dtex up to 5.5 dtex = 200 kg
Colour	natural golden yellow

P84® and P84® HT Filament yarn	
Available types	1060 dtex, 480 single threads
Twist	80 t/m and 130 t/m
Packaging	12 cones, 3.5 kg each
Colour	natural golden yellow

High temperature filtration

There is no magic behind filtration

There is only P84®

P84® applications in dry filtration

Unique performance in filtration efficiency

CEMENT

- Suitable for high dust load
- Performing also at increased air to cloth ratio (ACR)

WASTE TO ENERGY

- Consistently low emissions
- Not sensitive to HF, bromine, unburnt hydrocarbones

POWER

- Tough enough for high ash coals and upset conditions
- High plant availability

METALLURGIC & GLASS

- P84® blends with various fibres – the tougher alternative to PTFE membrane
- Service for material selection and performance evaluation

P84® applications in dry filtration

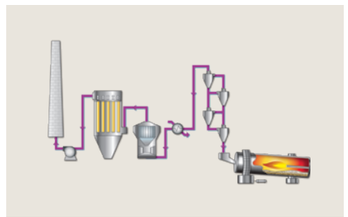
Performing under challenging conditions

CEMENT

Changing flue gas conditions are caused by using a variety of fuels, as well as switching the kiln filter from direct mode to compound mode. High CO and Volatile Organic Compounds (VOC) values can be generated by the extensive use of secondary fuels in the precalciner. The partly abrasive dust is a crucial parameter for the filter media in terms of delamination. Because of the high alkaline content, the bypass filter is a true challenge for the filter media.
The ever increasing demand for higher cement quality is a challenge for the grinding system and the high amount of fine dust requires a highly effective filter media.

Therefore P84® based filter media can be found in following filter units of a cement plant.

Kiln filter:
P84®
Clinker mill filter:
P84® blended with PET and PAN
Alkali bypass filter:
P84®/PTFE blends
Clinker cooler filter:
P84®

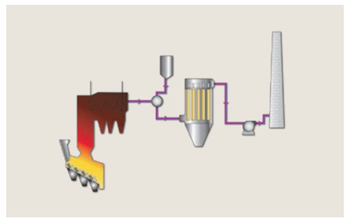


WASTE TO ENERGY

Increased dust emissions are an absolute disaster for a WTE plant. Inhomogeneous fuel quality requires a highly flexible flue gas treatment system, including the bag filter unit being the barrier for all solid substances.
Due to its filtration performance, P84® based filter bags are used in all common process variations of flue gas treatment systems of WTE plants.

The main benefits are a low and stable residual pressure drop and long filtration cycles. High collection efficiency is achieved for fine particulate also. This ensures low emissions and an efficient use of the absorbent.

Where are P84® based filter media installed?
In the main filter unit of semi dry and conditioned dry sorption systems.
In the primary or tail end filter unit of 2 stage wet scrubbing systems.



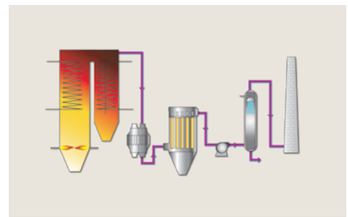
POWER

Flue gas treatment systems are a necessary component of energy plants. In order to keep the overall performance high, the energy consumption of the FGD plant has to be low. P84® based needle felts are known to ensure low emissions and a stable pressure drop of the filter plant.

When using biomass, the operation load of the plant varies in a wide range. Operation at low boiler load sometimes causes high values of unburnt hydrocarbons and temperature fluctuations.

The design of the flue gas treatment system can be different. The bag filter can be operated without neutralisation of acidic components, or the desulphurisation unit is downstream of the filter unit, like it can be found in most coal fired boiler systems.

Further it can be combined with the filter unit. This is done by using a dry sorption system, which is common for biomass fired plants. No matter how the FGD system is designed, P84® is suitable to be at least one of the basic components of the filter media.



METALLURGIC & GLASS

A wide range of operating temperatures and the presence of explosive environments are the characteristics of flue gases in the steel industry. Covering temperature peaks up to 260 °C and having a limiting oxygen index of 38 %, P84® is capable to deal with sparks, varying oxygen contents and high temperatures.

The glass transition temperature of 315 °C ensures the physical integrity of the fibre, even when the temperature limits are exceeded. Volume flows change due to the discontinuous operation of many processes. P84® prevents from dust penetration if the A/C ratio or the dust load reach peak values.

Metallurgical Processing
Whenever filtration processes are realized at elevated temperatures, P84® is a viable option. Due to its combination of physical and chemical performance, P84® is the superior fibre for a wide range of applications. Further, P84® is the ideal partner in blends with other fibres, whenever another base material is used for technical or economical reasons.

Filter bag performance analysis

Filter performance analysis

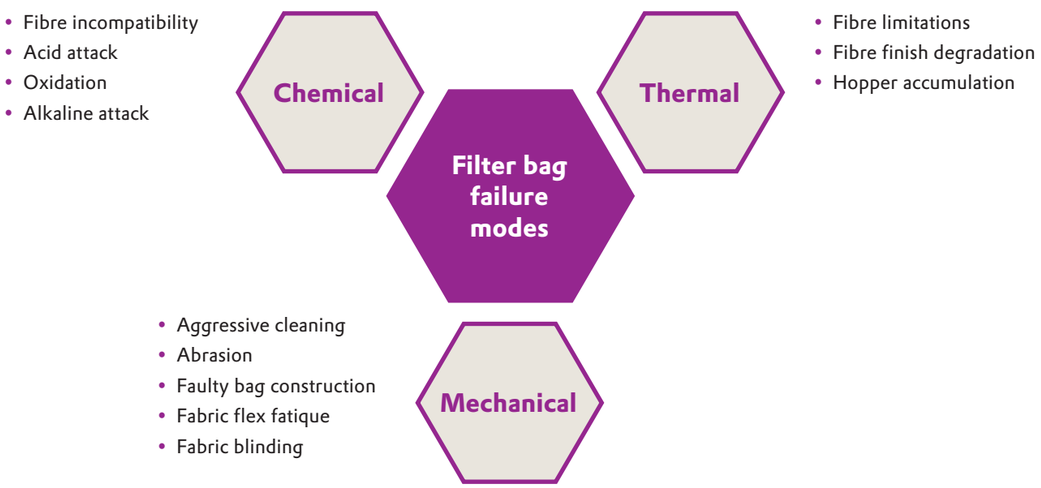
Offering outstanding services

Bag condition monitoring by conduction of lab investigations of used bags is a useful tool to get information on:

- The performance and remaining life of filter bags
- Beginning damage and failure patterns of filter bags.

The analysis is splitted into several sections covering the physical performance such as strength of the material, air permeability as well as the chemical condition of the base material.

All aspects of a lab investigation offer an overview of the actual bag performance or give indications of the failure mechanism.



BASIC ANALYSIS PACKAGE

Basic package includes the fundamental mechanical inspection of the filter bags.

This contains the visual inspection, air permeability, pH measurement and the mechanical properties of the felt material.

The basic package includes:

- Visual inspection
- Air permeability measurement (as received / simulated pulse cleaning / washed)
- Weight per area (as received / washed)
- pH measurement of dust
- Tensile strength testing

ADVANCED ANALYSIS PACKAGE

Advanced package includes all the examinations from the Basic Analysis.

Additionally, it encompasses filtration technical investigations such as microscopy (fiber cross sections and felt cross sections) as well as a detailed chemical analysis of polyimide materials (HPLC)

The advanced package includes:

- **Basic package**
- Taking microscopic images of the felt cross section (top, middle and bottom section) to assess the level of dust penetration
- High magnification microscopic images of the fibre cross section to identify the type of fibres forming the felt (ie. P84® multilobal vs. Chinese PI)
- HPLC – Hydrazinolysis (High Pressure Liquid Chromatography)

PREMIUM ANALYSIS PACKAGE

Premium package includes a wide range of insturmental analysis, which may be required by different media.

The subsequent report will not only explain the root cause of possible failure but also predict the resiudal bag life.

The premium package includes:

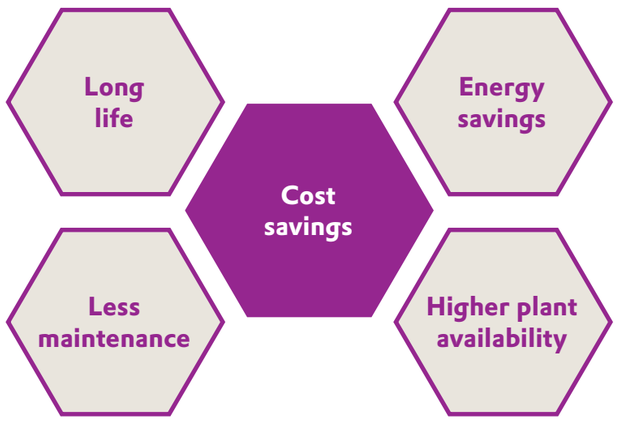
- **Advanced package**
- DSC (Differential Scanning Calorimetry)
- FTIR (Fourier Transform Infrared Spectroscopy)
- PSD (Particular Size Distribution)
- Fibre identification / determination of P84® content

Cost savings

Cost savings in high temperature filtration

Uncover the potential of P84®

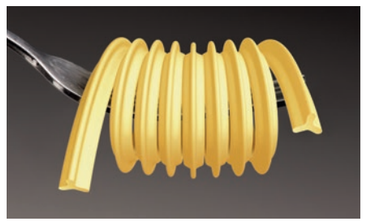
The ID-fan power is one of the main cost factors for operation of a bag house and may even exceed the annual costs for filter bags. The bag material is influencing the pressure drop (and therefore ID-fan power) to a high degree. Evonik can provide an estimate of the full costs of ownership case by case. The choice of the right filter media can save more than the costs of a new set of bags during the life of the filter bags. Invest in future savings with P84®.

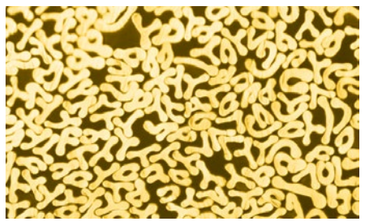


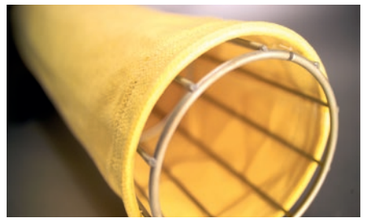
What can pasta teach us about filtration?

The profile makes the difference

P84® filter bags ensure the best filtration performance. The unique multi-lobed P84® fibre shape maximizes the filter surface and minimizes emissions and pressure drop.







P84® HT fibres

Advanced protection for life's toughest challenges

Trust P84® HT fibres to keep you cool, comfortable, and focused on the task at hand.

The unique multilobal profile of **P84® HT** fibres found in protective hoods and other undergarments has an amazing ability to allow skin to breathe while fighting intense heat battles. It allows air to flow freely, supporting your body's natural cooling system and reducing the threat of dangerous heat stress for firefighters and other extreme temperature environment professionals.

P84® HT unique fibre profile offers many product advantages.

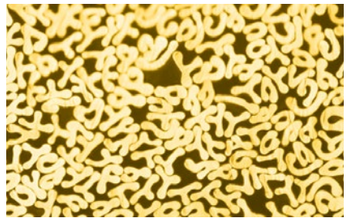
P84® HT FIBRE CHARACTERISTICS

The innovative **P84® HT** fibre is a non-melting polyimide based fibre with an exceptional thermal stability, based on the unique multilobal cross section & the aromatic backbone of the polymer.

Additionally, with a remarkable LOI of 38%, these halogen-free fibres are classified as non-flammable, making them the perfect choice for applications where safety is a top priority.

P84® HT multilobal shape

- Unique irregular cross section for excellent thermal insulation
- Soft-touch
- Non-melting



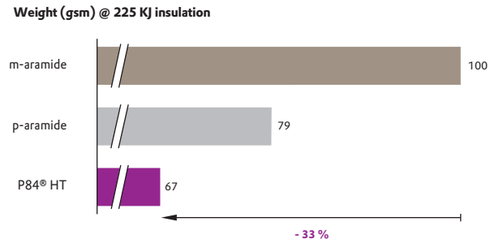
ÖKO-TEX® 100 certified

- No skin irritation
- Halogen free

OEKO TEX® STANDARD 100 VN004 185153 OETI www.oeko-tex.com

Special industrial applications

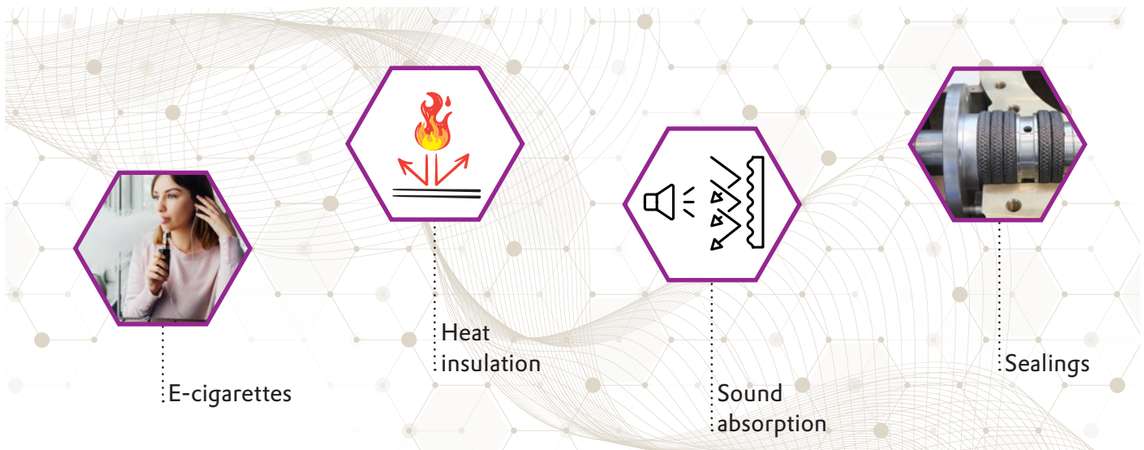
ADD COMFORT, PROTECTION AND REDUCE WEIGHT



Your job requires you to do heavy lifting. Your protective gear should not. Allow **P84® HT** fibres to protect you & get maximum insulation at the lowest weight.

In addition, **P84® HT** is comfortable to the touch. Enjoy thermal protection superior to aramide fibres at almost 33 % less weight!

P84® HT FIBRE APPLICATIONS



P84® fibre characteristics

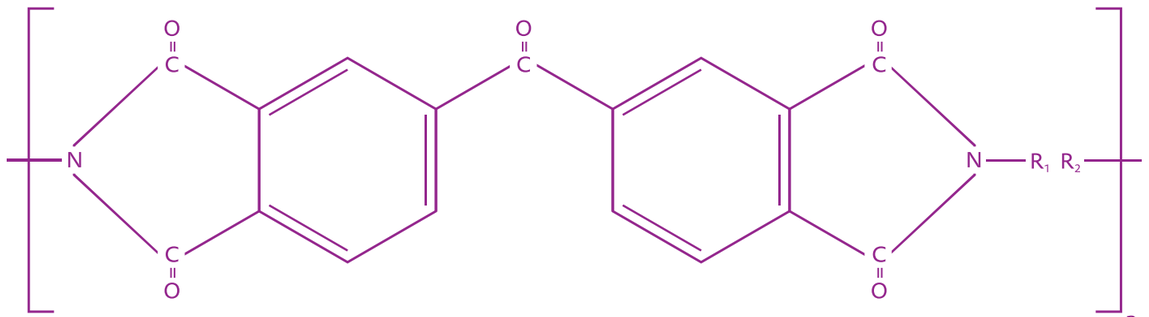
Unique properties for demanding applications

CHEMICAL STRUCTURE

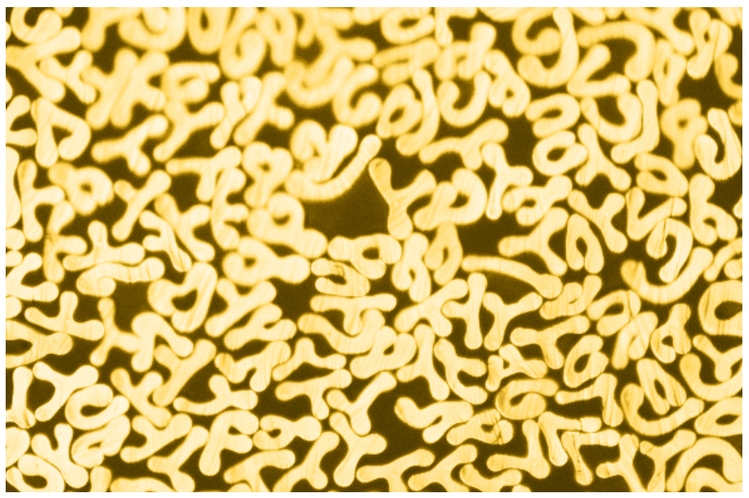
The P84® fibre is a polyimide based fibre with a typical textile character. Polyimides are known to be used in a wide range of operating temperatures starting from cryogenic applications and ending at high temperature applications at the limits of polymer based materials.

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.

P84® fibre technical data

P84® AND P84®HT FIBRE CHARACTERISTICS

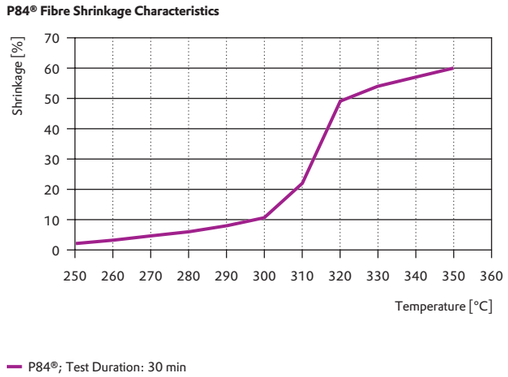
P84® and P84®HT Fibre characteristics	P84®		P84® HT	
Tenacity (dry)	38 cN/tex	4.3 g/den	38 cN/tex	4.3 g/den
Elongation	30 %		30 %	
Shrinkage (15 min.)	< 3 % @ 240 °C		< 3 % @ 270 °C	
Density	1.41 g/cm³	88 lb/ft³	1.41 g/cm³	88 lb/ft³
Limiting oxygen index (LOI)	38 %		38 %	
Glass transition temp. (Tg)	315 °C	599 °F	380 °C	716 °F
Moisture gain at 20 °C (60 % rel. hum.)	3 %		3 %	

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

P84® STRESS / ELONGATION BEHAVIOUR

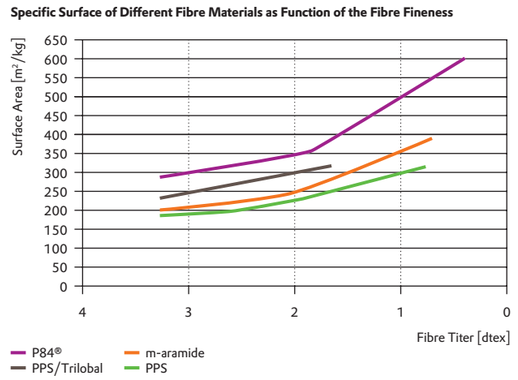
P84® fibres show a typical textile character with a low modulus and a relatively high elongation. Therefore P84® fibre can be processed on standard carding and needling equipment. The irregular lobed cross section and the crimp are responsible for the bulkiness of the fibre.

P84® FIBRE SHRINKAGE CHARACTERISTICS



During the manufacturing process, P84® fibres are stretched and the polymer molecules are getting oriented. When exposed to temperatures near the glass transition temperature, a reorientation of the molecules takes place and fibres may shrink.

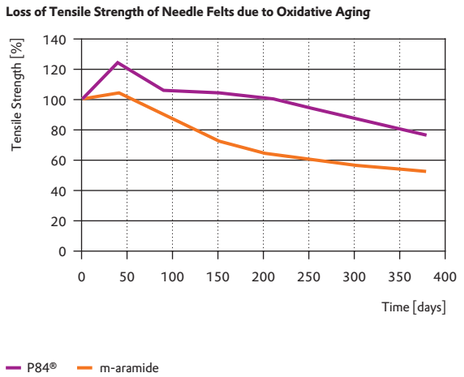
SPECIFIC SURFACE AREA



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

P84® specific surface area outperforms all other fibres with same titer.

OXIDATIVE AGING

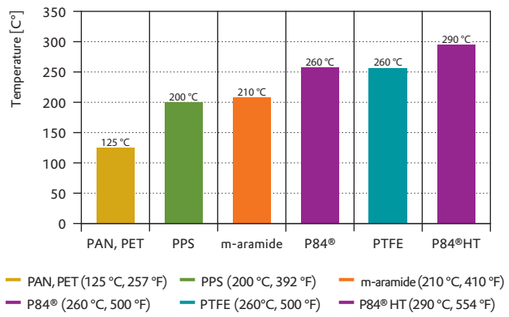


Fibers exposed to air at high temperatures are deteriorated by oxygen. The results shown in the chart were obtained during tests carried out at 210 °C (410 °F).

P84® fibres show a superior performance compared to m-aramids.

SERVICE TEMPERATURES

Max. Service Temperatures of Different Fibre Materials

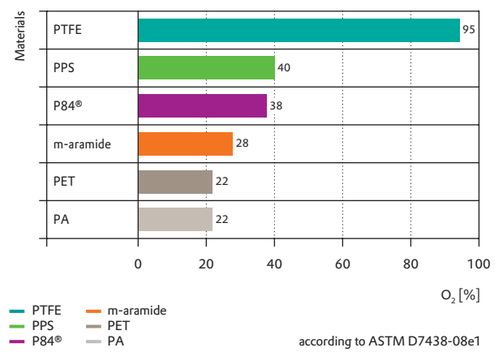


The acceptable average temperature depends on the environment and can be significantly lower than the maximum service temperature.

The peak temperature for the P84® fibre is 260 °C. This is well below the glass transition temperature of 315 °C. P84®HT withstands a peak temperature of 290 Celsius thanks to its 50 °C higher glass transition temperature. The acceptable average working temperature of fibres depends on the operating environment and the expected service life for a given application.

LIMITING OXYGEN INDEX (LOI) OF FIBRES

Limiting Oxygen Index (LOI) of Fibres

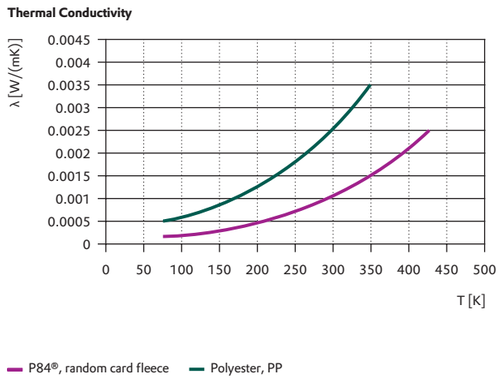


according to ASTM D7438-08e1

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

INSULATION PROPERTIES

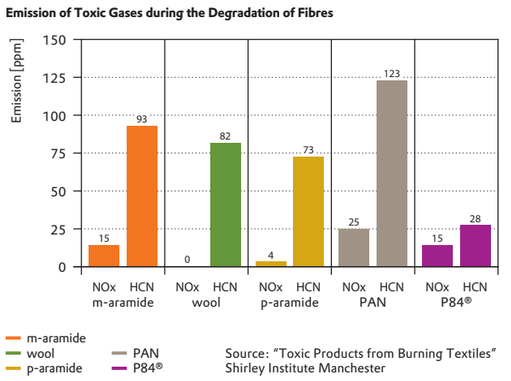
Thermal Conductivity



The very low thermal conductivity of P84® fibres makes it a suitable partner in a variety of special industrial applications such as: Insulating cryogenic processes and protective apparel.

EMISSION OF TOXIC GASES DURING DEGRADATION

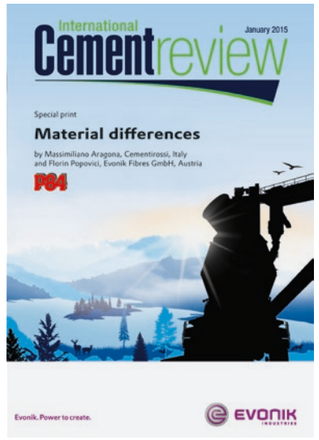
Emission of Toxic Gases during the Degradation of Fibres

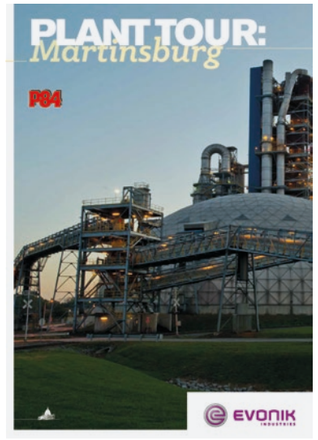


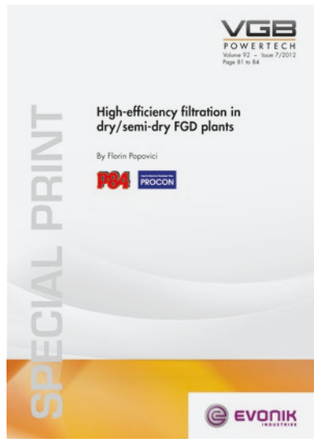
Source: "Toxic Products from Burning Textiles" Shirley Institute Manchester

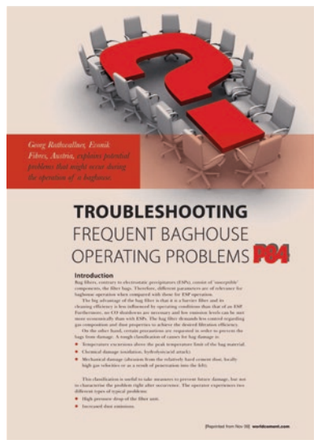
Testing performed by the Shirley Institute demonstrated that P84® fibres generated the lowest emissions of toxic HCN (cyanic acid) gas. Actual emissions depend on environmental conditions, like available oxygen.

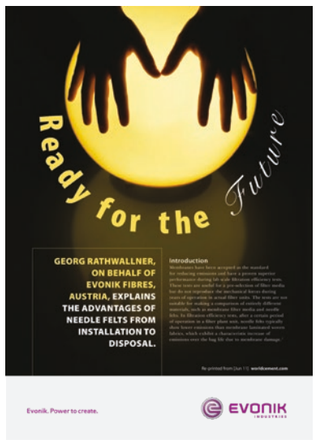
RELEASED ARTICLES ON P84® IN FILTRATION MAGAZINES



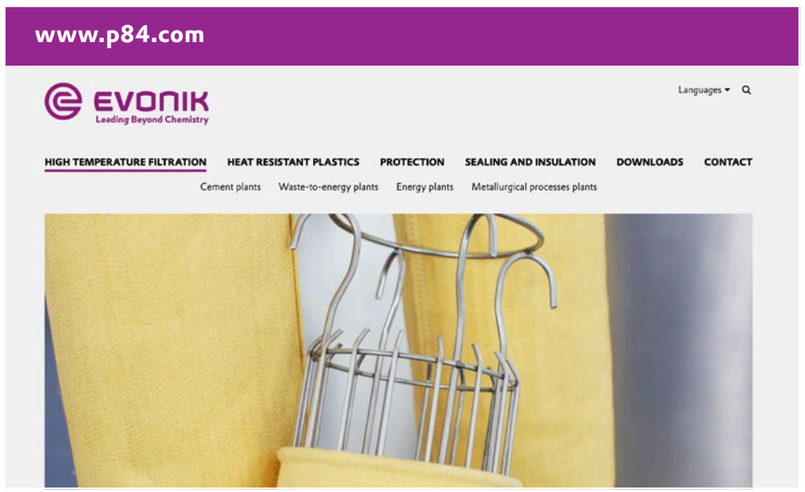




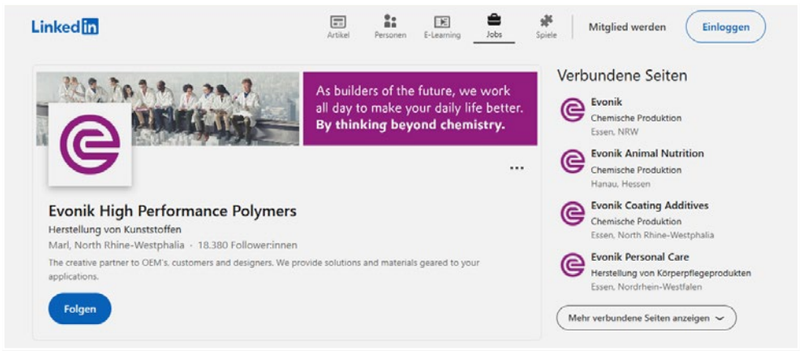




P84® WEBSITE



EVONIK ON LINKEDIN



LEGAL REFERENCES

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