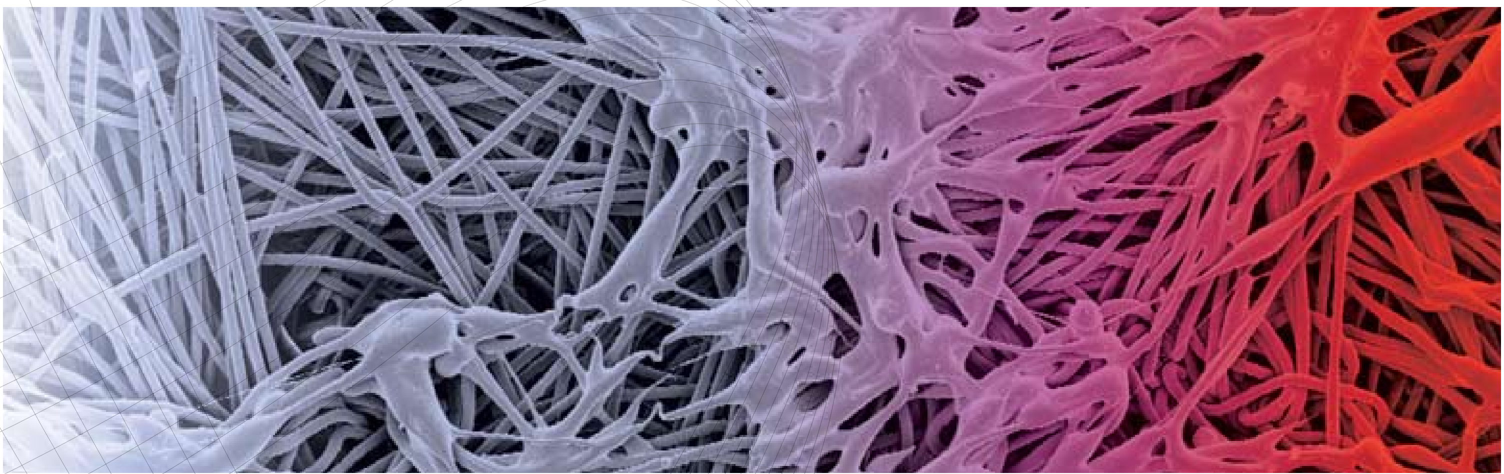
Pioneers in the filtration industry



Product Brochure

Andrew Webron Ltd

Corporate Overview Andrew Webron is a subsidiary of Andrew Industries Limited, a privately owned company with manufacturing bases in Europe, North America and China.

Head quarters based in the heart of Lancashire

Andrew Webron Limited is a leading European manufacturer of filtration media and associated technical textiles. Two manufacturing sites bring a combination of high speed manufacturing capability delivering consistent quality at competitive prices allied to smaller manufacturing lines that allow the manufacture of special qualities in smaller quantities.

Recent investments in plant and equipment ensure Andrew Webron Limited offer quality, quantity and competitive prices on all fibre types from polyester through to PTFE. Further investments for 2008-09 include a fourth high speed line, adding capacity for an additional 50,000 linear metres per week.

Formed in 1894 Andrew Industries Limited have been pioneers in the manufacture of technical textiles for dust filtration, laundry and business machine parts.

The group employ in excess of 1200 people globally with Andrew Webron accounting for 156 staff on its 3 UK sites.

Revenues for Andrew Industries Limited in 2007 were $250million, significant investment plans for state of the art manufacturing equipment within Andrew Webron Limited during 2008-09 include a high speed line to compliment existing capability whilst increasing capacity.

Contents

Filter Media Selection

FIBRE	COMMENTS
Polypropylene	Polypropylene exhibits excellent resistance to acids, alkalis and hydrolysis, but is susceptible to attack from oxidising agents such as H_2O_2.
Homo polymer acrylic	Good resistance to acids, alkalis and hydrolysis, but not physically strong
Polyester	Sensitive to hydrolysis brought on by moisture, particularly in the presence of acids and alkalis
PPS	The biggest weakness of PPS is oxidising agents with high temperature, the higher the temperature, the lower the O_2 level must be. It almost behaves like a high temperature polypropylene.
Meta aramid	Susceptible to hydrolysis, particularly in hot acid environments such as power generation, but is often used in "inappropriate" applications where it can be cost effective.
Polyimide	Similar weaknesses to meta aramids, but exhibits them at up to around 30 degrees hotter.
PTFE	Chemically the best fibre, has few limitations, almost always withstands the environment.

There cannot be a definitive guide to selecting the correct filtration media, a wide range of parameters must be taken into account, amongst other issues, the following all affect the choice:

- Temperature
- Humidity
- Chemistry
- Particle composition
- Size distribution and shape
- Static electricity
- Filter type

Looking at these in turn:

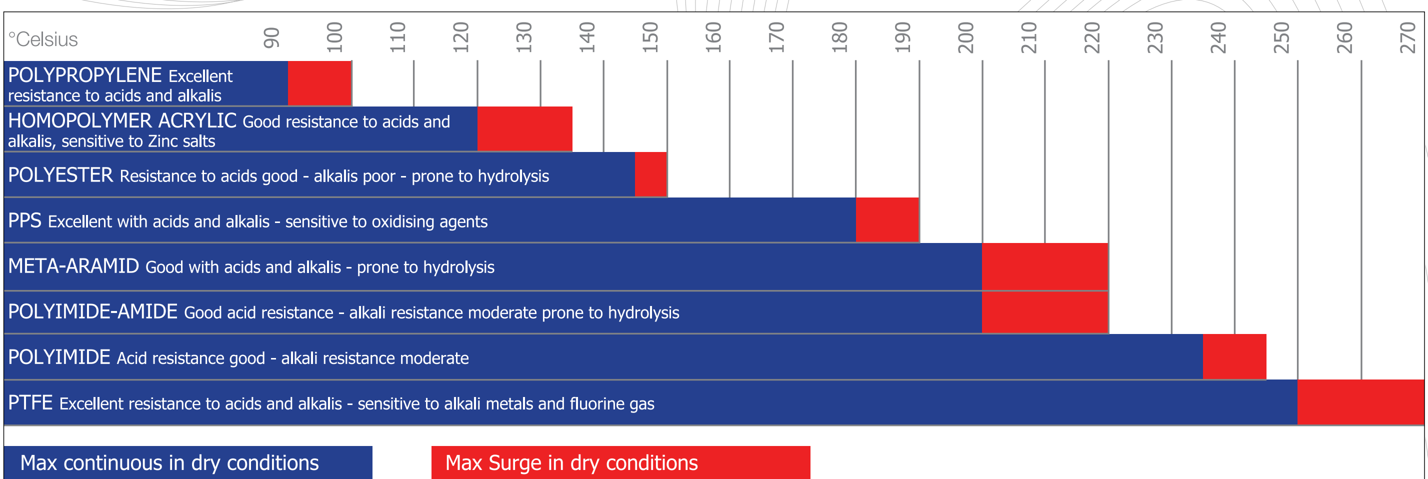
TEMPERATURE

Temperature is possibly the major media consideration (at the very least the starting point), this chart gives a basic break down of each medium and its dry operating range.

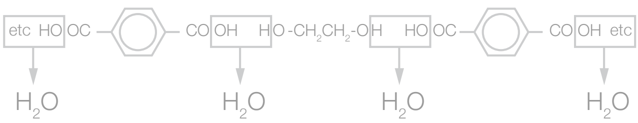
So, looking at PPS, the maximum continuous temperature we recommend is 180°C, with short term peaks (perhaps totalling 1 day a year) up to 190°C. It is important to recognise that PPS cannot be used in all applications at these temperatures as, in common with all media, it has chemical limitations which will frequently reduce the temperature it can tolerate.

HUMIDITY

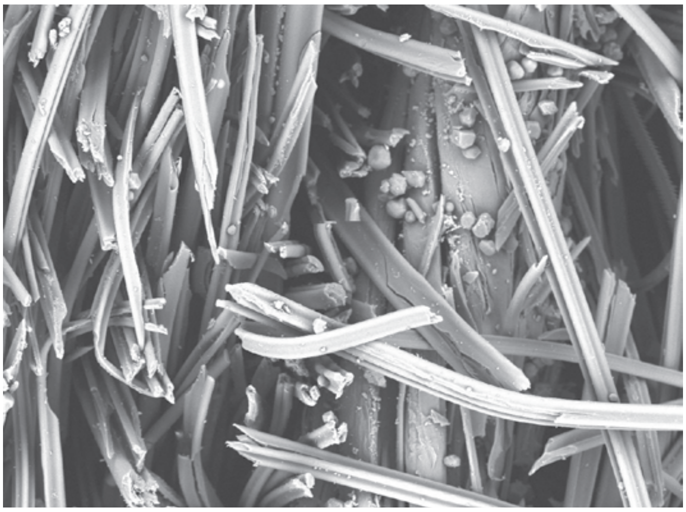
Humidity is also crucial as polyester and aramid fibres in particular, and to a degree imide fibres are susceptible to hydrolysis. In simple terms these polymers are made, by combining 2 small



molecules; as they combine, they produce water as a bi-product. In moist filters the water can re-open the chemical bonds recombining with the molecules to reform the original components. This is usually evident as the felt turns to dust. The following diagram shows how the chemicals come together during manufacture with the evolution of water. Hydrolysis is the reverse:

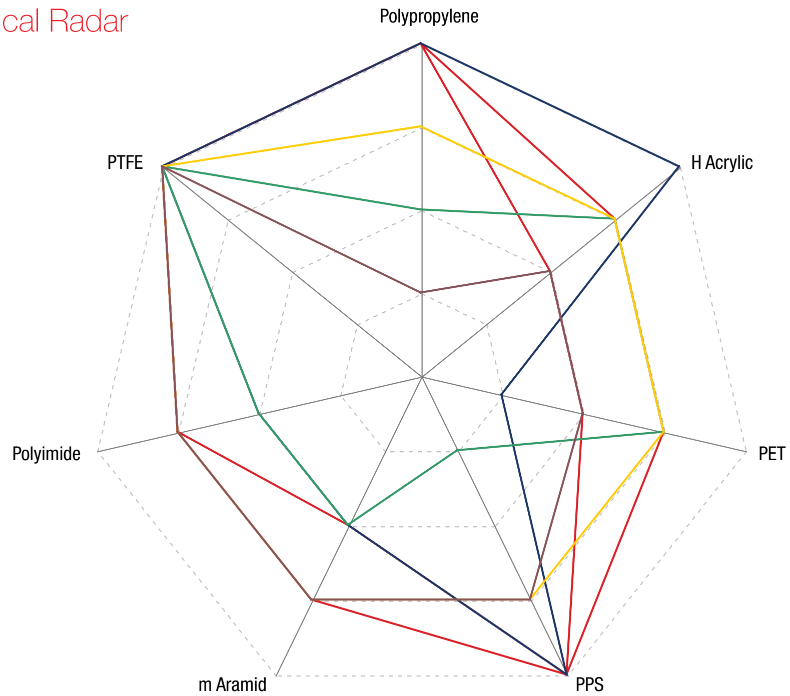


So if an application is running at say 110°C, then polyester would seem 'ideal', but if there is appreciable moisture present, it isn't suitable, and so we have to look for a fibre with comparable temperature tolerance but good water tolerance, which brings us to acrylic. Humidity is really just a specific case of chemistry; many chemicals react adversely with fibres causing premature failure.



This is P84 fibre that has hydrolysed.

Chemical Radar



	ACID	ALKALI	HYDROLYSIS	OXIDATION	SOLVENTS	TEMPERATURE
Polypropylene	4	4	4	2	3	1
H Acrylic	3	2	4	3	3	2
PET	3	2	1	3	3	2
PPS	4	4	4	1	3	3
m Aramid	2	3	2	2	3	3
Polyimide	3	3	2	2	3	3
PTFE	4	4	4	4	4	4

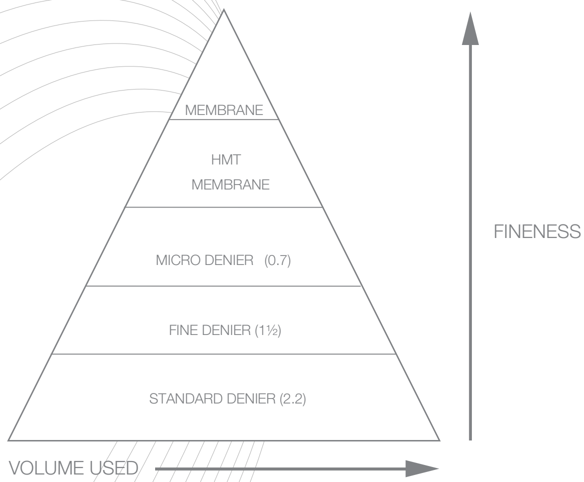
Filter Media Selection

There are many other considerations:

QUESTION	COMMENT
Does the dust agglomerate?	Easier to collect
Is the dust spherical or irregular or needle-like?	Spherical dusts are hard to collect so tend to use finer deniers or membranes
How fast is it moving?	The faster the air flow, the harder it is to collect the dust
Does it have a static charge?	Makes cake formation difficult anti-static felts can help
Is it greasy?	Can contaminate the medium use LR5
Is it damp?	Can cause premature blinding use LR5
Dust loading?	Too much and too little dust can be problematic. Membranes better with light loadings, heavy loadings sometimes use coarse deniers (accepting the high emissions as inevitable)
Abrasive?	Polyester is good, acrylic is poor
Particle size distribution?	A varied distribution can assist in cake development

PARTICLE SIZE AND SHAPE

Defines the denier of the felt or treatment as opposed to the type of fibre. It's an over simplification, but the finer the dust, the finer the fibre needs to be:



STATIC ELECTRICITY

Is a very serious consideration. Flour is possibly one of the best known examples of a dust which develops an explosive level of static electrical charge. In such situations it is normal to include electrically conductive fibres in the blend such as epitropic, copper sulphide or stainless steel. The ultimate protection comes with stainless steel fibres in the blend in conjunction with our grid scrim which guarantees a conductive path throughout the felt. Epitropic and copper sulphide have performance limitations such as hydrolysis and a maximum temperature around 100°C.

FILTER TYPE

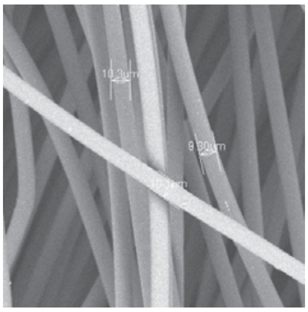
Determines the weight of felt. Generally speaking the older reverse air systems and shaker systems use lighter felts whereas pulse jet system tend to be more than 500 g/m².

Denier

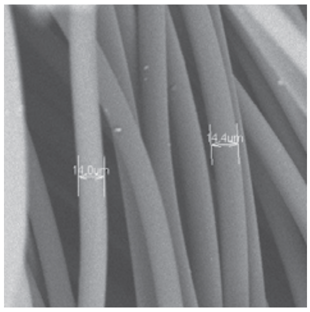
The majority of filtration applications are relatively simple, and so tend to use standard textile fibres such as 2¼ denier polyester. 1 Gram of a 1 denier fibre has a length of about 9,000 metres. Similarly 2¼ grams of a 2¼ denier fibre also stretch to 9,000 metres. So, amazingly, a bale of a typical microdenier fibre (0.7 Denier) which weighs 200kg would stretch for 1,600,000 miles, that's 64 times round the planet.

So you can clearly see with finer fibres that the collection surface increases and the pore size decrease, both factors which enhance filtration efficiency.

The differences in fibre size can be clearly seen here:



0.7 Denier



2.2 Denier

The above information only applies to polyester, for example, a 0.7 Denier polypropylene would be 10.4 Microns with a pore size of 13 as opposed to 8.5 and 15 as in the table.

The following table illustrates how changing denier alters a felt: based on 500 g/m² polyester Fiberlox™ felt 1.8mm thick.

Denier	Fibre diameter microns	Length of fibre per m² of felt	Surface area of fibre per m² of felt	Mean pore size microns
0.7	8.5	3995 miles	171	15
1.5	12.4	1864 miles	116	22
2.2	15.0	1271 miles	96	27
6.0	24.8	466 miles	58	44

Fine Filtration

The various fibres which are available for filtration come in a range of diameters. Traditionally in the textile industry the term denier is used to define them. Effectively, 9000 metres of any 1 denier fibre, will weigh 1 gram. 9000 Metres of any 5 denier fibre weighs 5 grams etc.

Diameter (in microns) is related to denier:

$$\mu = 11.9 \sqrt{\frac{\text{Denier}}{\text{Fibre S G}}}$$

Here is a table which demonstrates how fibre diameters change with denier for various fibre types:

Diameter in microns compared with fibre type and denier

		DENIER						
FIBRE	SG	0.5	1	1.5	2.2	3	5	15
POLYPROPYLENE	0.91	8.8	12.5	15.3	18.5	21.6	27.9	48.3
ACRYLIC	1.15	7.8	11.1	13.6	16.4	19.2	24.8	42.9
POLYESTER	1.38	7.2	10.1	12.4	15.0	17.5	22.6	39.2
PPS	1.34	7.3	10.3	12.6	15.2	17.8	23.0	39.8
M ARAMID	1.38	7.2	10.1	12.4	15.0	17.5	22.6	39.2
POLYIMIDE	1.41	7.1	10.0	12.3	14.9	17.3	22.4	38.8
PTFE	2.3	5.5	7.8	9.6	11.6	13.6	17.5	30.4

So in terms of diameter a 1½ denier acrylic fibre is the same as a 3 denier PTFE.

Based on the above, if you consider any polyester filter felt at 500 g/m^2 it will contain 362 cm^3 of fibre, if the fibre is 2.2 Denier, then its length will be 2045 km. If it were produced from 1 denier fibre, the length would rise to 4500 km.

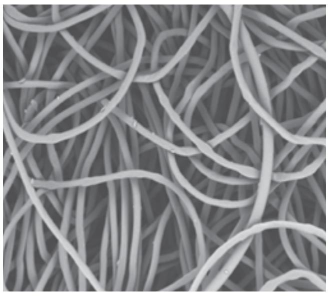
All this additional fibre length is contained in the same volume of felt and so the spacing between adjacent fibres must be smaller inside the finer denier medium. This is the first reason why finer denier fibres give improved fine dust collection. Quite simply the pores inside the felt are reduced in size so it is easier for the fibres to catch particles.

A second benefit is found because the total surface area of the fibres inside the felt increases as the denier is reduced:

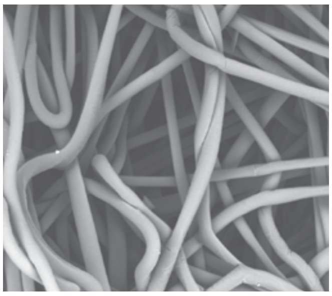
Surface area in square metres per 500 grams of fibre

		DENIER						
FIBRE	SG	0.5	1	1.5	2.2	3	5	15
POLYPROPYLENE	0.91	249	176	144	119	102	79	45
ACRYLIC	1.15	222	157	128	106	90	70	40
POLYESTER	1.38	202	143	117	96	83	64	37
PPS	1.34	205	145	119	98	84	65	37
M ARAMID	1.38	202	143	117	96	83	64	37
POLYIMIDE	1.41	200	142	116	95	82	63	37
PTFE	2.3	157	111	90	75	64	50	29

Halving the denier increases the fibre surface area by just over 40%. This isn't just a theoretical difference between materials as the following images show:



0.7 Denier



2.2 Denier

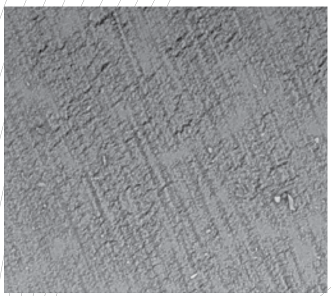
It is very evident that the distances between the fibres in the fine denier felt are smaller and that the structure is finer. Almost all routine filtration can be handled by 'normal' fibres (2 to 2½ denier). When higher efficiency or reduce emissions are specified, then it is normal practice to change the fibres to 1½ denier. Media as fine as 0.7 Denier are in regular use in demanding applications.

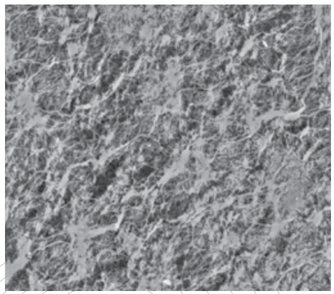
Fine Filtration

Andrew Webron Limited has a range of products designed to satisfy the BGIA specified performance levels. BGIA is a German Testing and Safety House which sets performance standards. They have performance levels, 'L' and 'M', the latter being more demanding. Our products include:

PRODUCT	CLASSIFICATION
MICROWEB I	M
MICROWEB MW2	M
T10T56239 (PX352P1G)	L
T12T56329 (PX401P1G)	L
T15T56329 (PX502P1G)	L
T15TS56309 (P0502SPS)	L
T16T56329 (PX552P1G)	L

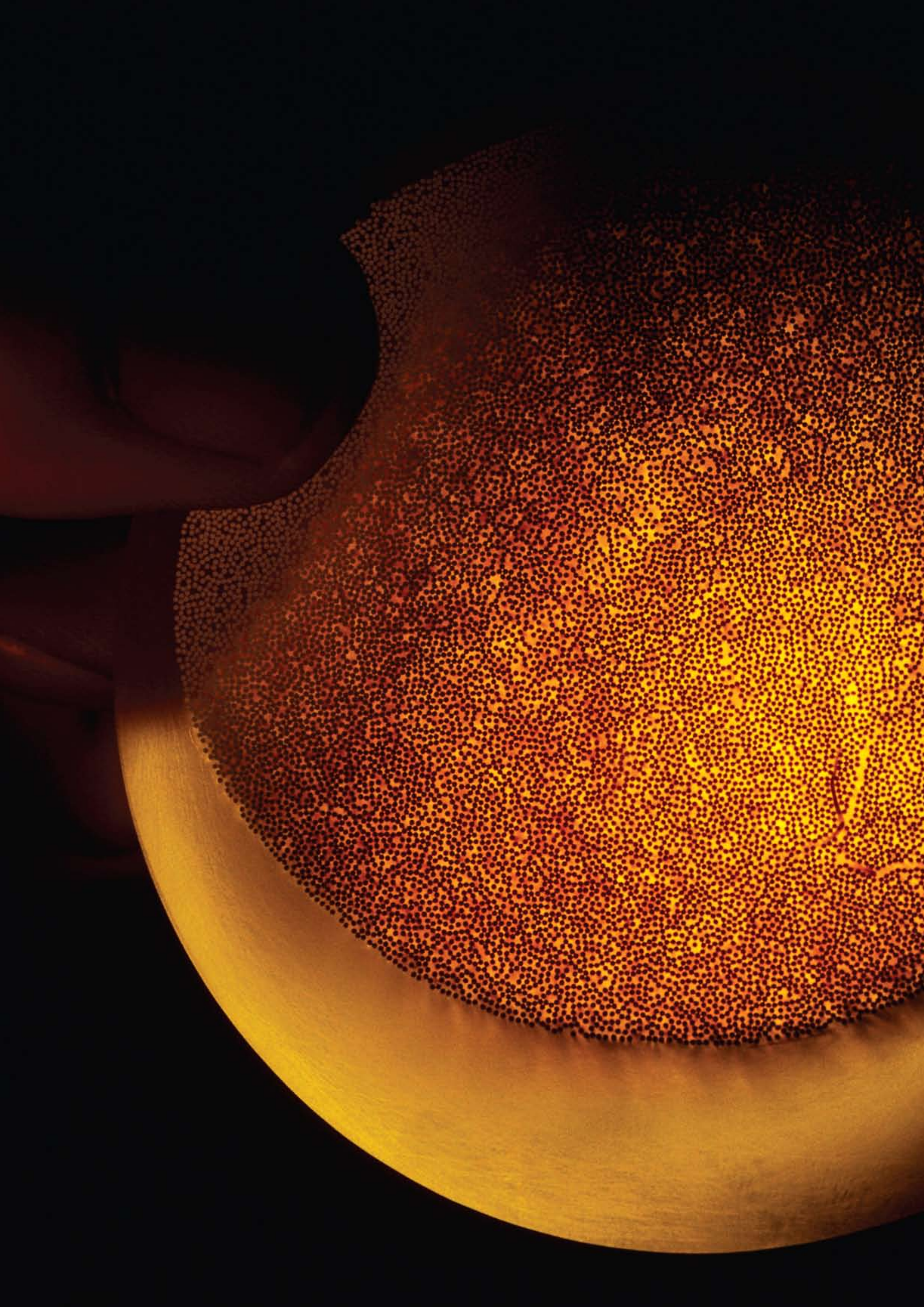
When the filtration demands are even higher, other options come into play such as membranes, on the left below is a picture of a PTFE membrane at the same magnification as the 2 felts pictured on page 9. On the right below is the same membrane material magnified a further 10 times:





The huge reduction in fineness is very clear. Typical applications for fine filtration are:

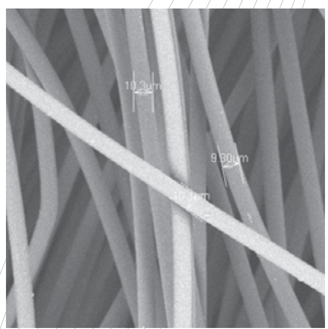
Combustion	Incineration	Pigments
Industrial Vacuums	Metal Processing	Coal
Food	Toxic Chemicals	Minerals



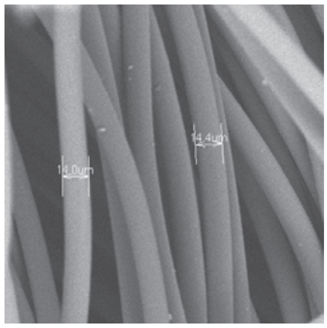
Polyester Filter Media

Polyester is the most versatile, most cost effective and most widely used filter medium for dust collection. It is strong, abrasion resistant, can work up to 150°C and has good resistance to common acids, solvents and oxidising agents.

Polyester's only real weakness is a tendency to hydrolyse at elevated temperature which means that moisture can break down the fibres and cause them to revert to their basic constituents. This results in powdering of the fibres and a serious loss of strength. Being a high volume fibre means that polyester filter felts can be produced from a wide variety of sizes from microdenier (typically 9 microns in diameter) up to 3 denier (18 microns). These finer deniers allow the collection of finer dusts (even sometimes replacing membranes) and/or the attainment of lower emission levels:



0.7 denier



2.2 denier

°Celsius	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290

STRONG ACIDS	WEAK ACIDS	WEAK ALKALIS	STRONG ALKALIS	SOLVENTS	OXIDISING AGENTS	HYDROLYSIS
FAIR	FAIR	FAIR	FAIR	GOOD	FAIR	POOR

Maximum Continuous in Dry Conditions

Maximum Surge in Dry Conditions

Many modest temperature applications are suited to polyester:

Nuisance dusts	Wood
Lead	Quarrying
Fertiliser	Metal processing
Grain handling	Tobacco
Cement	Ceramics
Vacuum cleaners	Flour
Plaster	Smelting
Polishing	Milk

Andrew Webron Limited pioneered the superglaze finish for polyester which now is the standard treatment for effective filtration. Other finishes can include singeing and calendering to modify properties such as permeability.

Chemical enhancements are common with polyester fibres, particularly LR5 which is a powerful oleophobic and hydrophobic finish. These felts can also be FR treated and can have surface and embedded foams added to further modify collection efficiency, for example, in the attainment of BGIA accreditation.

As polyester is essentially a 'plastic' it is prone to the build up of static charge because it doesn't dissipate electricity; so in applications where the dust may be explosive, conductive fibres can be added to reduce this risk. These range from epitropic fibres to copper sulphide to stainless steel.

Alternatively, we developed our range of checkstatic grid scrim products where conductive yarns are incorporated into the woven scrim. For the ultimate protection, we advocate our checkstatic grid scrim along with a small percentage of steel fibres intimately mixed with the polyester fibres.

Polyester particularly lends itself to the production of Fiberlox™ needlefelts. This innovative range of materials is produced on proprietary manufacturing equipment and obviates the need for a reinforcing scrim.

In conclusion, polyester is the workhorse of the dust filtration industry.

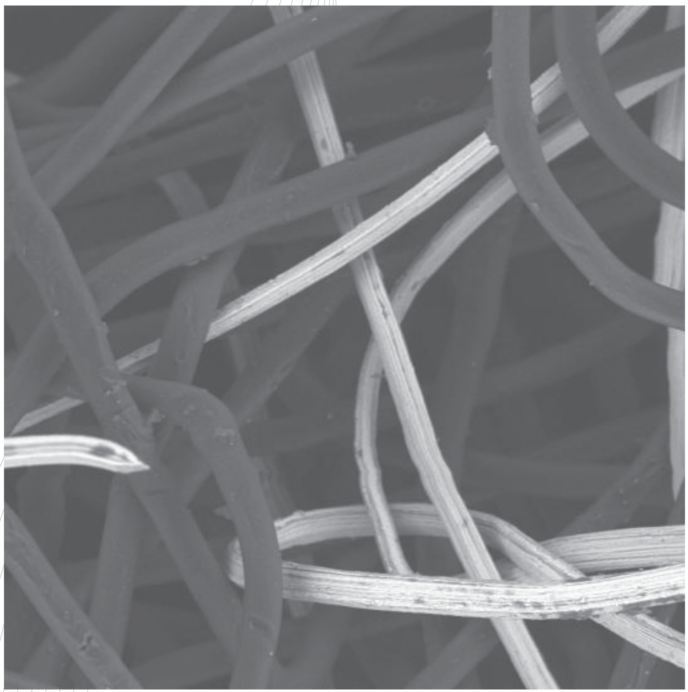
Well over a half of our company's output uses this technology testifying to its effectiveness, see these typical properties:

	g/m²	mm	dm³/dm²/min	MD N/5cm	XD N/5cm
P0500P1G	500	1.7	150	1580	1750
P0500ZZG	500	1.9	175	1145	1565

Anti Static Filter Media

It is widely known that static electrical charges can build up in certain dusts such as ground plastics and flour. Further, as most synthetic fibre filter media are very good electrical insulators, there is the potential for very high electrical charges to build up in a filter which can then instantaneously discharge (like a lightning bolt) and cause an explosion.

This danger can be ameliorated by incorporating conductive fibres into the filter media. In the following image stainless steel fibres appear bright against the dark polyester fibres:



Several years ago, as a further enhancement, Andrew Webron Limited developed the checkstatic range of felts where conductive yarns are woven into the scrim to provide a conductive path throughout the felt. The ultimate performance is achieved by using these scrims with a small loading of conductive fibres within the batt to link the surface to the grid.

These fibres have inherently different levels of conductivity:

FIBRE	CONDUCTIVITY
Epitropic	≈ 50,000,000 Ωώcm
Copper sulphide	≈ 10,000 Ωώcm
Stainless steel	≈ 1,000 Ωώcm

So when they are incorporated into needlefelts, different properties are exhibited depending on the fibre and the percentage used:

FIBRE	CONDUCTIVITY
Epitropic	1500×10^6 Ω
Copper sulphide	20×10^6 Ω
Stainless steel with grid scrim	5×10^6 Ωω

Andrew Webron Limited has obtained certification (DIN 54345 parts 1 and 5) for some of the product range such as:

CPX400P1G	Contains copper sulphide on a filament scrim
CPX550ZZG	A Fiberlox™ product using copper sulphide
PX500SPS	Incorporates a conductive stainless steel grid scrim

Three basic fibres are used:

1 Epitropic is a type of bi-component polyester with conductive carbon particles embedded into the surface.

2 Copper sulphide (not sulphate) where the conductive material is applied to the surface of a polyester fibre similar to the above.

3 Stainless steel fibre.

The choice of fibre is determined not only by the level of conductivity required but also by the environment of the application. For example, as epitropic and copper sulphide fibres are based on polyester they are not suited to warm moist environments (in fact their maximum temperature is limited below regular polyester, maybe 110°C).

Steel would be the ultimate fibre and can be used with just about every filter medium. PPS, P84 and Nomex® would almost invariably be used in conjunction with steel.

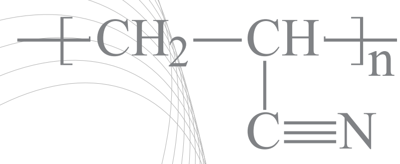
Epitropic tends to be favoured for food related applications, though not exclusively.

As a final comment, other treatments such as hydrophobic impregnations can be used with conductive fibres, but care must be taken as some treatments such as foams can insulate the conductive fibres so diminishing their effectiveness.

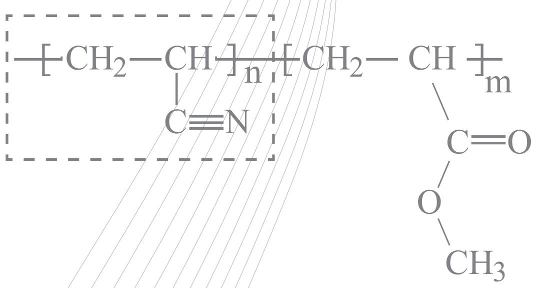
Acrylic Filter Media

Normally in filtration acrylic refers to homopolymer acrylic which is essentially made from 100% of acrylonitrile. Occasionally less expensive lower performance copolymer acrylics are used.

The following illustrates the chemical difference:



HOMO POLYMER



CO POLYMER WITH METHYL ACRYLATE

The thermal performance of the homo polymer is significantly better, see this following image which shows the two acrylic variants before and after exposure in air for 1 hour and 4 hours at 170°C showing the progressive darkening due to oxidation:

HOMO POLYMER

CO POLYMER

Typical applications for acrylic needlefelts are:

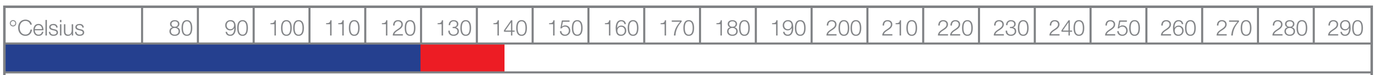
Power Generation	Cement
Limestone	Incineration
Smelting	Asphalt

The strength of acrylic is inherently quite low, and sometimes this is boosted by mixing the fibres with polyester and weaving the reinforcing scrim from acrylic and filament polyester yarns.

Even though acrylic doesn't hydrolyse, a number of applications use liquid repellent treatments to reduce the tendency of moist or oily cakes to adhere.

Being a synthetic fibre there can be a tendency in certain situations for the felts to develop a static electrical charge. With some dusts this can lead to a high explosion risk. The felts can be modified to dissipate this charge by the incorporation of either conductive fibres in the felt or by using a conductive scrim reinforcement. Steel is the preferred fibre here due to the conditions normally found with acrylic felts.

The major attributes of acrylic fibre are its excellent resistance to hydrolysis, its modest cost compared with the high performance fibres and reasonably high temperature resistance:



ACIDS	ALKALIS	OXIDISING AGENTS	HYDROLYSIS	SOLVENTS	
GOOD	FAIR	FAIR	EXCELLENT	GOOD	USED AS ALTERNATIVE TO POLYESTER WHEN HYDROLYSIS IS A PROBLEM MAXIMUM 125°C UNDER HUMID CONDITIONS - USED IN THE CEMENT AND LIMESTONE INDUSTRIES IN POWER GENERATION, AND ASPHALT INDUSTRIES

Maximum Continuous in Dry Conditions   Maximum Surge in Dry Conditions

Fiberlox™ Filter Media

Here are data for 500 g/m² superglazed polyester products:

PROPERTY	WITH FILAMENT SCRIM	FIBERLOX™
Weight g/m²	500	500
Thickness mm	1.7	1.9
dm³/dm²/min @ 200Pa	150	175
MD N/5cm	1580	1140
MD El @ 50N	0.5	1.9
MD El @ peak	25	54
MD stability	3.0	3.0
XD N/5cm	1750	1570
XD El @ 50N	1.4	3.9
XD El @ PEAK	55	65
XD STABILITY	2.2	1.6

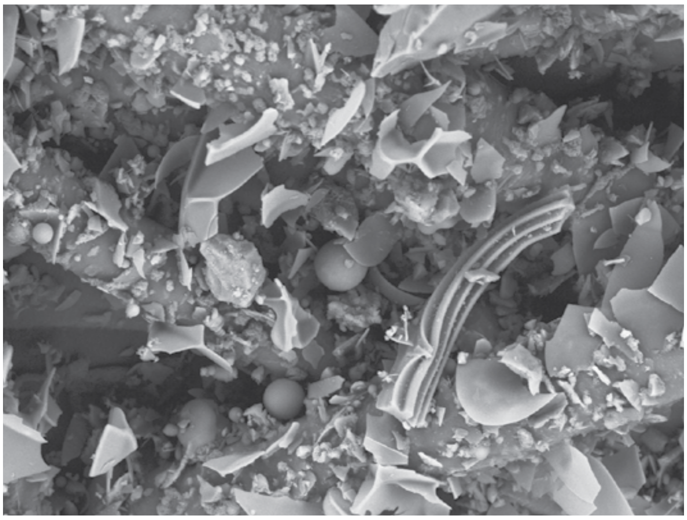
These properties are slightly inferior to those where a filament scrim is used, but this is more a case of the scrim products being over engineered as opposed to the Fiberlox™ being inadequate. There is clear evidence for this is in the huge sales for the technology!

Fiberlox™ is Andrew Industries name for its innovative range of needlefelts produced without the use of a reinforcing scrim. Our proprietary processes have been developed and refined over several years to enable the manufacture of needlefelts solely from fibres. Such has been the success of this technology that well over 20,000,000 m² of this material has been supplied to the filtration industry worldwide. There are no known failures attributable to the absence of the scrim.

Fiberlox™ needlefelts are available in the following fibres:

- Polypropylene
- Polyester
- PPS
- Aramid
- Polyimide

They typically exhibit slight changes in properties when compared with scrim supported felts.



Andrew Webron Limited have successfully manufactured and promoted Fiberlox™ needlefelts for 30 years, encompassing a wide range of filter applications.

The primary advantages with Fiberlox™ needle felts are in the composition of the product and its cost efficient manufacture. As there is no woven support scrim, cut widths can be readily slit for any bag diameter with minimal waste costs.

In the actual bag house, Andrew Webron Limited now promote Fiberlox™ in pulse jet applications, up to 8.0 metre bag length, and in a wide range of fibre types.

Fiberlox™ needle felts use 100% pure filtration fibre, contributing to surface filtration, therefore by maintaining the dust on the surface of the needle felt in a pulse jet bag house system, less mechanical stress is required to keep the filter bag clean, resulting in lower emissions and longer bag life which is the ultimate goal in any dust extraction application.

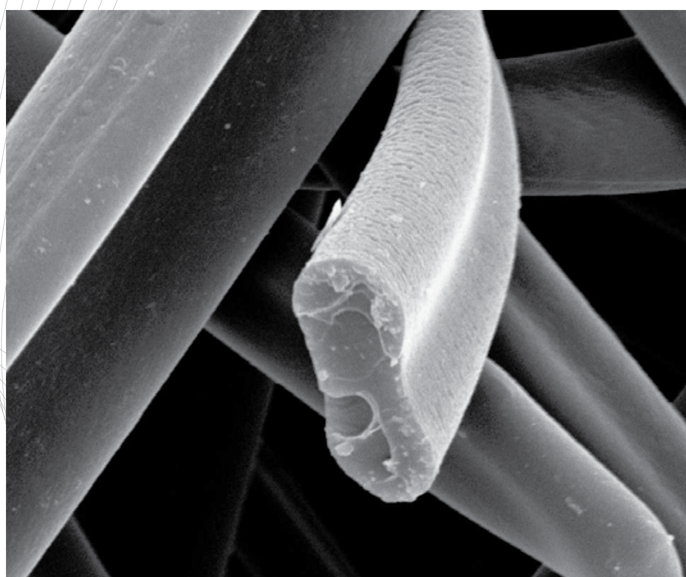
Further, the absence of a woven scrim, actually reduces the tendency to blinding as the very fine dust which inevitably penetrates into all felts does not become lodged in the scrim so potentially extending the bag life.

Andrew Webron Limited have invested heavily to ensure the correct equipment and techniques are used to manufacture Fiberlox™ products correctly and efficiently, in order to maintain tensile strengths and elongation properties which are the essential criteria of any fabric operating in the dust extraction industry.

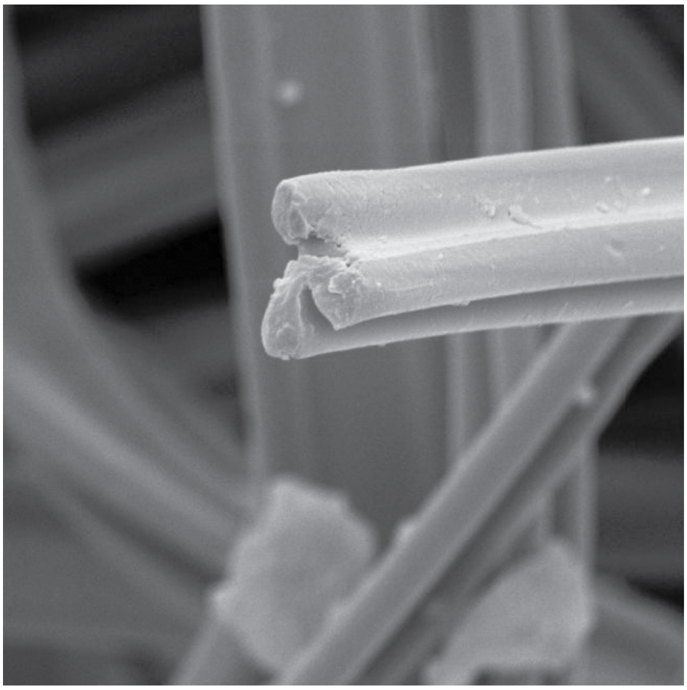
High Temperature Filtration

PPS is an excellent high temperature fibre, in terms of its properties it can be viewed as a high temperature polypropylene in that it has excellent chemical resistance and can't hydrolyse in the presence of heat and moisture. It's biggest drawback is a sensitivity to oxidation, and so care is needed particularly when the O_2 level is high. Typical applications would be incinerators, coal fired boilers etc.

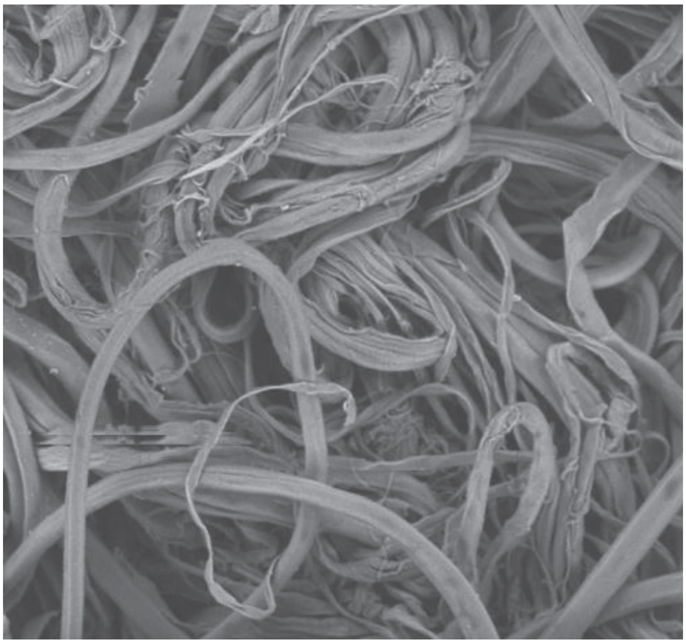
Meta aramid (Nomex®) is an excellent all round fibre ideally suited to dry hot environments where hydrolysis isn't likely to occur. These felts are frequently used in asphalt and cement plants.

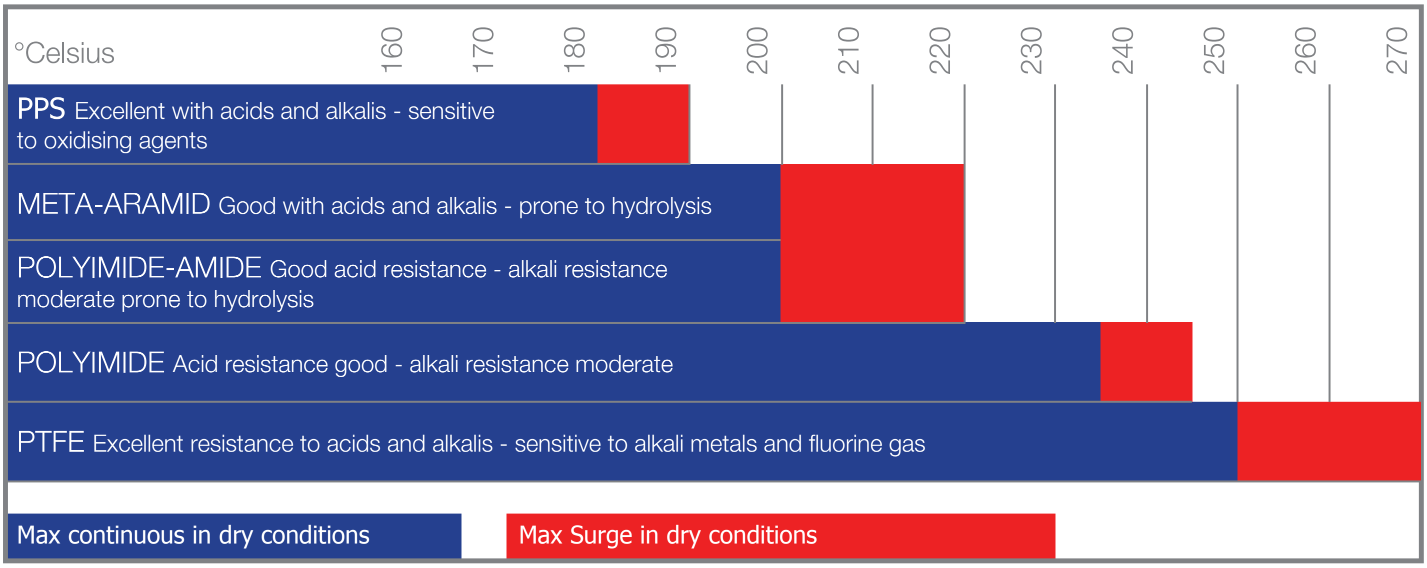


Polyimide felts (P84), for application purposes, can be viewed as high temperature meta aramids, they have similar properties, perhaps a little weaker with alkalis, but can tolerate say 30 degrees more. Moreover, the complex cross section of the fibres gives them high filtration efficiencies. They find use in incineration, combustion and cement industries.



PTFE is the 'ultimate' fibre, it has the best chemical and thermal resistance of all the fibres routinely used in gas filtration. Two types are available, white and brown, the latter was the first of the fibres, being introduced by DuPont as Teflon. Applications are limited due to the high price, but include combustion, certain waste and incineration processes as well as TiO_2 manufacture.





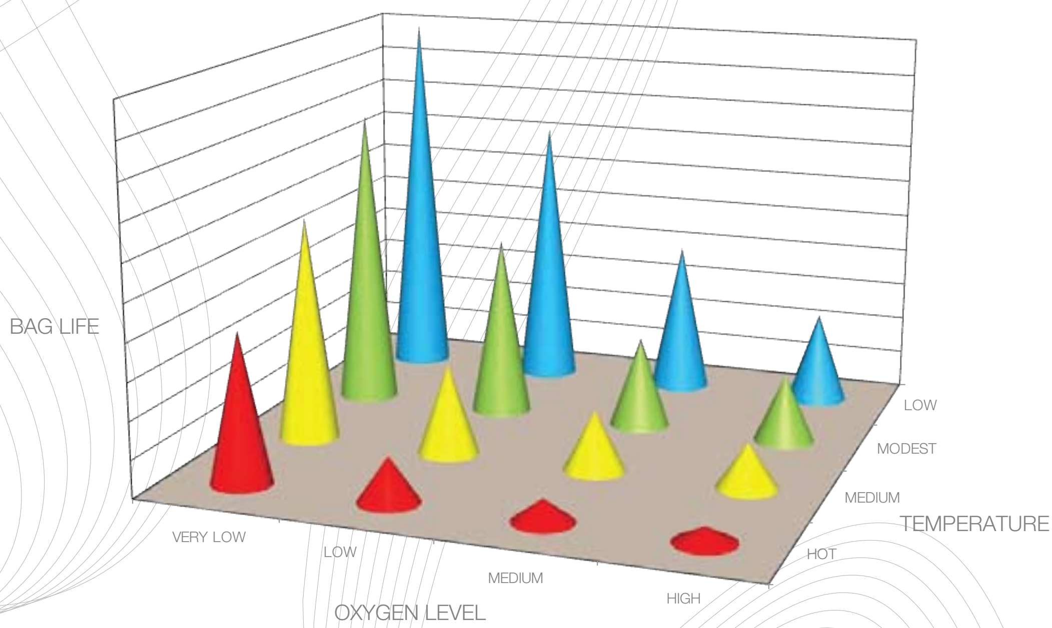
PPS Filter Media

PPS is a high temperature thermoplastic fibre with excellent resistance to hydrolysis and so is a good complement to aramid fibres, being frequently used where their susceptibility to moisture is a problem.

The temperature resistance is not as high as aramid, but far in excess of the volume fibres such as polyester.

Its weakness is its resistance to oxidation bringing about strength loss and the higher the application temperature, the lower the O_2 level must be to compensate or a performance life reduction will occur:

Illustration of the relationship between oxygen, temperature and bag life for PPS



It's temperature range is quite extensive:

°Celsius	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290

STRONG ACIDS	WEAK ACIDS	WEAK ALKALIS	STRONG ALKALIS	SOLVENTS	OXIDISING AGENTS	HYDROLYSIS
EXCELLENT	EXCELLENT	EXCELLENT	EXCELLENT	GOOD	POOR	EXCELLENT

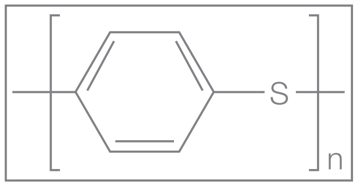
Maximum Continuous in Dry Conditions

Maximum Surge in Dry Conditions

Typical applications for PPS needlefelts are:

Power generation	Cement
Combustion processes	Incineration
Dryers	Carbon

A unique distinguishing feature of PPS is that by weight it is actually about 30% sulphur:



This goes a long way to explaining the excellent limiting oxygen index figure of 34 which is above that quoted for meta aramid fibres. This means that the fibre won't support combustion in a normal atmosphere, but a burning dust cake or flame will obviously destroy the bags.

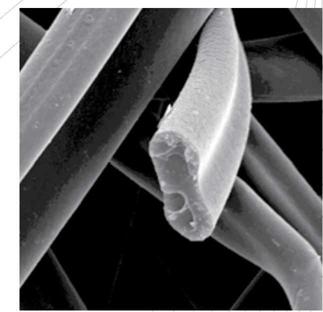
In common with other felts, PPS needlefelts can incorporate conductive fibres to reduce the possibility of static electricity build up. These are mainly steel because of the exposure temperatures. These help mitigate the potential of explosion with susceptible dusts, both our Checkstatic™ scrim and / or fibre blends can be used.

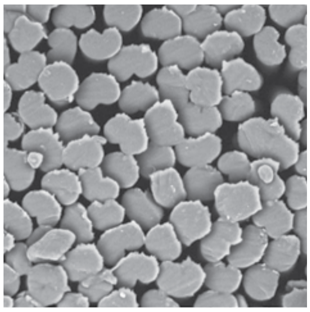
Because PPS products cannot hydrolyse, chemical treatments are not as common as with certain other fibres, but a number of systems are used. The major one by far being LR5, our liquid repellent finish, being used to protect the felt against the tendency of moist or oily dust cakes to adhere to the surface. Temperature wise, PPS is the highest rated thermoplastic fibre, and as such is the easiest to weld. It melts at about 285°C, hence its suitability up to about 190°C for short periods.

Aramid Filter Media

Nomex® from DuPont was the original aramid fibre introduced into industry over 40 years ago. Several other manufacturers have since started to produce chemically identical products and several variants are currently available.

The manufacture of these fibres is much more complex than say for polyester and takes place from solvent, which results in more complex fibre cross sections, 2 examples being shown here:





These non circular shapes actually assist in filtration because they bring more surface area of fibre per square metre of felt. This can increase the dust holding capacity of the felt and reduce emissions. Aramids are capable of working at much higher temperatures than many other fibres.

°Celsius	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290

STRONG ACIDS	WEAK ACIDS	WEAK ALKALIS	STRONG ALKALIS	SOLVENTS	OXIDISING AGENTS	HYDROLYSIS
FAIR	FAIR	GOOD	GOOD	GOOD	FAIR	FAIR

Maximum Continuous in Dry Conditions

Maximum Surge in Dry Conditions

Typical applications for aramid needlefelts are:

Asphalt	Quarrying
Lime	Foundries
Cement	Smelting
Gypsum	Chemicals

The temperature resistance is good (up to 220°C for short periods in dry conditions), but in common with other fibres such as polyester and P84, aramids are susceptible to hydrolysis. This means that in hot moist environments water can break down the chemical from which the fibres were made turning them back to their constituent chemicals. This greatly reduces their strength and ultimately turns the fibres to powder. Some chemical treatments can delay this onset of degradation, in particular strong fluoro-carbon treatments such as “CR1” protect the fibres from moisture, though they cannot actually prevent hydrolysis.

In common with other felts, aramid needlefelts can incorporate conductive fibres to reduce problems associated with the build up of static electricity. These can take the form of Checkstatic™ conductive scrims or conductive fibres, or a combination of the two. With aramid products, it is normal to use stainless steel fibres due to the temperature and chemical conditions which are frequently encountered in the filter. Being performance fibres, aramids are produced in small volumes in textile terms and are not available in the wide range of diameters which is found for commodity fibres such as polyester. So the opportunities for design are a little restricted.

Aramid fibres lend themselves to being manufactured using our proprietary Fiberlox™ technology, exhibiting all the advantages associated with the removal of support scrims. The majority of aramid felts are heat stabilised followed by press singeing to reduce the harshness of the singe traditionally found with aramid felts. They are frequently impregnated with fluorocarbon treatments to enhance their resistance to hydrolysis and to improve cake management with certain dusts. In summary aramid felts are good all round high temperature media which need care in selection when the moisture level is high.

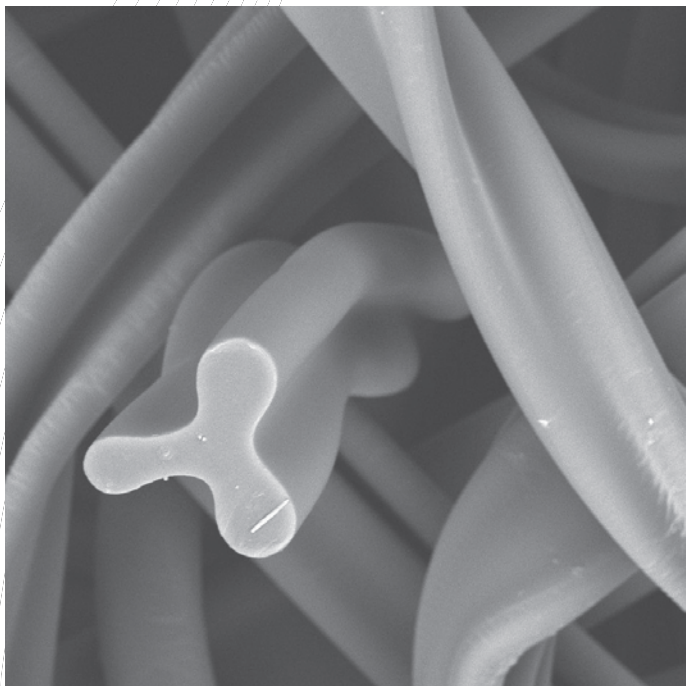
Polyimide (P84) Filter Media

Polyimide needlefelts are excellent high temperature filter media in terms of performance, generally surpassing the other standard media with the exception of PTFE.

They are generally good up to around 240°C provided the chemistry is benign, hydrolysis being a potential problem at elevated temperatures if the moisture content is too high.

In common with many fibres, polyimides can be blended with conductive fibres or manufactured on a conductive grid scrim to reduce the potential for static electrical build up. Because of the end use environment, steel is the preferred conductive fibre though other fibres could be used in the low temperature applications.

Interestingly, the fibres have a complex cross sectional shape which results in a much enhanced collection efficiency when compared with circular fibres:



°Celsius	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290

ACIDS	ALKALIS	OXIDISING AGENTS	HYDROLYSIS	SOLVENTS	
GOOD	GOOD	FAIR	FAIR	GOOD	IMPROVED HYDROLYSIS RESISTANCE COMPARED WITH m-ARAMID FIBRES - IRREGULAR CROSS SECTION ENHANCES FILTRATION EFFICIENCY - USED IN POWER GENERATION, INCINERATORS AND THE CEMENT INDUSTRY

Maximum Continuous in Dry Conditions

Maximum Surge in Dry Conditions

Typical applications for P84 needlefelts are:

Power Generation	Metallurgical
Waste Incineration	Straw Burning
Clinical Incineration	Gypsum
Cement	Lime

The chemical conditions in a filter do not always require Polyimide. However, the complex fibre structure aids the filtration efficiency of the working surface.

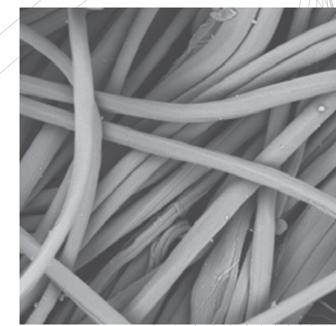
Polyimide fibres are gold in colour and have a limiting oxygen index (LOI) sufficiently high to prevent them burning in air. However, should a fire be burning in a filter (for example the dust), then the felt will be destroyed.

Various chemical enhancements are regularly applied to polyimide needlefelts, in particular high performance fluorocarbon systems which aid in filtration, especially when wet or sticky dusts are involved. Such systems can retard the process of hydrolysis, but it must be stressed that they don't stop it.

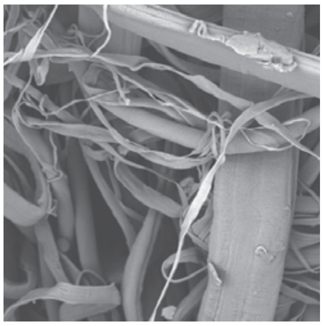
PTFE and Tefaire™ Filter Media

PTFE is the 'ultimate' high temperature needlefelt filter medium. Of all the fibres normally encountered it has the best combination of chemical and thermal properties.

PTFE is available in 2 forms; white and brown. The brown comes from residues from the fibre production process. Brown tends to have more uniform fibre diameters, again due to the production process:



Brown



White

PTFE is a very dense polymer and so produces very fine fibres with the potential to provide good filtration performance. Because the density is very high the volume of its fibres is quite low so to achieve the same volume of fibre as is found in a 550 g/m² polyester felt, approximately 850 g/m² would be required. A typical PTFE felt has a specific gravity around 0.65 Whereas polyester is typically 0.30.

°Celsius	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290

ACIDS	ALKALIS	OXIDISING AGENTS	HYDROLYSIS	SOLVENTS	
EXCELLENT	EXCELLENT	EXCELLENT	EXCELLENT	EXCELLENT	SENSITIVE TO ALKALI METALS - EXCELLENT IN ALL KEY PROPERTIES - USES ARE SPECIALISED BUT INCLUDE POWER GENERATION, INCINERATION AND IN HARSH CHEMICAL ENVIRONMENTS

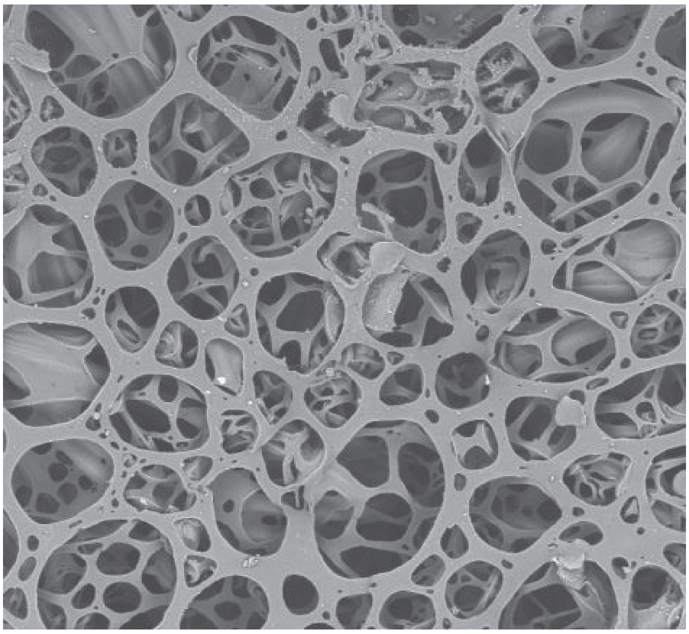
Maximum Continuous in Dry Conditions

Maximum Surge in Dry Conditions

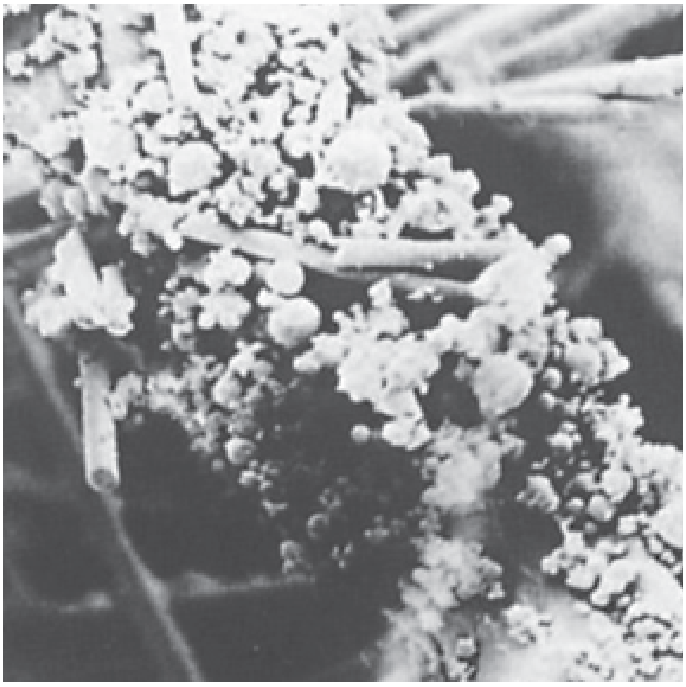
The major applications for PTFE are:

Incineration	Chemical
Combustion	Carbon black

PTFE is inherently very liquid repellent, (similar chemicals are the normal mechanism used in the textile industry for water proofing textiles) so it is very uncommon for treatments to be applied to the surface, though certain collection enhancing treatments are available such as embedded membranes:



In certain specialised applications, particularly for incineration, PTFE fibres are supplied blended with glass fibres to produce Tefaire™. This resultant felt can be a very efficient filter because friction and contact between the PTFE and the glass builds up electrical charges on the fibres (through triboelectricity) which attract electrically charged dust particles. The PTFE becomes negatively charged and the glass becomes positive, so attracting dust particles of the opposite polarity as shown in this image from DuPont where only the PTFE has collected a dust:



Polypropylene Filter Media

Polypropylene is a relatively low temperature fibre with quite excellent chemical resistance which finds use in specialist applications such as the chemical industry.

The fibres cannot hydrolyse, the only chemical weakness being a susceptibility to oxidising agents. Other than that they can be used almost universally provided the temperature is below 90°C.

The fibre is of a low density (it floats in water) and so a given denier of fibre is much larger in diameter than the polyester equivalent. This leads to felts being quite thick, almost 50% thicker than for the same polyester weight.

The fibre is very prone to static build up so the felts are often augmented by the incorporation of either conductive fibres or a conductive scrim or a combination of the two. This then helps to dissipate potential static electric discharges.

Typical applications for polypropylene needlefelts are:

Food	Oil
Galvanising	Chemical
Liquid	Detergents

°Celsius	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290

ACIDS	ALKALIS	OXIDISING AGENTS	HYDROLYSIS	SOLVENTS	
EXCELLENT	EXCELLENT	FAIR	EXCELLENT	GOOD	SUSCEPTIBLE TO ATTACK BY STRONG OXIDISING AGENTS SUCH AS HYDROGEN PEROXIDE - USED IN THE FOOD IDUSTRY, IN CHEMICAL LIQUID APPLICATIONS AND FOR CERTAIN FUEL APPLICATIONS

Maximum Continuous in Dry Conditions

Maximum Surge in Dry Conditions

Strainer Felts

Most products are available in a range of ratings from 1 to 200 microns the main scrim supported products are:

NYLON	POLYESTER	POLYPROPYLENE
D0370D1B+001	P0370P3S+001	Y0500Y2B+001
D0370D1B+005	P0370P3S+005	Y0370Y2B+005
D0370D1B+010	P0370P3S+010	Y0370Y2B+010
D0370D1B+025	P0370P3S+025	Y0370Y2B+025
D0370D1B+050	P0370P3S+050	Y0370Y2B+050
D0370D1B+100	P0370P3S+100	Y0370Y2B+100
D0370D1B+200	P0370P3B+200	Y0370Y2B+200

For Fiberlox™ filter media the main products are:

POLYESTER	POLYPROPYLENE
P0500ZZT+001	Y0500ZZB+001
P0340ZZT+005	Y0340ZZB+005
P0340ZZT+010	Y0340ZZB+010
P0340ZZT+025	Y0340ZZB+025
P0340ZZT+050	Y0340ZZB+050
P0340ZZT+100	Y0340ZZB+100
P0400ZZT+200	Y0400ZZB+200

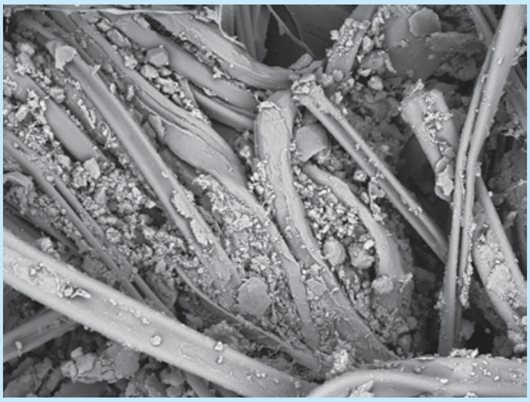
Andrew Webron Limited offers a comprehensive range of strainer felts designed to cover a very wide range of liquid filtration applications. The standard media are made from polyester, polypropylene or nylon in scrim supported and Fiberlox™ forms depending on the end application. Other fibres can be supplied subject to minimum order constraints.

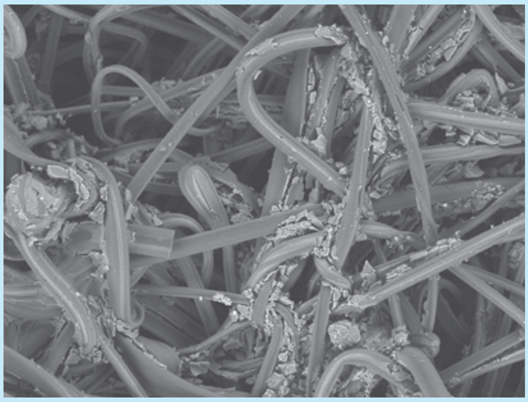
As these materials are used in a very specific type of filter they are almost always used at widths of 600mm and so are held in stock at that size.

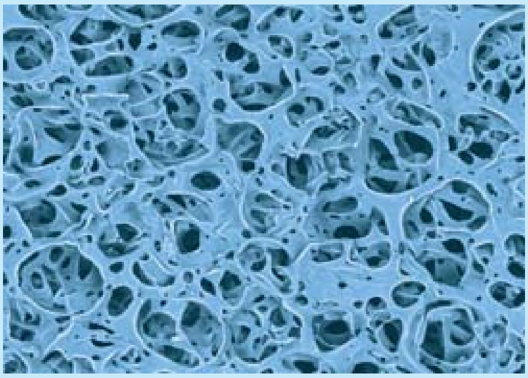
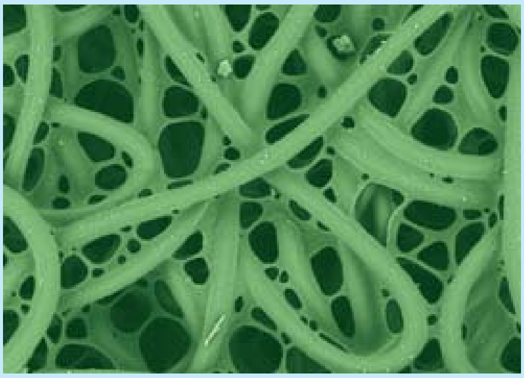
The major application for these media is paint filtration and so it is essential that we maintain a silicone free manufacturing environment for blemish free finishes.

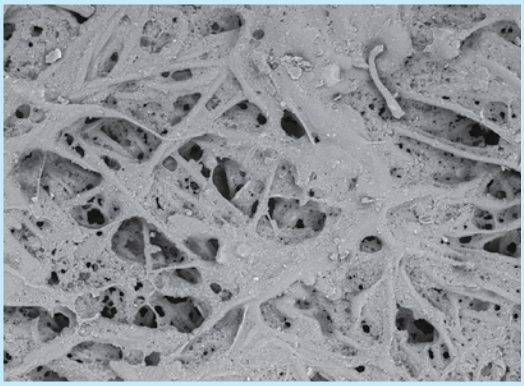
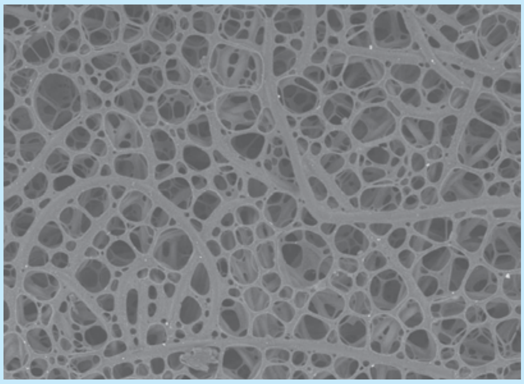
Lubricants	Varnishes	Cutting Fluids	Sugar
Effluents	Dyes	Edible Oils	Inks

Major Chemical Treatments

CODE	DESCRIPTION
CR1	A very heavy fluorocarbon treatment designed to reduce the effects of chemical attack, in particular hydrolysis. Works by providing outstanding liquid repellency so slowing down the penetration of water into the fibres. Suitable for polyester, m-aramid and P84 felts.
DR6	A treatment designed to aid in the release of dust from a filter bag surface; an alternative to traditional silicones.
DR7	Fluorocarbon treatment to enhance particle collection by modifying the pore structure of the needle felt whilst at the same time aiding in cake removal. 
FR3	Flame retardant treatment for polyester needle felts designed to meet BS 5867 Part 2 Type B.
FR4	Flame retardant treatment for acrylic needle felts designed to meet BS 5867 Part 2 Type B.

CODE	DESCRIPTION
LR5	A cross linked fluorocarbon treatment (impregnation) imparting liquid repellency; additionally provides a limited level of chemical resistance and can assist with the release of certain dust cakes. Can be applied to almost all felt types. 
LS1	A thermoplastic fluorocarbon treatment used to laminate expanded PTFE membranes to high temperature needlefelts such as m-aramid and P84 products. 
LS2	A thermoplastic fluorocarbon used to laminate ePTFE membranes to homo polymer acrylic needlefelts.

CODE	DESCRIPTION
MW1	Blue foamed acrylic coating designed to increase collection efficiency; for use in shaker applications. On certain products achieves M class BGIA Efficiency.
MW2	Blue foamed acrylic coating designed to increase collection efficiency; for use in pulse jet applications. On certain products, achieves M class BGIA Efficiency. 
MW3	Green foamed polyurethane coating for increased collection efficiency for abrasive dusts. 
MW4	Colourless foamed polyurethane coating for increased collection efficiency for abrasive dusts.

CODE	DESCRIPTION
SB1	Graphite based permeable surface coating designed to resist spark burn through on polyester needle felt. 
ZN1	TFE/PTFE embedded foam coating for enhanced collection efficiency and dust release. Has improved chemical resistance when compared with acrylic and polyurethane. 

Technical Department Capabilities

USED BAG ANALYSIS

Felt condition (Blinded, Degraded, Hydrolysed etc)

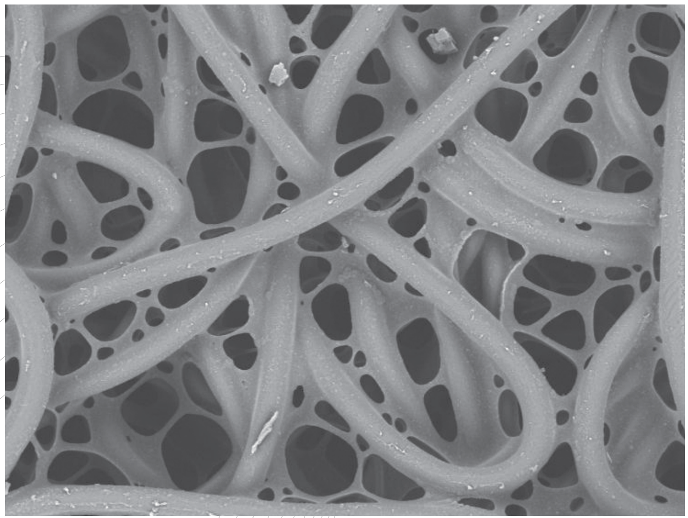
Media Recommendations

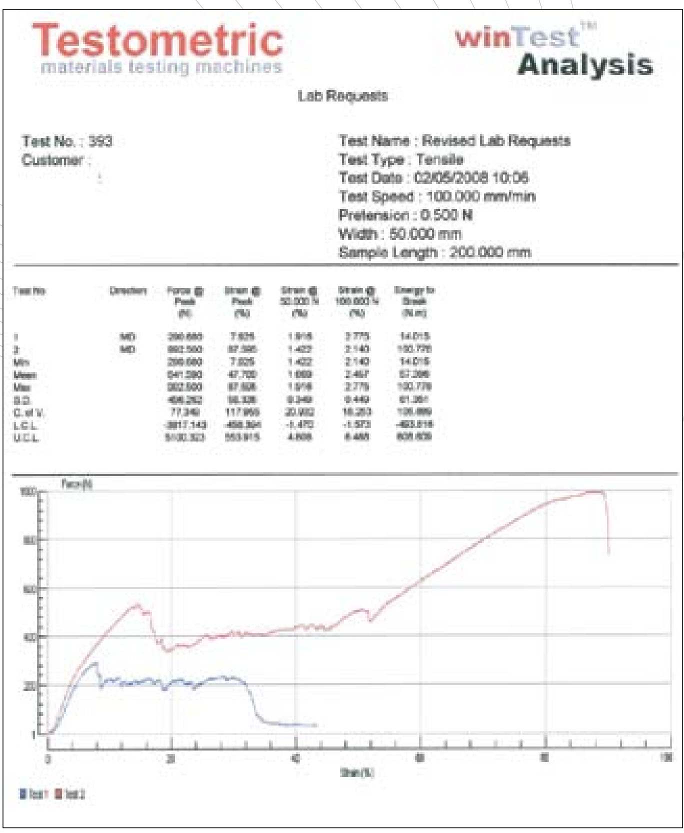
Failure Analysis

Remaining Bag Life (our felt)

V.D.I.

MICROSCOPY





Testometric
materials testing machines

winTest™
Analysis

Lab Requests

Test No. : 393
Customer :

Test Name : Revised Lab Requests
Test Type : Tensile
Test Date : 02/05/2008 10:06
Test Speed : 100.000 mm/min
Pretension : 0.500 N
Width : 50.000 mm
Sample Length : 200.000 mm

Test No	Direction	Force @ Peak (N)	Strain @ Peak (%)	Strain @ 50.000 N (%)	Strain @ 100.000 N (%)	Energy to Break (N.m)
1	MD	290.680	7.825	1.916	2.775	14.015
2	MD	992.500	87.395	1.422	2.140	100.778
Min		290.680	7.825	1.422	2.140	14.015
Mean		641.590	47.700	1.669	2.457	57.396
Max		992.500	87.595	1.916	2.775	100.778
S.D.		496.262	56.328	0.349	0.449	61.351
C. of V.		77.349	117.955	20.932	18.253	106.889
L.C.L.		-3817.143	-458.394	-1.470	-1.573	-493.816
U.C.L.		5100.323	553.915	4.808	6.488	608.609

Force (N)

Strain (%)

Test 1 Test 2

Weight

Thickness

Air Permeability

Strengthen

Elongation

Toughness

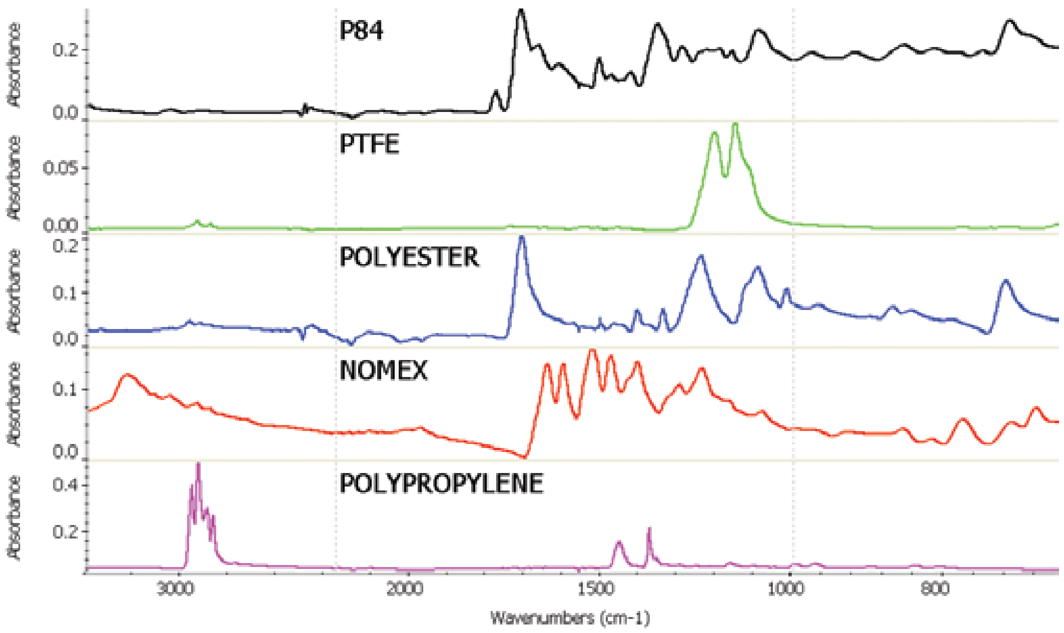
Conductivity

Liquid Repellency

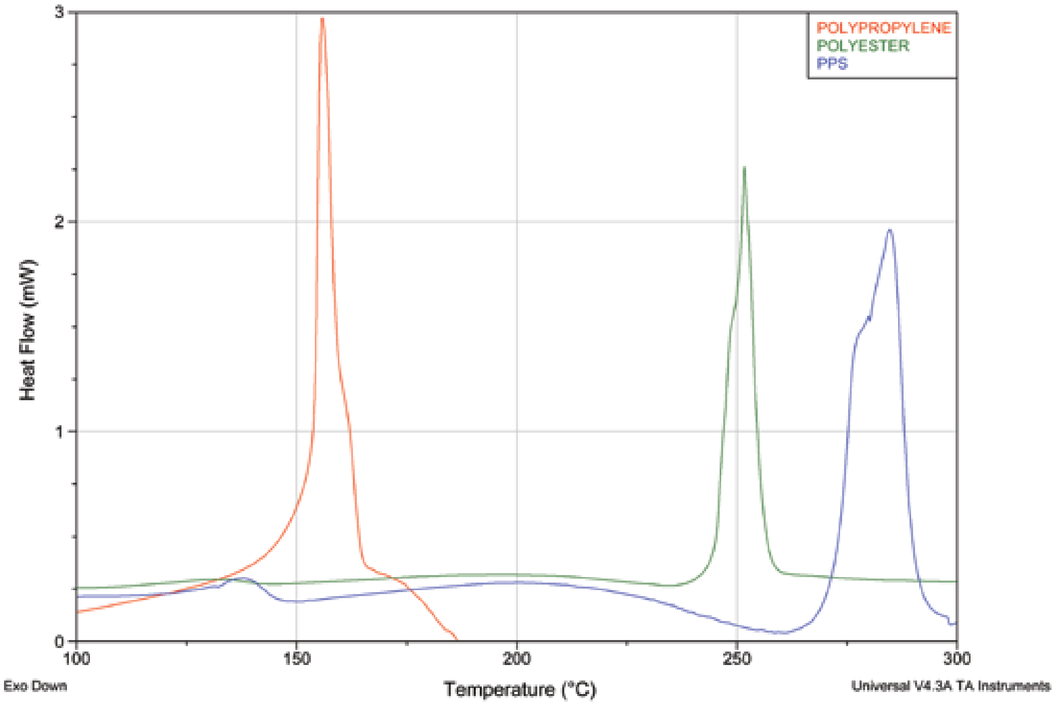
Denier

Scrim Analysis

FIBRE IDENTIFICATION FTIR



DSC



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