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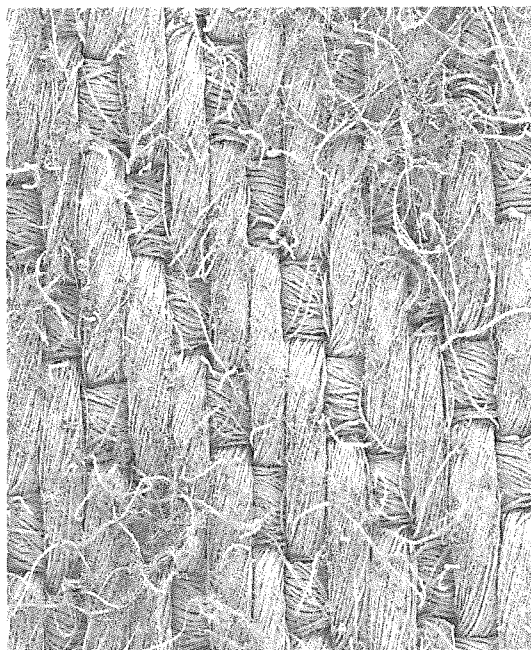
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(54) Title: SOUND ABSORPTION MATERIAL

Fig. 3 a:



(57) Abstract: This invention relates to a fabric suitable for sound absorption applications consisting in whole or in part of a fibrillating fibre and which has been treated to develop fibrillation on the surface of the fabric, wherein this fabric has enhanced sound absorption properties. It also relates to the use of this fabric as well as to sound absorbing articles made using this fabric.



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Sound absorption material

This invention relates to a fabric suitable for sound absorption applications consisting in whole or in part of a fibrillating fibre and which has been treated
5 to develop fibrillation on the surface of the fabric, wherein this fabric has enhanced sound absorption properties. It also relates to the use of this fabric as well as to sound absorbing articles made using this fabric.

Prior Art

10 The insulation and absorption properties of textile fabrics depend on the fibre geometry and the arrangement of the fibres in the fabric. In knitted and woven fabrics, the yarn structure and the fabric construction are important factors in determining how much of an incident sound wave is absorbed and how much is reflected or transmitted through the fabric. The surface texture also has a
15 role in determining the directions in which reflection of sound occurs.

In nonwoven fabrics the construction of the fabric and the density are important in determining how much sound is absorbed. The voids between fibres are important in sound absorption.

In all fabrics the shape and size of the fibres used to form the fabric also play
20 a significant part in how much sound is absorbed. Fabrics made using low diameter fibres give better sound absorption than those made using fibres with a larger diameter for similar fabric construction. Fabrics made using microfibres are known to be much better at absorbing sound than conventional fibres.

25 Sound is absorbed by any material whenever the sound is incident on its surface. The pressure wave causes the material to physically vibrate. As the vibration dissipates the energy that was provided by the pressure wave is converted to heat and the reflected sound wave is reduced in intensity. If
30 multiple reflections occur, there is an additive reduction in the intensity of the

sound wave which includes the amount of energy absorbed on each reflection.

The reason why fabrics made from smaller diameter fibres are better at
5 absorbing sound is that the number of reflections that occur before a sound
wave can pass through the fabric is larger. Because the fibres are smaller,
there is a greater number of spaces between the fibres and the sound wave
necessarily follows a more tortuous path, experiences more reflections and
hence the energy of the sound wave is reduced more than with a fabric made
10 from larger diameter fibres. The total surface area of the fibres in a fabric is
larger for fibres with a small diameter.

There is a relationship between the air permeability of a fabric and its ability to
absorb sound. If air can easily pass through the fabric, then sound waves can
15 also do so. The air permeability of a fabric is dependent on the pathways
through the fabric between the fibres or yarns. The larger these spaces the
more easily air can pass through the fabric. Fabrics made using small
diameter fibres have smaller spaces between the fibres and hence have a
lower air permeability. They also give better sound absorption. Air
20 permeability is a useful indicator of the sound absorption capability of a fabric.

Fibres which are described as microfibers have been used to make fabrics
with good sound absorbing properties. The term microfiber is most often used
for fibres with a linear density of 1.0 decitex or less.

25 Some highly oriented manmade fibres can fibrillate during processing of a
fabric made from them. This means that the fibre splits along planes parallel
to the axis of the fibre to give a multitude of fibrils. If the surface of the fibre is
damaged then a fibril at the surface of the fabric may be broken giving two
30 lengths of fibril both of which are attached to the parent fibre. The dimensions
of the fibrils depend on the polymer from which the parent fibre is made, the
degree of orientation of the polymer in the fibre, the structure of the fabric and
the way in which the surfaces of the fibres have been abraded.

One example of a fibrillating fibre is lyocell. This is a cellulosic manmade fibre produced by a solvent spinning process. During the extrusion process a highly viscous liquid cellulose solution is highly stressed as it is made to flow through small spinneret holes. This makes the cellulose molecules align with the direction of flow. When the stream of liquid is washed free of solvent, the parallel cellulose molecules form hydrogen bonds with their immediate neighbours. As the solvent concentration reduces, the polymer forms groups of molecules, a process known as spinodal decomposition. The molecules in a region of the precipitating stream of liquid are attracted towards one another and away from more distant molecules. The result is bundles of cellulose molecules attached to each other but with a lower level of hydrogen bonding than the level of hydrogen bonding between cellulose molecules within each bundle. These bundles can potentially be separated from each other to form fibrils, so when in the fibre, they are referred to as protofibrils.

The resulting fibre, when washed free of solvent and dried, has an internal structure consisting of a multitude of protofibrils each of which is bound together by hydrogen bonds between the cellulose molecules. The boundaries between these protofibrils provide planes of weakness that allow the protofibrils to be separated from each other to form fibrils. This occurs most readily when the fibre is wet because some hydrogen bonds in the planes of weakness will be broken by the presence of water. Abrasion of the surface of the fibre provides the energy needed to break more hydrogen bonds. Abrasion also causes the fibrils which are formed to rupture perpendicular to the axis of the fibre. When this occurs, two separate fibrils are formed each of which is attached to the fibre at one end, with the other end where the rupture occurred, free.

In practice fibrillation can take two forms – primary fibrillation where the end of a fibre protruding from the surface of a fabric splits into fibrils and secondary fibrillation where a fibre is abraded between two points where it is gripped by surrounding fibres.

At the surface of a fabric made from spun staple yarns, the ends of fibres protrude from the surface. Fibre ends may also protrude from the surface of nonwoven fabrics. When the fabric is subjected to mechanical action in the wet state, a protruding fibre will split parallel to its axis to form a multitude of
5 fibrils which are attached to the portion of the fibre gripped in the fabric. The degree to which the fibre ends are fibrillated depends on the intensity and duration of the mechanical action and the number of protruding fibre ends.

As the surface of a wet lyocell fabric is abraded, the fibres at the surface of
10 the fabric are most subject to the mechanical action. Each fibre may form a large number of fibrils. In the case of a woven fabric, the fibres at the surface of the fabric at the knuckles or high points of the weave are exposed to the mechanical action of abrasion. The protofibrils rupture at or near the highest point of the knuckle of the weave where the stress on the fibre is highest. The
15 two fibrils that are formed when each protofibril is ruptured are attached to the fibre away from the knuckle of the weave and form two groups of fibrils on each knuckle of the weave.

The fibrils which are formed when lyocell is fibrillated are irregularly shaped in
20 cross-section as they are composed of one or more protofibrils which are peeled away from the body of the parent fibre. The cross-section of a fibril is often approximately rectangular with the larger dimension corresponding to the circumferential direction on the parent fibre. This circumferential dimension is referred to as the width of the fibril. The smaller dimension of the
25 fibril corresponds to the radial dimension of the parent fibre. This radial dimension is referred to as the depth of the fibril. Typically the width of a fibril is in the range 0.5 to 2 microns. The depth of a fibril is typically in the range of 0.25 to 1.0 microns.

30 It can readily be appreciated that a large number of fibrils can be formed from a single fibre. A common linear density of a lyocell fibre used in textiles is 1.4 decitex. A round cross-section cellulosic fibre of this linear density has a diameter of 12 microns. If one quarter of a single fibre were abraded away giving fibrils of the dimensions given above, the number of fibrils formed would

be in the range of 15 to 200 depending on the dimensions of the fibrils formed.

Fibrillation is used to produce fabrics with a peach touch finish which can be highly desirable in some fashion garments. In one method of producing a peach touch finish on a fabric, a greige fabric rich in lyocell is subjected to wet abrasion by garment washing, processing in an airjet dyeing machine, tumbling in a purpose designed tumbler or similar means. This initial processing produces a fabric surface with a high level of primary fibrillation. The fabric is then processed further to remove the primary fibrillation by enzyme treatment, singeing, further tumbling or similar means. Finally the fabric is processed in a tumbler, an airjet dyeing machine or similar means to form the desired secondary fibrillation evenly over the surface of the fabric. It should be understood that there are many variants to the process of forming a peach touch finish. Those skilled in the art may use different combinations of the processes described, may use additional or alternative processes or may combine the steps in one or more processes. The important factor is that the target is to achieve an even distribution of secondary fibrillation over the surface of the fabric without damaging the fabric and without leaving any primary fibrillation.

Fibrillation of lyocell fibre can be made to occur with any fabric type. Knitted and nonwoven fabrics can be made to fibrillate by using the appropriate mechanical process to abrade the fibres in the wet fabric.

Not all lyocell fabrics have a peach touch finish. Non-fibrillating versions of lyocell are used commercially to produce fabrics with a clean (non-fibrillated) finish. Standard lyocell fibre can be used to make a fabric that does not have a peach touch finish by treating the fabric to prevent the fibres from fibrillating. For example, treating a fabric with crease resist resin will prevent the fibres from fibrillating. A fabric may also be allowed to fibrillate during processing and then treated to remove all of the fibrils formed. For example a fabric with primary and secondary fibrillation on the fibres in the fabric could be treated with a cellulase enzyme to remove all of the fibrillation.

A common method of testing the sound absorption properties of a material is using an impedance tube following the method described in BS EN ISO 10534-2. A sample of fabric is held in a sample holder which holds the fabric flat and positions it so that the surface of the fabric is perpendicular to the axis of the impedance tube. Immediately behind the fabric is a cylinder of sound absorbent foam. Behind the foam is a rigid backed air filled cavity. The excitation signal comprised of wideband random noise is played into the tube via a loudspeaker mounted at one end of the impedance tube. The sound pressure is measured at two microphone positions over the whole range of audible sound frequencies. The result is a graph of the sound absorption corresponding to the frequency.

A typical absorber has low sound absorption at the lowest frequencies and has a peak sound absorption at a frequency of around 2500 Hz. In one experiment, fabrics of similar construction made from cotton, polyester and lyocell had similar sound absorption curves. All three fabrics had a maximum absorption coefficient at 2500 Hz. The maximum sound absorption coefficient for cotton was 0.95. For lyocell the maximum was 0.95 and for polyester the maximum was 0.90.

A sound absorbing material containing Lyocell fibers is disclosed in Austrian Utility Model AT003506 U2. Therein the sound absorbing properties are given to the fibers by incorporation of Barium sulfate (BaSO_4), preferably in an amount of 20 to 60 weight-%, relating to the whole fiber. The incorporation of such a material needs not only an additional raw material, but also additional process steps in the fiber production. Therefore such fibers are significantly more expensive than regular Lyocell fibers. Moreover these fibers have to be individually produced specifically for the requested application. This would make them even more expensive, with even worse availability. Such fibers with high amounts of incorporated particles always show In this disclose the fibrillation properties of the fibers are not mentioned.

Problem

To produce an aesthetically pleasing and highly effective sound insulation fabric, to maximise the surprisingly good sound absorption properties of a lyocell fabric by optimising the design to make the best use of the superior effect due to fibrillation and to produce a fabric with a wider range of frequencies at which it absorbs sound than currently available fabrics.

Description

It is an object of the present invention to provide a fabric suitable for sound absorption applications consisting in whole or in part of a fibrillating fibre and which has been treated to develop fibrillation on the surface of the fabric, and which has enhanced sound absorption properties. In particular the fabric according to the invention has enhanced low frequency sound absorption properties.

In an especially preferred embodiment of the invention the fabric shows a maximum sound absorption (according to BS EN ISO 10534-2) at between 1500Hz and 40 Hz, an air permeability of 200 to 1400 (according to DIN EN ISO 9237).

The fibers can be generally of the type used for textile as well as for nonwoven purposes. While the titer can be between 0,9 and 30 dtex, the length can be between 0,1 and 120 mm. Generally preferred are finer fibers, i.e. with titer between 0,9 and 6,0 dtex.

In a preferred embodiment of the present invention the fibrillating fibre is one or more of the group including Lyocell, Modal, Cupro, Aramid or bicomponent fibre. In a specifically preferred embodiment the fibrillating fibre in the fabric according to the invention is lyocell.

In another specifically preferred embodiment the fibrillating fibre is lyocell and the fabric is finished to give primary fibrillation on the surface of the fabric.

Further in another specifically preferred embodiment the fibrillating fibre is in blend with or mixed with a one or more other fibres. In an especially preferred embodiment the fibrillating fibre is lyocell in blend with or mixed with a one or
5 more other fibres.

A fibrillated lyocell fabric with a peach touch finish surprisingly has superior sound absorbing properties compared to a similar fabric which does not have a peach touch finish. The peach touch fabric absorbs more of the incident
10 sound and gives good sound absorption at frequencies at which the non-peach touch fabric does not absorb well ie lower sound frequencies.

The fabric of the invention can have highly desirable aesthetic properties when produced by one skilled in the art of finishing of lyocell fabrics. Fabrics
15 can have a good appearance and are pleasant to the touch. They drape well when hung, for example, as drapes or curtains. This allows the fabric to perform more than one function. For example, it can be highly decorative and suitable for use as a wall covering and also be an effective sound absorber.

The fabric may be woven, knitted or nonwoven. Woven fabrics may be any weave, but fabrics with good cover factors are preferred. Preferably the cover factor is between 75 and 120%, in particular preferred between 90 and 110 %. Examples of weaves that are suitable Include plain, twill, satin, sateen, hopsack, cord and fancy weaves. Knitted fabrics may be circular knits, flat bed
20 knits, fully fashioned or warp knits. Any nonwoven fabric may be used, but those with a structure which is capable of withstanding wet processing are preferred. The same preferred cover factor as for the woven fabrics above also applies for the nonwoven fabrics. Fibrillation can be induced by high pressure spunlacing processes or refining in wet state according to processes
25 generally known in the state of the art. Examples of nonwoven fabrics which are suitable for the invention include dry laid, wet laid, adhesive bonded, spunlaced and needled fabrics. Braided fabrics may also be used.

After production of the unfinished fabric, the fabric is finished by processes
35 which include dyeing, finishing and in some cases resination. These

processes are generally known to one skilled in the art. During finishing, the fabric is treated to make the lyocell fibres fibrillate. Methods of fibrillation include but are not limited to air jet dyeing, moist tumbling, sanding or emerisation of the surface of the fabric and washing in a domestic or industrial washing machine. Fig. 1 shows a micrograph of a fibrillated fibre. Fig. 2 shows a micrograph of a nonwoven fabric of fibrillated fibres according to the invention and Fig. 3 shows micrographs of a woven fabric surface after fibrillation in two different zoom scales.

The fibrillation on the surface of the fabric may be primary and secondary fibrillation or it may be solely secondary fibrillation depending on the application and the appearance of the fabric required. Fabrics with primary and secondary fibrillation will have a matted appearance and may not launder well. Fabrics with only secondary fibrillation will have a frosted appearance and will be fully washable. Thus for decorative uses fabrics with only secondary fibrillation will be most suitable. For applications where the fabric is not visible then primary fibrillation can be left on the fabric and will add to the sound absorbing properties.

If removal of the primary fibrillation is required, then this may be achieved by a number of processes. A common way to remove primary fibrillation is to treat the fabric with a cellulase enzyme which attacks the cellulose causing it to crack and weaken. Subsequent mechanical stress on weakened primary fibrils causes them to break off giving a clean fabric surface. Further wet abrasion of the surface of the fabric in an air jet dyeing machine, by moist tumbling or washing in a domestic or industrial washing machine will then develop secondary fibrillation.

Primary fibrillation can also be removed by lightly resinating the fabric before the first fibrillation process. The fibrillation can then be removed by moist tumbling. The resin makes the cellulose more brittle and therefore a fibril is more likely to break off the parent fibre.

Primary fibrillation can be prevented to some degree by singeing the fabric before it is put through a process which will cause the fibres to fibrillate.

Removing all of the fibre ends protruding from the surface of the fabric before it is exposed to wet abrasion prevents the formation of primary fibrillation which is the fibrillation of fibre ends protruding from the surface of the fabric.

- 5 Fibrillation of a lyocell fabric occurs mainly at the surface and is evenly distributed. Secondary fibrils peel back from the high points of the knuckles of a woven fabric and form an assembly of fibrils in the low regions of the fabric. These bundles of fibrils create a more tortuous path for incident sound waves. The sound waves undergo a greater number of reflections than with a non-
- 10 fibrillated fabric giving consequently a greater absorption of sound

Other fibres are also capable of producing a fibrillated finish on a fabric and the same approach as used with lyocell fabrics will result in an increase in sound absorption. Suitable fibres include but are not limited to modal, cupro,

15 polyester, bicomponent fibres and cotton. The techniques required to produce a fibrillated finish using these other fibres will differ from those used to produce a fibrillated finish on a lyocell fabric. The techniques are well known to finishers of fabrics with skills in the art.

- 20 The improvement in sound absorption may also be achieved with fabrics which consist of a fibrillating fibre such as lyocell in blend or mixtures with other fibres which may not be capable of fibrillation. For example a 3/1 twill woven fabric could consist of a warp of yarns made from 100% lyocell fibre and a weft made from polypropylene yarns. One face of the fabric would be
- 25 predominantly lyocell. When fibrillated the lyocell would be an effective sound absorber. Alternatively a fabric could be produced from yarns which are a blend of polyester and lyocell. Applying the process required to fibrillate the lyocell would yield a fabric with fibrillate lyocell fibres at the surface giving an effective sound absorbing fabric.

30

Applications

Fibrillated fabrics as described may be used in place of non-fibrillated fabrics wherever enhanced sound absorption is desirable.

Therefore it is another object of the present invention to provide curtains or drapes made from the fabric according to the invention with enhanced sound absorption properties.

- 5 Preferred embodiments of the invention are sound absorbing linings for the use in automotive, helmets and headphones, made from the fabric according to the invention with enhanced sound absorption properties.

Other preferred embodiments of the invention are wall coverings made from the fabric according to the invention with enhanced sound absorption
10 properties.

Still other preferred embodiments of the invention are sound insulation panels with a surface layer of a fibrillated fabric according to the invention combined with other materials for use in automotive construction, domestic appliances,
15 office partitions or any similar application.

Therefore it is also an object of the present invention to provide a use of the fabrics described above for the manufacture of articles designated to have sound absorbing applications.
20

Curtains or drapes made from fibrillated fabric will absorb more of the sound produced in a room and will serve to reduce the intensity of sound transmitted into the room from outside.

- 25 Upholstered furniture covered in fibrillated fabric will absorb more sound than an equivalent covered in non-fibrillated fabric. Wall coverings made from fibrillated fabrics will absorb sound generated in the room more effectively.

Roof and door linings made from fibrillated fabric for use in cars and other
30 means of transport will reduce the sound intensity in the passenger compartment. Panels made from foam or other suitable materials covered with one or more layers of fibrillated fabric will be more effective at absorbing sound than uncovered materials.

In all applications, the fibrillated surface may be primary fibrillation or secondary fibrillation. Primary fibrillation on the surface of the fabric will maximise the sound absorption, but will not necessarily be aesthetically pleasing and may give rise to a change in appearance on washing or in use.

- 5 Secondary fibrillation on the surface of the fabric will give an aesthetically pleasing appearance and good care performance and enhanced sound absorption compared to a non-fibrillated fabric.

The invention will now be illustrated by examples. These examples are not limiting the scope of the invention in any way. The invention includes also any
10 other embodiments which are based on the same inventive concept.

Examples

Example 1:

- 15 A fabric was produced from lyocell fibre and processed to give a series of fabrics which represented the stages in production of a fibrillated peach touch fabric. They included a greige loomstate fabric, a prepared and desized fabric, a fabric with primary fibrillation achieved by air jet dyeing, an enzyme treated fabric with the fibrillation removed, a reactive dyed fabric and a tumbled fabric
20 showing secondary fibrillation. The results are shown in Table 1.

Table 1

Fabric	Air permeability (DIN EN ISO 9237)
greige loomstate fabric	1060
prepared and desized fabric	460
fabric with primary fibrillation	220
enzyme treated fabric	314
reactive dyed fabric	310
tumbled fabric	394

- These results show that air permeability is decreased by fabric preparation
25 (due to wet shrinkage) and by fibrillation. Permeability increases with enzyme

treatment (loss of fibrillation) and increases again as secondary fibrillation is generated by final tumbling.

The acoustic performance of the loomstate fabric is changed when it is prepared and desized.

- 5 The sound absorption is improved as the flow resistance is increased. For these samples under study this meant that acoustic performance of the loomstate fabric is improved when the fabric is prepared and further improved when fibrillated. However, the width of the absorptive peaks is decreased. Fibrillated fabrics show an increase in absorption of lower frequency sound
10 and a decrease in absorption of high frequency sound.

Example 2:

Four fabrics were prepared:

- 15 A. 100% Tencel®, plain weave, constructed from 1/20 Ne RS yarn, to give 150 g/m² weight. The fabric was then subjected to a preparation process to remove all yarn spinning and weaving process aids.
- B. 100% Tencel® fabric as fabric 1 but the fabric was subjected to an additional washing process to give a fibrillated surface. The fabric was then subjected to a preparation process to remove all yarn spinning
20 and weaving process aids.
- C. 100% polyester – same yarn type and fabric structure as fabric 1. The fabric was then subjected to a preparation process to remove all yarn spinning and weaving process aids.
- D. 100% cotton – same yarn type and fabric structure as fabric 1.
- 25 All four fabrics were then tested according to BS EN ISO 10534-2. For fabrics A, C and D the frequency of maximum absorption is 2500Hz. Cotton and Tencel® absorb around 95% of the sound at that frequency whereas polyester absorbs only about 90% at that frequency. Fabric B, consisting of the fibrillated Tencel®, gives a maximum absorption at 1250Hz, a much lower
30 frequency, where it absorbs 95%. The other three fabrics at 1250Hz were

greatly inferior, absorbing only 50-60%. Fig. 4 shows the absorption behaviour of the four samples. The frequency (in Hz) is on the x-axis, while the y-axis shows the sound absorption value (in %).

Claims

1. A fabric suitable for sound absorption applications consisting in whole or in part of a fibrillating fibre and which has been treated to develop fibrillation on the surface of the fabric, characterized in that this fabric has enhanced sound absorption properties.
2. A fabric according to claim 1 which fabric has enhanced low frequency sound absorption properties.
3. A fabric according to claim 1 where the fibrillating fibre is one or more of the group including Lyocell, Modal, Cupro, Aramid or bicomponent fibre.
4. A fabric according to claim 1 where the fibrillating fibre is lyocell.
5. A fabric according to claim 1 where the fibrillating fibre is lyocell and the fabric is finished to give primary fibrillation on the surface of the fabric.
6. A fabric according to claim 1 where the fibrillating fibre is in blend with or mixed with a one or more other fibres.
7. A fabric according to claim 1 where the fibrillating fibre is lyocell in blend with or mixed with a one or more other fibres.
8. Curtains or drapes made from the fabrics of claims 1 to 7 with enhanced sound absorption properties.
9. Sound absorbing linings for the use in automotive, helmets and headphones, made from the fabrics of claims 1 to 7 with enhanced sound absorption properties.
10. Wall coverings made from the fabrics of claims 1 to 7 with enhanced sound absorption properties.
11. Sound insulation panels with a surface layer of a fibrillated fabric as in claims 1 to 7 combined with other materials for use in automotive construction, domestic appliances, office partitions or any similar application.
12. Use of the fabrics of claim 1 for the manufacture of articles designated to have sound absorbing applications.

Fig. 1:



5 Fig. 2:



Fig. 3 a:

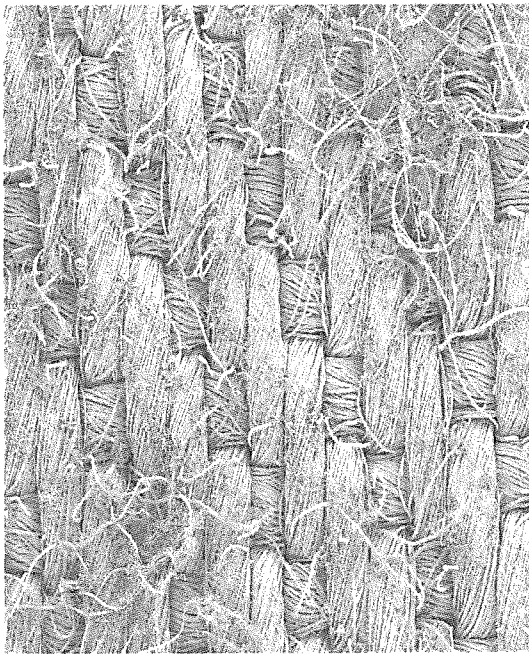


Fig. 3 b:

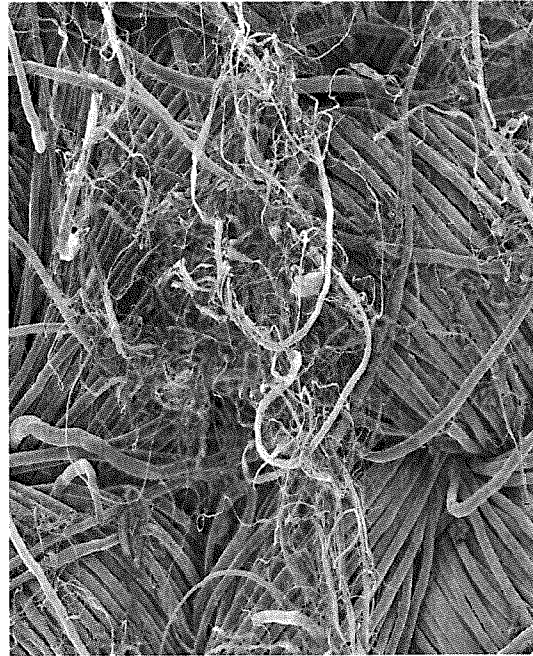
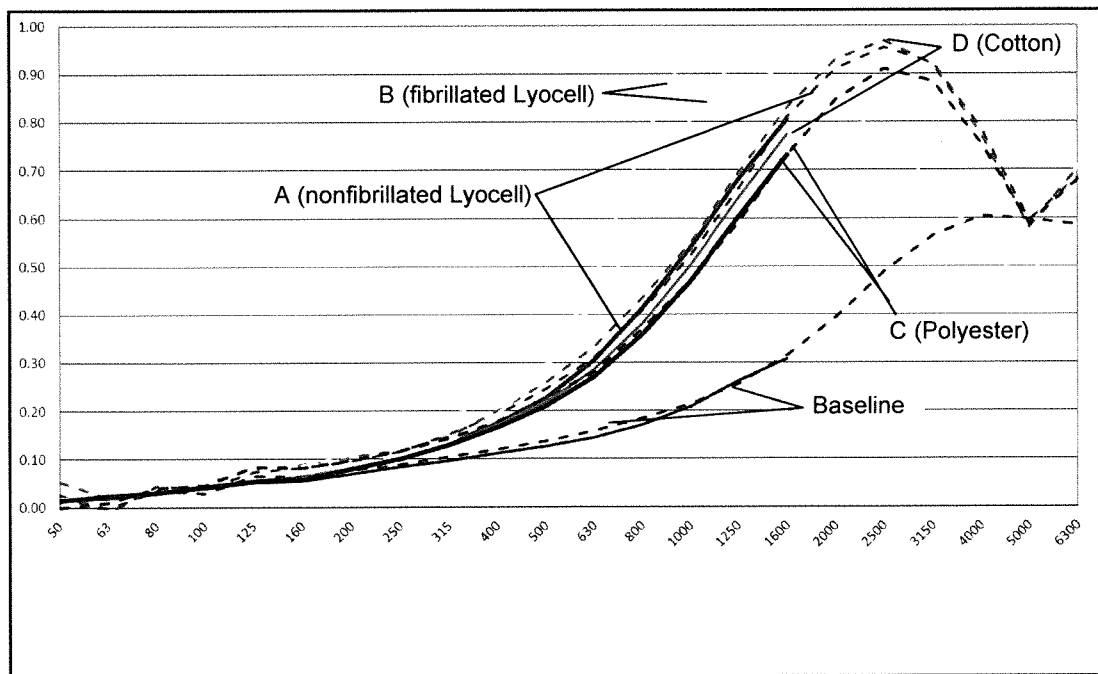


Fig. 4:



INTERNATIONAL SEARCH REPORT

International application No
PCT/AT2015/000020

A. CLASSIFICATION OF SUBJECT MATTER

INV. D04H1/4258 B60R13/08 D04H1/4342 D01F2/00 E04B1/82
G10K11/162

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D04H B60R D01F E04B G10K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	WO 2014/100842 A1 (CHEMIEFASER LENZING AG [AT]) 3 July 2014 (2014-07-03)	1-10
A,P	page 4, line 11 - page 5, line 19 page 7, line 13 - line 30 page 11, line 10 - line 24 page 12, line 10 - line 28	11,12
X	JP 2004 232137 A (OKAYAMA PREFECTURE) 19 August 2004 (2004-08-19) paragraph [0009] paragraph [0014] paragraph [0018] paragraph [0022] paragraph [0029] ----- -/-	1-12



Further documents are listed in the continuation of Box C.



See patent family annex.

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INTERNATIONAL SEARCH REPORT

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2009/111808 A1 (LENZING PLASTICS GMBH [AT]; KNAPPE FAISAL H J [DE]; WIELEND JOSEF [AT]) 17 September 2009 (2009-09-17)	1-3,6, 8-12
A	page 5, line 18 - line 24 page 6, line 23 - page 7, line 29 page 9, line 3 - page 10, line 28 -----	4,5,7
X	US 4 324 831 A (PARRINI PAOLO ET AL) 13 April 1982 (1982-04-13)	1,2,6, 9-12
A	column 1, line 53 - line 55 column 3, line 1 - line 31 column 4, line 4 - line 10 column 4, line 64 - column 6, line 13; examples 1,2 -----	3-5,7,8
X	WO 2006/009539 A1 (DU PONT [US]; ALTS THORSTEN [DE]; PFISTER FRIEDRICH V [CH]; WYSS KURT) 26 January 2006 (2006-01-26)	1-3,6, 8-12
A	page 4, line 5 - line 32 page 8, line 7 - line 15; claims 1-3,8 -----	4,5,7
X	WO 95/35399 A1 (COURTAULDS FIBRES HOLDINGS LTD [GB]; GANNON JAMES MARTIN [GB]; GRAVESO) 28 December 1995 (1995-12-28)	1-10
A	page 2, line 8 - line 21 page 10, line 35 - page 12, line 8; claims 1, 13; example 1 -----	11,12
X	GB 2 399 094 A (TENCEL LTD [GB]) 8 September 2004 (2004-09-08)	1-10
A	page 1, line 31 - page 3, line 36; claims 1,2,13,14, 19; examples 1-3, 7 -----	11,12
X	GB 2 314 568 A (COURTAULDS FIBRES [GB]) 7 January 1998 (1998-01-07)	1-10
A	page 1, line 2 - page 2, line 13 page 4, line 4 - line 23; examples 1,2 -----	11,12

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/AT2015/000020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2014100842	A1	03-07-2014	AT 513761 A1 15-07-2014
		TW 201435166 A 16-09-2014	
		WO 2014100842 A1 03-07-2014	
JP 2004232137	A	19-08-2004	JP 4285683 B2 24-06-2009
		JP 2004232137 A 19-08-2004	
WO 2009111808	A1	17-09-2009	AT 506406 A4 15-09-2009
		WO 2009111808 A1 17-09-2009	
US 4324831	A	13-04-1982	AT 368482 B 11-10-1982
		AU 8653375 A 02-06-1977	
		BE 835526 A1 13-05-1976	
		BR 7507490 A 31-08-1976	
		CA 1071795 A1 12-02-1980	
		DE 2550569 A1 20-05-1976	
		DK 504475 A 15-05-1976	
		ES 442576 A1 01-05-1977	
		FR 2291168 A1 11-06-1976	
		GB 1514530 A 14-06-1978	
		IT 1025698 B 30-08-1978	
		JP S5171383 A 21-06-1976	
		NL 7513130 A 18-05-1976	
		NO 753753 A 18-05-1976	
		SE 418854 B 29-06-1981	
		SU 589931 A3 25-01-1978	
		US 4324831 A 13-04-1982	
		ZA 7507127 A 27-10-1976	
WO 2006009539	A1	26-01-2006	NONE
WO 9535399	A1	28-12-1995	AT 187782 T 15-01-2000
		AU 702214 B2 18-02-1999	
		AU 2744695 A 15-01-1996	
		BR 9508084 A 18-11-1997	
		CA 2193370 A1 28-12-1995	
		CN 1151195 A 04-06-1997	
		CZ 9603719 A3 18-02-1998	
		DE 69513978 D1 20-01-2000	
		DE 69513978 T2 31-05-2000	
		EP 0766755 A1 09-04-1997	
		ES 2141360 T3 16-03-2000	
		FI 965050 A 16-12-1996	
		HU 218756 B 28-11-2000	
		JP H10504858 A 12-05-1998	
		NO 965481 A 19-12-1996	
		PL 317942 A1 12-05-1997	
		RU 2144101 C1 10-01-2000	
		SK 165896 A3 05-11-1997	
		TR 28779 A 06-03-1997	
		TW 382641 B 21-02-2000	
		US 6042769 A 28-03-2000	
		WO 9535399 A1 28-12-1995	
		ZA 9505194 A 14-02-1996	
GB 2399094	A	08-09-2004	AT 410540 T 15-10-2008
		CN 1754019 A 29-03-2006	
		EP 1599630 A1 30-11-2005	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/AT2015/000020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		ES 2315642 T3	01-04-2009
		GB 2399094 A	08-09-2004
		KR 20050106402 A	09-11-2005
		PT 1599630 E	19-01-2009
		TW I250238 B	01-03-2006
		WO 2004079082 A1	16-09-2004

GB 2314568	A	07-01-1998	NONE
