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WOVEN COMPRISING A FIRE-PROOF COATING

The invention relates to a textile such as a fabric, preferably which is luminous, comprising a textile backing and a flame retardant coating. The invention also relates to a process for manufacturing a textile having an improved fire resistance by depositing an aqueous flame retardant composition.

The objective of the invention is to produce a textile intended for applications for the building trade, especially a luminous fabric, having an excellent fire resistance.

A textile comprises a textile backing, that is to say a sheet consisting of yarns oriented in a particular direction or randomly. The textile backings may be woven or nonwoven.

A nonwoven textile backing corresponds to a sheet consisting of yarns which have not been woven or knitted, and the internal cohesion of which is ensured in various ways such as by mechanical, physical and/or chemical means.

A woven textile backing corresponds to a sheet consisting of directionally distributed yarns that is obtained by weaving or knitting. Weaving is the result of the interlacing, in one and the same plane, of yarns positioned in the direction of the warp (referred to hereinbelow as warp yarns) and of yarns positioned perpendicular to the warp yarns, in the direction of the weft (referred to hereinbelow as weft yarns). The binding obtained between these warp yarns and these weft yarns is referred to as a weave.

The yarns used to manufacture luminous or nonluminous, woven or nonwoven textile backings may be of organic or mineral nature.

The textiles intended for applications for the building trade advantageously comprise textile backings comprising yarns of mineral nature such as glass yarns and an at least partly organic additional coating.

Luminous fabrics comprise woven textile backings obtained by weaving binding yarns and optical fibers. The optical fibers are very often of organic nature.

Consequently, these luminous or nonluminous textiles comprise a significant proportion of product of organic nature originating from the yarns of the textile backing and/or from an optional additional coating. These materials of organic nature do not intrinsically have good fire resistance properties.

In order to improve the fire resistance of textiles, especially of luminous fabrics, it has been proposed to use flame retardant coatings. A flame retardant coating is a coating which confers flame-retardant properties, that is to say a coating which makes it possible to inhibit or delay the combustion of the underlying support when the latter is subjected

to excessive heat, to reduce the generation of smoke and/or to retard the propagation of a flame.

The complexity of luminous fabrics makes it difficult to improve the fire resistance properties without adversely affecting the lighting properties. For example, increasing the density of optical fibers in order to increase the lighting levels, when these fibers are of organic nature, is not capable of improving the fire properties or even is carried out to the detriment of said properties.

Furthermore, the known flame retardant coatings used for improving the fire resistance of fabrics are for the most part opacifying. The presence of such an opacifying coating on the surface used as a lighting surface of a luminous fabric reduces the lighting levels that can be obtained.

The application WO 2013/088094 discloses for example a fire-proofed illuminating web by a fire-proofing composition impregnated into the bulk of the illuminating web and/or contained in a coating on at least one side of the illuminating web. The fire-proofing composition comprises for example a flame-retardant agent chosen from phosphorus compounds, halogenated compounds and mineral fillers.

There is therefore a need to develop textiles comprising a transparent flame retardant coating that has an improved fire resistance, especially luminous fabrics.

The applicant has demonstrated a textile comprising a flame retardant coating that makes it possible to obtain the desired fire-resistant properties and also advantageous esthetic properties while maintaining a good transparency owing to the combined use of specific flame retardants and a suitable polymer.

The invention therefore relates to a textile comprising a woven or nonwoven textile backing and a flame retardant coating, characterized in that the flame retardant coating comprises:

(i) nanoparticles of a mineral flame retardant selected from the group consisting of aluminum monohydroxide (AlOOH), aluminum trihydroxide ($Al(OH)_3$) and a mixture thereof and (ii) poly(vinyl alcohol) (PVOH).

The textile according to the invention has a structure that is referred to as a three-dimensional structure in that it has a certain thickness when flat. The textile according to the invention comprises two main faces that define two opposite surfaces. Depending on the envisaged applications, one or both faces of the textile are intended to be visible to a user. A luminous fabric comprises a flame retardant coating, preferably on a face intended to be visible to a user.

According to one advantageous embodiment, the flame retardant coating comprises

a large proportion of nanoparticles. The flame retardant coating may especially comprise, by weight of the total weight of (i) and (ii):

(i) 50% to 90% of aluminum monohydroxide and/or aluminum trihydroxide nanoparticles,

(ii) 10% to 50% of poly(vinyl alcohol).

According to another advantageous embodiment, the textile comprises a textile backing comprising glass yarns.

According to another advantageous embodiment, the textile is a luminous fabric.

The textile thus defined has improved reaction to fire performances. When the textile is a luminous fabric, these improvements are observed without adversely affecting the lighting properties. These advantageous properties result from a synergy between the nanoparticles and the poly(vinyl alcohol).

Indeed, the specific choice of poly(vinyl alcohol) as binding medium and the choice of large proportions of nanoparticles in the flame retardant coating work toward obtaining advantageous transparency and fire resistance properties.

Surprisingly, the excellent transparency of the coating according to the invention results on the one hand from the choice of the constituents but also from their excellent compatibility with one another before deposition in the form of an aqueous composition. Indeed, the aluminum monohydroxide and/or aluminum trihydroxide nanoparticles and the poly(vinyl alcohol) are both hydrophilic and readily form homogeneous aqueous compositions even when the proportions of nanoparticles are high relative to the proportions of poly(vinyl alcohol). The homogeneity within the aqueous composition is retained after elimination of the water and formation of the coating.

The nanoparticles do not appear to agglomerate in a prejudicial manner. The flame retardant coating thus obtained has a good transparency, even when the proportions of mineral material due to the presence of the nanoparticles are high.

From the point of view of the fire resistance properties, the choice of the poly(vinyl alcohol), aluminum monohydroxide and/or aluminum trihydroxide nanoparticles and also the significant presence of said nanoparticles work toward obtaining these properties.

The poly(vinyl alcohol), the primary role of which is to act as medium binding the nanoparticles, surprisingly appears to contribute to obtaining fire resistance properties. This polymer generates carbonization residues during its combustion. These residues form, at the surface of the textile, a barrier that appears to hamper the supply of oxygen, to reduce the thermal conductivity and to limit heat transfers. This barrier corresponds to a protective layer resulting from the carbonization of the organic species (including PVOH) in the presence of the mineral flame retardant.

The aluminum monohydroxide and/or aluminum trihydroxide nanoparticles undergo an endothermic dehydration during their thermal degradation. The release of water cools the system and dilutes the gases in the flame zone, thus giving rise to a delay in combustion. But also, a protective ceramic is formed at the end of the degradation on the surface of the material. This ceramic acts as a thermal shield.

The large proportions of nanoparticles in the coating make it possible to obtain a sizeable layer of protective ceramic over the whole of the surface where the flame retardant coating was before combustion. This ceramic layer is particularly advantageous since it makes it possible, even in the case of significant degradation of the textile backing, to maintain a cohesion. The capacity of the textile according to the invention not to generate dust once burnt and to retain a certain stability is particularly advantageous.

From the point of view of the esthetic properties, the flame retardant coating does not modify, or even improves, the esthetics of the textile, in particular the appearance and the feel. For example, as a function of the targeted applications, the presence of the coating makes it possible to adjust the flexibility or the rigidity of the textile. Indeed, this coating is supple enough not to crack during handling of the textile. Furthermore, it gives the surface of the coated textile a smooth appearance.

Finally, added to these advantages, when the textile is a luminous fabric, is the maintenance of the lighting levels that may be obtained. No significant loss of luminance measured normal to the emitting surface is observed due to the presence of the flame retardant coating. The luminous fabric according to the invention has advantageous lighting performances relative to fabrics that have nontransparent or opacifying flame retardant coatings placed on their lighting face.

The flame retardant coating advantageously has a grammage, corresponding to the basis weight, of from 25 to 500 g/m^2, preferably from 50 to 350 g/m^2, preferably from 100 to 350 g/m^2, in particular from 150 to 250 g/m^2.

The weights of coating per unit area correspond to the weight of the dry coatings, that is to say after elimination of the solvent or dispersing media.

A nanoparticle is understood within the meaning of the present invention to mean a particle having an equivalent diameter of less than 950 nm, the equivalent diameter corresponding to the diameter of the equivalent sphere, that is to say the sphere having the same behavior in laser scattering particle size analysis as the nanoparticle.

Preferably, the mineral flame retardant comprises aluminum monohydroxide, in particular in boehmite form.

The particles must be nanoparticles, that is to say have an equivalent diameter of less than 950 nm. Advantageously, at least 95% of the mineral flame retardant nanoparticles have an equivalent diameter of less than 750 nm, or even less than 500 nm, in particular less than 400 nm and ideally less than 300 nm. The equivalent diameter is advantageously greater than 20 nm, or even greater than 50 nm, or even greater than 60 nm, in particular greater than 80 nm. The equivalent diameter is determined by laser particle size analysis (DLS, *dynamic light scattering*) on a PARTICA LA-950 device sold by Horiba, the powders being analyzed in water without the use of ultrasonic waves.

Such particles appear to contribute to obtaining a coating that has a non-rough surface.

Although the nanoparticles can in principle have various shapes, for example elongated or flattened, use will preferably be made of nanoparticles having an aspect ratio - defined as the ratio L/l between the largest dimension L and the largest dimension l in a plane perpendicular to L - of less than or equal to 2, preferably close to 1.

Although the use of aluminum monohydroxide and/or aluminum trihydroxide as the sole mineral flame retardant constitutes a preferred embodiment of the present invention, it can be envisaged for a relatively small fraction of the aluminum monohydroxide and/or aluminum trihydroxide to be replaced by another mineral flame retardant selected from flame retardants having endothermic decomposition. Mention may be made, as examples of such other flame retardants, of magnesium hydroxide ($Mg(OH)_2$ and magnesium hydroxycarbonate (especially hydromagnesite $Mg_2(CO_3)_4(OH)_2.4H_2O$). This replaced fraction does not however generally exceed 20% by weight.

The poly(vinyl alcohol), prepared by hydrolysis of poly(vinyl acetate), typically has a degree of hydrolysis of at least 60%, preferably of at least 72%, preferably of at least 85%, in other words at most 40%, preferably at most 28%, preferably at most 15% of the units forming the polymer are still in acetate form.

The flame retardant coating preferably essentially consists of mineral flame retardant and PVOH; in other words it preferably contains no ingredients other than PVOH and aluminum monohydroxide, aluminum trihydroxide or a mixture thereof.

The mineral flame retardant/PVOH weight ratio is preferably between 8/2 and 6/4, in particular between 7/3 and 5/5.

The invention also relates to a process for manufacturing a textile as defined above comprising a textile backing and a flame retardant coating, the process comprising:

- deposition of an aqueous flame retardant composition comprising:

(i) nanoparticles of a mineral flame retardant selected from the group consisting of

aluminum monohydroxide (AlOOH), aluminum trihydroxide ($Al(OH)_3$) and a mixture thereof and (ii) poly(vinyl alcohol),

- drying in order to obtain the flame retardant coating.

The invention also relates to the use of a flame retardant coating as described above for improving the fire behavior of a textile comprising a textile backing.

The flame retardant coating is obtained by depositing an aqueous flame retardant composition. This aqueous composition is a colloidal composition. It comprises, in an aqueous medium, preferably demineralized water, poly(vinyl alcohol) and nanoparticles of a mineral flame retardant selected from the group consisting of aluminum monohydroxide, aluminum trihydroxide and a mixture thereof.

Preferably, the aqueous flame retardant composition comprises, by weight relative to the total weight of solid material in the composition: (i) 50% to 90% of aluminum monohydroxide and/or aluminum trihydroxide nanoparticles,

(ii) 10% to 50% of poly(vinyl alcohol).

In order to be able to obtain the required thicknesses, the composition must have a suitable viscosity. Its viscosity is advantageously less than 10 Pa.s, preferably less than 5 Pa.s, in particular less than 3 Pa.s.

This viscosity corresponds to the Brookfield viscosity, determined using a controlled stress rheometer (AR-2000 type from TA Instruments) using a cone-plate geometry under a stress of 10 Pa at ambient temperature (25°C).

In order to obtain such a viscosity, the mineral flame retardant is advantageously in the form of a colloidal solution of boehmite.

The aqueous composition has a pronounced thixotropic nature. When it is left to rest for a prolonged time, it forms a physical gel by establishing hydrogen bonds between the hydroxyl groups of the PVOH and the hydroxyl groups at the surface of the flame retardant. Before each deposition step, it is essential to subject the composition to a shear stress in order to fluidize it.

The aqueous composition has a solids content of between 10% and 30%, preferably between 12% and 22%.

When the aluminum monohydroxide and/or trihydroxide are/is suspended in demineralized water, they naturally give the colloidal suspension a weakly acidic pH. The aqueous flame retardant composition typically has a pH of between 2 and 6, preferably between 3 and 5.

The aqueous flame retardant composition advantageously contains, by weight relative to the total weight of the aqueous flame retardant composition, from 5% to 40%,

preferably from 6% to 30%, in particular from 7% to 20% and ideally from 8% to 15% of mineral flame retardant nanoparticles, preferably of aluminum monohydroxide and/or aluminum trihydroxide nanoparticles, and from 2% to 30%, preferably from 3% to 20%, in particular from 4% to 15% and ideally from 5% to 10% of poly(vinyl alcohol).

The aqueous composition is preferably prepared by first dissolving the poly(vinyl alcohol) in demineralized water, with stirring and heating. Added next to the PVOH solution is the flame retardant powder which has optionally first been suspended in demineralized water.

The drying may be carried out at ambient temperature or with heating to a temperature, preferably below 80°C, at atmospheric or subatmospheric pressure. The drying time depends of course on the drying conditions and on the dimensions of the textile to be dried and is generally between a few seconds and several hours.

The textile backings may be based on mineral fibers, organic fibers or composites, i.e. may comprise a mixture of organic and mineral fibers.

The mineral fibers are for example selected from the group comprising glass, quartz and silica.

The organic fibers may be natural or synthetic fibers and are for example selected from fibers of polyester, polyamide, polymethyl methacrylate (PMMA), polycarbonate (PC), cyclic olefins (COP) and fluoropolymers.

The textile backings that may be used according to the invention have a basis weight generally of between 30 and 2500 g/m^2.

The textile backings may be woven or nonwoven. They comprise:

- meshes, preferably open meshes, corresponding to textile backings composed of chemically bound continuous yarns,
- mats, preferably glass mats, corresponding to nonwoven textile backings composed of uniformly dispersed and chemically bound glass fibers,
- all woven products manufactured on a weaving loom or knitted with warp and weft yarns in various weaves that form a textile backing.

As examples of woven products, mention may be made of the meshes for external thermal insulation applications and also the meshes for reinforcing components of the building such as facade coatings.

The nonwoven textile backings advantageously have:

- a basis weight of from 30 to 500 g/m^2, 50 to 300 g/m^2, 100 to 1500 g/m^2 and/or
- a mesh opening size of between 1 mm^2 and 15 cm^2.

The woven textile backings advantageously have:

- a basis weight of from 100 to 2500 g/m^2, 250 to 1000 g/m^2, and/or
- a thickness of less than 10 mm, preferably between 0.25 µm and 5 mm.

According to one advantageous embodiment, the textile comprises a woven or nonwoven textile backing comprising glass yarns.

The textile backing may comprise only glass yarns.

The textile backing may also comprise a combination of glass yarns and yarns of organic nature and form in this case a hybrid fabric. A luminous fabric based on glass yarns and optical fibers of organic nature constitutes an example of such hybrid fabrics.

Advantageously, the textile backing comprises, by weight relative to the weight of the textile backing, at least 20%, at least 30%, at least 40%, at least 50%, at least 60%, at least 70%, at least 80%, at least 90% of compounds of mineral nature such as glass yarns.

Suitable glass yarns according to the invention and their manufacturing process are described for example in “Fibres de verre de renforcement” [Reinforcing glass fibers], Techniques de l’Ingénieur, Traité Plastiques et Composites [Treatise on Plastics and Composites]. The glass yarns are formed from filaments having a diameter in general of between 5 and 24 µm, preferably between 6 and 16 µm, and better still between 8 and 13 µm. The glass yarns are produced from the conventional raw materials necessary for the manufacture of the glass such as silica, lime, alumina and magnesia. Suitable glass yarns according to the invention include especially E-glass yarns and silica yarns.

The glass yarns are defined by their TEX count or linear density which is a function of the diameter and of the number of base filaments forming the yarn. The TEX corresponds to the weight in grams of 1000 m of yarn. The glass yarns preferably have a count of between 10 and 30 000 TEX, preferably a count of greater than or equal to 30 TEX, preferably from 34 to 29 000 TEX.

The glass yarns may be twisted glass yarns having at least 5, at least 10, at least 15 or at least 20 twists/m.

The glass yarns are preferably first finished at the moment they are formed and may then be sized. The finish is a treatment product that is applied to the surface of the glass fibers after they leave the spinneret for forming the glass fibers. All the glass yarns are in general finished. Sizing, unlike finishing, is a treatment carried out “off-line”, that is to say after manufacture of glass yarns.

Finishing consists in applying a finishing composition comprising at least one finishing agent. For finishing agents, reference may be made to the finishing agents

described in “Fibres de verre de renforcement” [Reinforcing glass fibers], Technique de l’Ingénieur, Traités Plastiques et Composites [Treatise on Plastics and Composites].

Sizing consists in applying a sizing composition comprising at least one sizing agent. The same compositions may be used for finishing or sizing. At the end of the sizing step, each glass yarn, preferably used as warp, is coated with a sheath, which covers the whole of its periphery. For the sizing operation, reference may be made to application WO 2009/071812.

The flame retardant coating should not be confused with a finish or a size. The coating is deposited on a textile backing that has already been formed.

The flame retardant coating represents, by weight relative to the weight of the flame retardant coating and of the woven textile backing, at least 5%, preferably at least 8% or at least 10%. The proportions of finish and/or of size are much lower, in general less than 1% by weight of the weight of fibers for the finish and less than 5% by weight of the weight of fibers for the size.

Advantageously, the glass yarns represent, by weight relative to the weight of the woven or nonwoven textile backing, at least 20%, at least 30%, at least 40%, at least 50%, at least 60%, at least 70%, at least 80% or at least 90%. The higher the proportions of glass yarns in the woven textile backing, the better the fire performances.

According to one advantageous embodiment, the textile is a luminous fabric comprising two faces, at least one of which is used as a lighting surface. The luminous fabric comprises a flame retardant coating, preferably which is applied on the side of the face used as a lighting surface. According to a variant, the woven textile backing comprises a single face used as a lighting surface, referred to hereinbelow as main lighting surface or face. According to another variant, the woven textile backing comprises two faces used as lighting surfaces.

The textile then comprises a woven textile backing comprising warp yarns and weft yarns selected from binding yarns and optical fibers capable of emitting light sideways.

The binding yarns make it possible to ensure the good cohesion of the whole of the woven textile backing. The term “binding yarn”, within the meaning of the invention, comprises all yarns or fibers other than optical fibers, that is to say all yarns or fibers that do not have the property of being able to emit light sideways and therefore that are not directly connected or connectable to a light source.

The binding yarns advantageously comprise glass yarns.

Preferably, the glass yarns forming the woven textile backing are present in a large amount by weight and by number. According to this embodiment, the binding yarns are predominantly glass yarns by weight and by number.

The glass yarns used as binding yarns may represent, by weight relative to the total weight of the binding yarns forming the woven textile backing, in order of increasing preference, at least 50%, at least 60%, at least 70%, at least 80%, at least 90%, at least 95%, at least 99%.

The glass yarns represent at least 30%, preferably at least 40%, and better still at least 50%, by weight of the weight of the woven textile backing. The weight of the woven textile backing corresponds to the total weight of the weft yarns and warp yarns, that is to say to the weight of all of the binding yarns and optical fibers.

According to another embodiment, the binding yarns forming the woven textile backing may comprise yarns or fibers other than glass yarns. The binding yarns may especially comprise a combination of glass yarns and yarns of different nature such as yarns based on organic fibers, metal fibers or mineral fibers other than glass fibers.

According to another embodiment, all the binding yarns are glass yarns, that is to say that all the yarns other than optical fibers are glass yarns.

The optical fibers are capable, once connected to a light source, of emitting light sideways owing to the presence of invasive alterations along their surface. The optical fibers may be formed from a mineral or organic material and may be one-component or two-component optical fibers.

The mineral materials are for example selected from the group comprising glass, quartz and silica. The organic materials are for example selected from the group comprising polymethyl methacrylate (PMMA), polycarbonate (PC), cyclic olefins (COP) and fluoropolymers.

A sheath may cover the optical fibers in order to protect them. In this case, the optical fibers are made of two materials and have a core covered by a sheath which may be of a different nature. These structures are also referred to as core-shell structures.

As two-component optical fibers that are very particularly suitable, mention may be made of the fibers comprising a polymethyl methacrylate (PMMA) core and a sheath based on a fluoropolymer such as polytetrafluoroethylene (PTFE).

Among the optical fibers that are very particularly suitable, mention may be made of the one-component optical fibers based on silica or two-component optical fibers comprising a silica core and a polymer sheath.

The use of optical fibers of this type of partially or completely mineral nature makes it possible to increase even more the proportion of mineral materials in the woven textile backing and in particular to give it unrivalled fire resistance or recyclability properties.

The one-component or two-component optical fibers advantageously have a diameter between 100 and 1000 µm, preferably from 200 to 550 µm, preferably from 450 to 550 µm.

The optical fibers comprise invasive alterations, corresponding to notches or small slits, which enable the extraction of light at the fibers since they modify the angle of reflection of the light rays inside the fiber and the lateral transmission of light outside of the fiber. The optical fibers therefore make it possible both to convey the light inside their structure but also to emit the light sideways. Consequently, the optical fibers make it possible to guide the light, in a distributed manner, inside the luminous fabric and to diffusely illuminate the main surfaces of the luminous fabric.

The invasive alterations may be obtained in various ways and in particular by abrasive processes such as sandblasting, chemical attack or melting by means of a high-intensity light ray such as a laser.

Preferably, the optical fibers extend outside of the surface defined by the fabric corresponding to the edge of the luminous fabric. The optical fibers may be braided or assembled in the form of bundles so as to unite a plurality of free ends opposite one and the same light source, preferably at the edge of the luminous fabric. Regarding the manufacture of the luminous fabric and the connection of the optical fibers, reference may be made to patent FR 2859737.

The optical fibers therefore comprise free ends capable of being connected or arranged opposite a light source in order to transmit the light and emit the light sideways at the alterations.

The luminous fabric comprises at least one light source connected to at least one optical fiber.

The light sources intended to light the free ends of the optical fibers may be of different natures, and in particular be in the form of light-emitting diodes or of extended sources such as incandescent lamps, fluorescent tubes or discharge tubes incorporating a gas such as neon. The light sources are advantageously light-emitting diodes.

The textile may comprise at least one additional coating having the objective of imparting supplementary functionalities such as mechanical, reflecting, diffusing, decorative, fire resistance, impact strength, abrasion resistance, anti-soiling, washability, antistatic or other properties. The additional coating may therefore be selected from

reflective coatings, structuring coatings, coatings having a good cleanability and diffusing coatings.

The textile may in particular comprise a structuring coating, preferably on a face that is not used as a lighting surface when the textile is a luminous fabric. This additional structuring coating is advantageously of white color and/or reflective and/or predominantly based on material of mineral nature. The combination, within one and the same luminous fabric, of the luminous textile backing and of the structuring coating contributes even more to obtaining an excellent lighting performance while making it possible to obtain a good mechanical strength.

The fabric may therefore comprise an additional structuring coating on a face that is not used as a lighting surface and a flame retardant coating on a face that is used as a lighting surface.

The additional structuring coating advantageously has a grammage, corresponding to the basis weight, of from 50 to 500 g/m^2, preferably from 90 to 170 g/m^2.

One important field of application of the textile according to the invention lies in the building field, in particular in the housing field. The luminous fabric of the invention may be used in particular as lighting panels, as a wall partition or as a ceiling in a building.

The fabrics may be fastened directly or indirectly to a rigid or semirigid backing by any known means and in particular with the aid of an adhesive.

The luminous fabrics make it possible to produce light over a portion or over the whole of their surface. They are more particularly suitable for the interior illumination or lighting of housing on walls, partitions, ceilings or floors as a decorative or design product.

Examples

A. Raw materials

I. Fabrics without coating

1. “Nonluminous” fabrics

TP fabric: Nonwoven, nonluminous fabric based on polyester fibers.
TV fabric: Nonwoven, nonluminous fabric based on glass fibers.

2. “Lluminous” fabrics

LV fabric: Luminous fabric comprising glass yarns

The tables above group together the features of the glass yarns and of the optical fibers used. E-glass yarns were used as warp yarns and as weft yarns.

The binding yarns used as warp yarns are sized glass yarns having a density of 7.9 yarns/cm. The binding yarns used as warp yarns are all glass yarns. The weft yarns comprise optical fibers and glass yarns. The density of optical fibers used as weft yarns is 12 yarns/cm. The density of glass yarns used as weft yarns is 12 yarns/cm.

Binding yarns	**Direction**	**Tex**	**Twists**	**Name**	**g/m²**
Sized glass yarn	Warp	68	20 No./m	EC9 68 Z20	53.72
Glass yarn	Weft	136	28 No./m	EC11 136 Z28	163.2

Optical fibers	**Core/Shell Nature**	**Diameter**	**TEX**	**g/m²**
FO2	PMMA/fluoropolymer (PTFE)	500 µm	240	240

The woven textile backing obtained has a grammage of 524 g/m^2 and a proportion by weight of compounds of mineral nature relative to the weight of the woven textile backing of 43%.

The woven textile backings then underwent a treatment step in order to create invasive alterations on the optical fibers. The treatment step was carried out by sandblasting or by laser abrasion. Next, a step of connecting the optical fibers was carried out. This step consists in assembling a certain number of optical fibers, depending on their diameter, into a bundle and in joining the ends of the optical fibers to a system comprising a light source. The light sources used are light-emitting diodes (OSRAM Dragon Plus® LUW W5AM LEDs).

II. Aqueous flame retardant composition

An aqueous solution of PVOH is prepared by dissolving, at a temperature of 80°C and with stirring, PVOH (SELVOL sold by SEKUISI) in demineralized water. The poly(vinyl alcohol) used has a molecular weight of 87 000 g/mol, a degree of hydrolysis of 87 to 89 mol% and a density of 1.27 to 1.31 g/cm^3.

60 parts of this solution containing 12% by weight of PVOH is then mixed at ambient temperature with 40 parts of a colloidal suspension containing 33% by weight of nanometric boehmite in demineralized water. The boehmite particles have an aspect ratio of the order of 1. They essentially all have an equivalent diameter of less than 500 nm, with a large proportion of particles having an equivalent diameter of less than 200 nm.

The aqueous composition thus obtained contains 7.2% by weight of PVOH, 13.35% by weight of nanometric boehmite and 79.45% of water. Its pH is naturally between 3 and 5 without it being necessary to add acid.

III. Additional structuring coating composition

A structuring coating composition was tested that provides a coating comprising, by weight of the total weight of the dry coating:

- 78% of an acrylic-type binder selected from styrene-acrylic binders,
- 20% of calcium carbonate as filler, and
- 2% of white pigment of TiO_2 type.

The composition comprises water as solvent. The solids content in the composition is 75% by weight.

The composition is applied to a single surface of the various luminous fabrics by knife coating. Drying was carried out at ambient temperature.

A. Process for obtaining a fabric according to the invention

The following fabrics were tested:

- TP fabric: fabric comprising polyester binding yarns (100%),
- TV fabric: fabric comprising glass binding yarns (100%),
- LV fabric: luminous fabric without additional structuring coating,
- LVS fabric: luminous fabric comprising an additional structuring coating deposited with a grammage of 155 g/m^2.

Fabric according to the invention

The flame retardant composition is vigorously stirred just before application for 5 minutes. This composition is then applied to a single face of the various fabrics by knife coating. Drying is carried out at ambient temperature for 24 h.

The table below gives:

- the grammage (basis weight in g/m²) of the fabrics without coating,
- the grammage of the flame retardant coatings applied obtained following the application of the aqueous flame retardant composition and drying.

Ref.	Fabrics	Grammage g/m²	
		Textile backing	Flame retardant coating
1	PES fabric	100	87
2	Glass fabric	50	69.3
4	LV1 fabric	524	43
5	LV2 fabric	524	50.9
6	LV3 fabric	524	92.1
7	LV4 fabric	524	123.0
8	LVS1 fabric	524	79
9	LVS2 fabric	524	51

B. Determination of the properties

I. Evaluation of the fire resistance

Tests for evaluating the ignitability of the construction products subjected to direct flame impingement and their contribution to the propagation of the flame were carried out according to the NF EN ISO 11925-2 standard. The sample is placed in a vertical position in the combustion chamber and subjected to a flame. It is then subjected to a flame of calibrated height at a distance predefined in the standard. The tests are carried out on 2 separate samples. The flame is applied either at the surface or at the edge.

Tests were carried out for each fabric comprising a flame retardant coating and also for control fabrics corresponding to luminous fabrics comprising glass yarns (LV control). The table below summarizes the results obtained.

Ref.	Propagation time of the flame at 150 mm		Flame retardant coating
	Edge	Surface	
PES	-	-	87
LV control	12	20	0
LV1	14	30	43
LV2	19	35	50.9
LV3	23	40	92.1
LV4	23	42	123.0
LVS control	22	29	0
LVS	22	45	51

The PES fabrics comprising the flame retardant coating according to the invention retain their physical integrity and in particular do not melt when they are exposed to a flame unlike a PES fabric without flame retardant coating.

In all cases, the flame retardant coating delays the propagation of the flame and therefore slows down a possible degradation of the fabrics.

Determination of the esthetic properties

In order to demonstrate the esthetic qualities of the fabrics, a panel of several people qualitatively assessed the feel, the handleability and the visual appearance. The following assessment indicators were used:

- regarding the feel: “+”: soft, “-”: rough,
- regarding the handleability: “+”: absence of cracking of the flame retardant coating, “-”: cracking of the flame retardant coating,
- regarding the visual appearance: “-”: average, “++”: good.

The table below summarizes the results obtained for various fabrics.

Fabrics	Esthetic properties		
	Feel	Handleability	Visual appearance
PES fabric	-	+	+
Glass fabric	-	+	+
LV1 fabric	+	++	++
LV2 fabric	+	++	++
LV3 fabric	+	+	+
LV4 fabric	+	+	+
LVS1 fabric	+	++	++

II. Evaluation of the lighting properties in the case of a luminous fabric

The luminous performances of a luminous fabric comprising a structuring coating and a flame retardant coating were measured (LVS fabric) and compared with a luminous fabric comprising only a structuring coating (LVS control). The structuring coating is deposited on the face that is not intended to act as main lighting surface (rear coating) and the flame retardant coating is deposited on the face that is intended to act as main lighting surface.

For this, the luminance was measured according to the ISO 23539:2005 luminance standard.

Fabrics	Luminance (Cd/m2)
LVS2 control	210
LVS2	209

The fabrics comprising the flame retardant coating according to the invention simultaneously have excellent lighting properties, a satisfactory mechanical strength and an excellent fire resistance. The improvement in the fire resistance properties is obtained without adversely affecting the lighting properties.

VÆV OMFATTENDE EN TRANSPARENT, BRANDBESTANDIG BEKLÆDNING

PATENTKRAV

1. Tekstil, der omfatter en, vævet eller ikke-vævet, tekstilbærer og en brandhæmmende beklædning, kendetegnet ved, at den brandhæmmende beklædning omfatter:
(i) nanopartikler af et mineralsk brandhæmmende middel, der har en ækvivalent diameter på mindre end 950 nm og er udvalgt fra gruppen bestående af aluminiummonohydroxid (AlOOH), aluminiumtrihydroxid ($Al(OH)_3$) og en blanding deraf og (ii) af poly(vinylalkohol).

2. Tekstil ifølge krav 1, kendetegnet ved, at den brandhæmmende beklædning omfatter efter vægt af totalmassen af (i) og (ii):
(i) 50 til 90 % aluminiummonohydroxid- og/eller nanopartikler af aluminiumtrihydroxid,
(ii) 10 til 50 % poly(vinylalkohol).

3. Tekstil ifølge krav 1 eller 2, kendetegnet ved, at den brandhæmmende beklædning har en gramvægt på mellem 25 og 500 g/m^2.

4. Tekstil ifølge et hvilket som helst af de foregående krav, kendetegnet ved, at mindst 95 % af de mineralske brandhæmmende nanopartikler har en ækvivalent diameter på mere end 20 nm og mindre end 750 nm.

5. Tekstil ifølge et hvilket som helst af de foregående krav, kendetegnet ved, at bæretekstilet omfatter glastråde, der tegner sig for mindst 30 vægt-% af tekstilbæreren.

6. Tekstil ifølge et hvilket som helst af de foregående krav, kendetegnet ved, at tekstilet er et lysende stof, hvor stoffet omfatter to flader, hvoraf den ene anvendes som lysende overflade.

7. Tekstil ifølge krav 6, kendetegnet ved, at tekstilet omfatter en vævet tekstilbærer omfattende kædetråde og skudtråde udvalgt blandt bindetråde og optiske fibre, der er egnede til at udsende lys lateralt.

8. Tekstil ifølge krav 6 eller 7, kendetegnet ved, at bindetrådene omfatter

glastråde, der tegner sig for mindst 50 vægt-% af totalvægten af de bindetråde, der udgør den vævede tekstilbærer.

9. Tekstil ifølge et hvilket som helst af kravene 6 til 9 kendetegnet ved, at den brandhæmmende beklædning er påført fladen, der anvendes som lysende overflade.

10. Tekstil ifølge et hvilket som helst af de foregående krav, kendetegnet ved, at det omfatter mindst en supplerende beklædning, der er udvalgt blandt reflekterende beklædninger, strukturbeklædninger, rengøringsvenlige beklædninger og lysspredende beklædninger.

11. Fremgangsmåde til fremstilling af et tekstil ifølge et hvilket som helst af kravene 1 til 10 omfattende en tekstilbærer og en brandhæmmende belægning, hvilken fremgangsmåde omfatter:

- aflejring af en brandhæmmende, vandig sammensætning omfattende:

(i) nanopartikler af et mineralsk brandhæmmende middel, der er udvalgt fra gruppen bestående af aluminiummonohydroxid (AlOOH), aluminiumtrihydroxid ($Al(OH)_3$) og en blanding deraf og

(ii) af poly(vinylalkohol),

- tørring for at opnå en brandhæmmende beklædning.

12. Fremgangsmåde til fremstilling af et tekstil ifølge krav 11, kendetegnet ved, at den vandige sammensætning omfatter efter vægt i forhold til totalvægten af faststoffet i sammensætningen:

(i) 50 til 90 % nanopartikler af aluminiummonohydroxid- og/eller aluminiumtrihydroxid,

(ii) 10 til 50 % poly(vinylalkol).

13. Fremgangsmåde til fremstilling af et tekstil ifølge krav 11 eller 12, kendetegnet ved, at den brandhæmmende, vandige opløsning har en viskositet på mindre end 10 Pa.s, fortrinsvis mindre end 5 Pa.s, navnlig mindre end 3 Pa.s, viskositet svarende til Brookfield-visikositeten.

14. Fremgangsmåde til fremstilling af et tekstil ifølge et hvilket som helst af kravene 11 til 13, kendetegnet ved, at den brandhæmmende, vandige sammensætning

har et pH, der ligger mellem 2 og 6, fortrinsvis mellem 3 og 5.

15. Fremgangsmåde til fremstilling af et tekstil ifølge et hvilket som helst af kravene 11 til 14, kendetegnet ved, at den vandige, brandhæmmende sammensætning indeholder efter vægt i forhold til totalvægten af den vandige brandhæmmende sammensætning:

- fra 5 % til 40 %, fortrinsvis fra 8 % til 15 % nanopartikler af aluminiummonohydroxid- og/eller aluminiumtrihydroxid,
- fra 2 % til 15 %, fortrinsvis fra 5 % til 10 % poly(vinylalkohol).