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(54) Title: FLAME RETARDANT POLYMER COMPOSITION COMPRISING COATED ALUMINUM HYDROXIDE AS FILLER

(57) Abstract: The present invention relates to a flame retardant polymer composition comprising (A) a polar ethylene copolymer comprising alkyl acrylate comonomer units, (B) coated aluminum hydroxide as filler material to an article, in particular a wire or cable, comprising said flame retardant polymer composition, and to the use of said composition for the production of a layer of a wire or cable. The invention is furthermore directed to a process for producing a flame retardant polymer composition.



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Flame Retardant Polymer Composition comprising coated aluminum hydroxide as filler

The present invention relates to a flame retardant polymer composition, to an article, in particular a wire or cable, comprising said flame retardant polymer composition, and to the use of said composition for the
5 production of a layer of a wire or cable.

For improving the flame retardancy of polymers, several approaches are known in the art. First, it is known to include compounds containing halides into the polymer. However, these materials have the disadvantage that upon burning hazardous and corrosives gases like hydrogen halides
10 are liberated. This is also a disadvantage of flame retardant polymer composition based on PVC.

In a further approach, flame retardant compositions include relatively large amounts, typically 50 to 60 wt.%, of inorganic fillers such as e.g. hydrated and hydroxy compounds, which during burning decompose
15 endothermically and liberate inert gases at temperatures in the range of 200 to 600°C. Such inorganic fillers e.g. include $\text{Al}(\text{OH})_3$ and $\text{Mg}(\text{OH})_2$. However, these flame retardant materials suffer from the deterioration of the processability and mechanical properties of the polymer composition due to the high amount of filler.

20 A third approach as disclosed e.g. in EP 0 393 959 uses a silicon fluid or gum in a composition together with an organic polymer comprising an acrylate or acetate and an inorganic filler which is neither a hydroxide nor a substantially hydrated compound. The flame retardancy of such compositions is based on synergistic effects between these three
25 components which in case of burning lead to the formation of a physically and firmly stable char layer that protects the polymer from further

burning. Compounds based on such compositions show good flame retardancy in the limiting oxygen index (LOI) test method according to ISO 4589-A-IV. Sheathed cables and larger conduit (unsheathed) cables also fulfill specific cable tests, like e.g. the single-wire burning test according to IEC 332-1. Cables and wires, however, based on such
5 compositions have difficulties in fulfilling the requirements of bunch tests, e.g. FIPEC test according to prEN 50399:2007. Hence, the flame retardancy of such compositions can still be improved.

It is thus an object of the present invention to provide a flame retardant
10 polymer composition which shows a combination of good flame retardancy i.e. passes the FIPEC test according to prEN 50399:2007, good processability, such as extrudability, and good mechanical properties, such as improved surface quality.

It has surprisingly been found that the object of the present invention can
15 be achieved by using a polymer composition which comprises a polar ethylene copolymer comprising alkyl acrylate comonomer units and coated aluminum hydroxide as inorganic filler.

The invention therefore provides a flame retardant polymer composition comprising:

- 20 (A) a polar ethylene copolymer comprising alkyl acrylate comonomer units, and
- (B) coated aluminum hydroxide as inorganic filler

The flame retardant polymer composition according to the invention fulfills the requirements of class B2 and C of the FIPEC test according to
25 prEN 50399:2007 and further shows good processability, such as extrudability, and good mechanical properties, such as improved surface quality.

Preferably, the composition is free of halogen- and phosphorous-containing compounds as flame retardancy aids, i.e. such compounds, if at all, are present in the composition in an amount of below 3000 ppm.

5 More preferably, the composition is entirely free of halogen-containing compounds. However, especially phosphorous containing-compounds may be present in the composition as stabilizers, usually in an amount of below 2000 ppm, more preferably below 1000 ppm.

10 The aluminum hydroxides as inorganic filler can be coated in several manners known to the person skilled in the art. The coating agent is added in liquid form into the filler in powder form. Most common is to coat the filler and then add the filler to the compound. Another possibility is to add filler and coating agent separately or dry mixed to the compounding unit.

15 In the composition, components (A); (B) and optionally (C) as described below may either consist of a single chemical compound or a mixture of compounds of the required type.

The numbering of chemical groups, as used herein, is in accordance with the IUPAC system in which the groups of the periodic system of the elements are numbered from 1 to 18.

20 Furthermore, wherever herein the term "polyolefin" (or "polyethylene") is used both olefin homo- or copolymers (or ethylene homo- or copolymers) are meant.

The inventive flame retardant polymer composition comprises a polar ethylene copolymer comprising alkyl acrylate comonomer units.

25 Preferably, the alkyl acrylates are selected from C₁- to C₆- alkyl acrylates, more preferably the alkyl acrylates are selected from C₁- to C₄- alkyl acrylates and most preferably the alkyl acrylates are methyl acrylate

comonomers and most preferably, component (A) is an ethylene methacrylate copolymer.

Preferably, component (A) has an alkyl acrylate content from 10 to 40 wt.%, more preferably from 15 to 35 wt.% and most preferably from 20 to 30 wt.%.

In addition to alkyl acrylate comonomers component (A) may further comprise additional comonomers. These comonomers may be selected from but are not limited to C₃- to C₂₀-alpha-olefins, C₁- to C₆- alkyl methacrylates, acrylic acids, methacrylic acids and vinyl acetates. The polar ethylene copolymer may also contain ionomeric structures (like e.g. DuPont's Surlyn type).

In addition to ethylene and the defined comonomers, the copolymers can also contain additional monomers.

Preferably, component (A) is an ethylene copolymer comprising not more than 5 wt. % of comonomers other than alkyl acrylates, more preferably not more than 2.5 wt. % of comonomers other than alkyl acrylates, even more preferably not more than 1.0 wt. % of comonomers other than alkyl acrylates and most preferably not more than 0.5 wt. % of comonomers other than alkyl acrylates.

In the composition of the invention, preferably the amount of component (A) is from 10 to 50 wt.% of the total polymer composition, more preferably is from 15 to 40 wt. % of the total polymer composition and most preferably is from 25 to 35 wt. % of the total polymer composition.

Preferably component (A) has a density of at least 940 g/cm³.

Furthermore, the inventive composition comprises

(B) coated aluminum hydroxide as an inorganic filler.

The aluminum hydroxide has e.g. been coated with an organosilane, a polymer, a carboxylic acid or its salt or mixtures thereof etc. to aid processing and provide better dispersion of the filler in the organic polymer. Such coatings usually do not make up more than 3.0 wt % of the
 5 filler.

Preferably, the component (B) contains equal to or less than 3.0 wt % of the coating material, more preferably equal to or less than 2.0 wt % of the coating material and most preferably equal to or less than 1.5 wt % of the coating material.

10 Preferably the aluminum hydroxide of component (B) is coated with an aminosilane, more preferably a commercially available aminosilane or an aminosilane of one of the following formulas (I) or (II) is used.



15 and/or



wherein

- N is nitrogen and Si is silicon
- n is 0, 1, 2 or 3
- 20 - groups A are identical or different and each group A may be $-R^1$ or $-OR^2$, wherein
 - o R^1 is hydrogen or a halogen, e.g. F, Cl, Br, I, preferably F or Cl or a linear or branched C_1 - to C_{20} -hydrocarbyl group, preferably a C_1 - to

C₁₀-hydrocarbyl group, more preferably a C₁- to C₆-hydrocarbyl group; or

- R² is hydrogen or a linear or branched C₁- to C₂₀-hydrocarbyl group, preferably a C₁- to C₁₀-hydrocarbyl group, more preferably a C₁- to C₆-hydrocarbyl group;

- preferably the hydrocarbyl groups within R¹ and R² are aliphatic hydrocarbyl groups, more preferably alkyl groups;

- each of R¹ and/or R² may optionally been substituted with one or more substituents, each substituent may be independently selected from

- XR³ with

X being selected from oxygen or sulfur, preferably X is oxygen and

R³ is

hydrogen; or

a linear or branched C₁- to C₂₀-hydrocarbyl group, preferably a C₁- to C₁₀-hydrocarbyl group, more preferably a C₁- to C₆-hydrocarbyl group, preferably the hydrocarbyl groups are aliphatic hydrocarbyl groups, more preferably alkyl groups; or

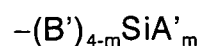
a linear or branched polyether with a molecular mass of not more than 1000 g/mol, preferably not more than 800 g/mol, more preferably not more than 600 g/mol, even more preferably not more than 400 g/mol and most preferably not more than 200 g/mol;

- groups B are identical or different and each has a molecular weight of 10 to 300 g/mol, preferably 20 to 200 g/mol or each B may be independently selected from
 - 5 ○ a linear or branched C₁- to C₂₀-hydrocarbyl group, preferably a C₁- to C₁₀-hydrocarbyl group, more preferably a C₆- to C₁₄-hydrocarbyl group, preferably the hydrocarbyl groups are aliphatic hydrocarbyl groups, more preferably alkyl groups or
 - 10 ○ a linear or branched polyether with a molecular mass of not more than 300 g/mol, preferably not more than 200 g/mol, more preferably not more than 100 g/mol, and
 - groups C and D are identical or different and each group may be
 - 15 ○ hydrogen; or
 - 20 ○ a linear or branched C₁- to C₂₀-hydrocarbyl group, preferably a C₁- to C₁₀-hydrocarbyl group, more preferably a C₁- to C₆-hydrocarbyl group, preferably the hydrocarbyl groups are aliphatic hydrocarbyl groups, more preferably alkyl groups; or
 - 20 ○ an aminocarbyl group of the form R⁴R⁵N-(C=O)- or R⁴O-(C=O)- with R⁴ and R⁵ being identical or different and each is hydrogen or a linear or branched C₁- to C₂₀-hydrocarbyl group, preferably a C₁- to C₁₀-hydrocarbyl group, more preferably a C₁- to C₆-hydrocarbyl group, preferably the hydrocarbyl groups are aliphatic hydrocarbyl groups, more preferably alkyl groups;
- B, C and/or D may optionally been substituted with one or more substituents, each substituent may be independently selected from
- 25 ○ halogens, e.g. F, Cl, Br, I, preferably F, Cl

- o alkoxide groups in the form of

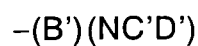


- o silyl groups in the form of

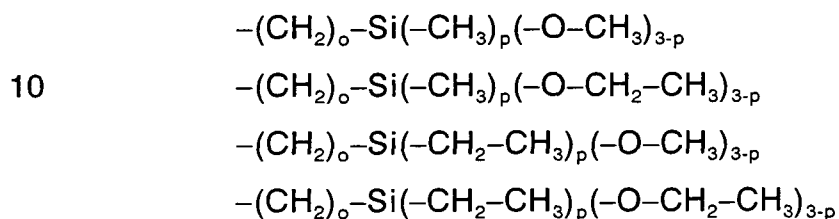


5 with m being 1, 2, 3 or 4; or

- o amino groups in the form of



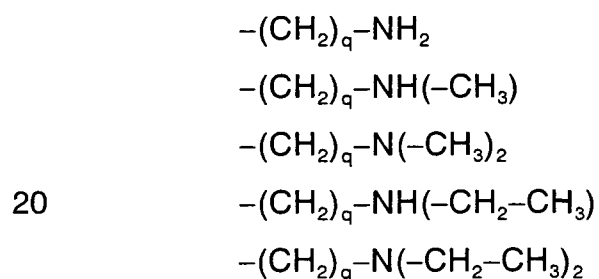
or the substituents may be selected from



wherein

15 o is 1, 2, 3, 4, 5 or 6, preferably 2, 3, 4 and more preferably 3
p is 0, 1, 2 or 3

and/or



wherein

q is 1, 2, 3, 4, 5 or 6, preferably 2, 3, 4 and more preferably 3

and/or

- $(\text{CH}_2)_2\text{NH}(\text{CH}_2)_3\text{Si}(\text{OCH}_3)_3$,
- $(\text{CH}_2)_2\text{NH}(\text{CH}_2)_3\text{Si}(\text{OC}_2\text{H}_5)_3$,
- $(\text{CH}_2)_2\text{NH}(\text{CH}_2)_3\text{Si}(\text{CH}_3)(\text{OCH}_3)_2$,
- 5 - $(\text{CH}_2)_2\text{NH}(\text{CH}_2)_3\text{Si}(\text{CH}_3)(\text{OC}_2\text{H}_5)_2$,
- $(\text{CH}_2)_2\text{NH}(\text{CH}_2)_2\text{NH}(\text{CH}_2)_3\text{Si}(\text{OCH}_3)_3$,
- $(\text{CH}_2)_2\text{NH}(\text{CH}_2)_2\text{NH}(\text{CH}_2)_3\text{Si}(\text{OC}_2\text{H}_5)_3$,
- $(\text{CH}_2)_2\text{NH}(\text{CH}_2)_2\text{NH}(\text{CH}_2)_3\text{Si}(\text{CH}_3)(\text{OCH}_3)_2$,
- $(\text{CH}_2)_2\text{NH}(\text{CH}_2)_2\text{NH}(\text{CH}_2)_3\text{Si}(\text{CH}_3)(\text{OC}_2\text{H}_5)_2$

- 10 wherein in the silyl- and amino groups
 $\text{R}^{2'}$ has the same definition as R^2 above
 A' has the same definition as A above
 B' has the same definition as B above
 C' has the same definition as C above
 15 D' has the same definition as D above,

this means that B' , C' and/or D' may again be substituted with the groups as defined for B , C and D respectively, e.g. $-(\text{B}')_{4-m}\text{SiA}'_m$ or $-(\text{B}')_{4-m}(\text{NC'D}')_m$. However, preferably B' , C' and D' do not carry said further substituents.

- 20 The aminosilane may also be a condensate of two or more identical or different aminosilanes of formulas (I) and/or (II) and or a cocondensate of one or more identical or different aminosilanes of formulas (I) and/or (II) with a silane of the following formula (III)



wherein

○ r is 1, 2, 3 or 4

○ R^6 are identical or different and each has a molecular weight of 10 to 300 g/mol, preferably 20 to 200 g/mol or is hydrogen or a linear or branched C_1 - to C_{20} -hydrocarbyl group, preferably a C_1 - to C_{10} -hydrocarbyl group, more preferably a C_1 - to C_6 -hydrocarbyl group, preferably the hydrocarbyl groups of R^7 are aliphatic hydrocarbyl groups, more preferably alkyl groups;

optionally R^6 is substituted with one or more substituents, each substituent may be independently selected from

- halogens, e.g. F, Cl, Br, I, preferably F and/or Cl
- vinyl groups
- acryloxy groups
- methacryloxy groups
- alkoxy groups
- mercapto groups

○ R^7 is hydrogen or a linear or branched C_1 - to C_{20} -hydrocarbyl group, preferably a C_1 - to C_{10} -hydrocarbyl group, more preferably a C_1 - to C_6 -hydrocarbyl group, preferably the hydrocarbyl groups of R^7 are aliphatic hydrocarbyl groups, more preferably alkyl groups;

- each R^7 may optionally been substituted with one or more substituents, each substituent may be independently selected from

- XR^8 with

5 X being selected from oxygen or sulfur, preferably X is oxygen and

R^8 is

hydrogen; or

10 a linear or branched C_1 - to C_{20} -hydrocarbyl group, preferably a C_1 - to C_{10} -hydrocarbyl group, more preferably a C_1 - to C_6 -hydrocarbyl group, preferably the hydrocarbyl groups are aliphatic hydrocarbyl groups, more preferably alkyl groups; or

15 a linear or branched polyether with a molecular mass of not more than 1000 g/mol, preferably not more than 800 g/mol, more preferably not more than 600 g/mol, even more preferably not more than 400 g/mol and most preferably not more than 200 g/mol;

The condensation of silanes is known in the art.

20 Preferably, the aluminum hydroxide used for component (B) has a surface area measured before coating of 3.0 m²/g or higher, more preferably of 3.5 m²/g or higher, even more preferably of 3.8 m²/g or higher and most preferably of 4.0 m²/g or higher.

25 Further, preferably the amount of component (B) is from 40 to 70 wt.% of the total polymer composition, more preferably from 50 to 70 wt. % of the

total polymer composition, even more preferably from 55 to 65 wt.% of the total polymer composition and most preferably from 57 to 63 wt.% of the total polymer composition.

The flame retardant polymer composition may further comprise

- 5 (C) an additional polymer selected from the group of polyolefins, polyesters, polyethers, polyurethanes, elastomeric polymers and silane-crosslinkable polymers or mixtures thereof in a total amount of up to 25 wt.% of the total polymer composition.
- 10 Preferably component (C) is present in an amount of 2.0 to 20 wt.% , more preferably component (C) is present in an amount of 3.0 to 18 wt.%, even more preferably component (C) is present in an amount of 5.0 to 15 wt.% and most preferably component (C) is present in an amount of 8.0 to 12 wt.% of the total polymer composition.
- 15 The polyolefins comprised in component (C) may be homopolymers or copolymers of ethylene, propylene and butene and polymers of butadiene or isoprene. Suitable homopolymers and copolymers of ethylene include low density polyethylene, linear low, medium or high density polyethylene and very low density polyethylene.
- 20 The elastomeric polymers comprised in component (C) maybe ethylene/propylene rubber (EPR), ethylene/propylene-diene monomer rubbers (EPDN), thermoplastic elastomer rubber (TPE) and acrylonitrile butadiene rubber (NBR).

- Silane-crosslinkable polymers may also be comprised in component (C),
- 25 i.e. polymers prepared using unsaturated silane monomers having hydrolysable groups capable of crosslinking by hydrolysis and condensation to form silanol groups in the presence of water and,

optionally, a silanol condensation catalyst.

Preferably, component (C) is an ethylene homopolymer, more preferably component (C) is a high density ethylene homopolymer with a density of 944 kg/m³ or more, more preferably 950 kg/m³ or more and most
5 preferably 955 kg/m³ or more.

In addition to the above described components, the inventive compositions may also contain additional conventional additives such as, for example, antioxidants or UV stabilizers in small amounts. Said additives are usually present in an amount of not more than 5.0 wt.%,
10 preferably not more than 3.0 wt.% and more preferably not more than 1.0 wt.%.

The flame retardant polymer composition according to the invention may be prepared by mixing together the components by using any suitable means such as conventional compounding or blending apparatus, e.g. a
15 Banbury Mixer, a 2-roll rubber mill or a twin screw extruder, Buss co-kneader, etc.

Generally, the composition will be prepared by blending the components together at a temperature which is sufficiently high to soften and plasticise the organic polymer, typically at a temperature in the range of
20 120 to 200 °C.

The flame retardant compositions according to the present invention can be used in many and diverse applications and products. The compositions can for example be molded, extruded or otherwise formed into moldings, sheets and fibers.

25 As already mentioned, a particularly preferred use of the flame retardant compositions is for the manufacture of wire and cables. The compositions can be extruded about a wire or a cable to form an insulating or jacketing

layer or can be used as bedding compounds.

The invention is furthermore directed to a process for making a flame retardant polymer composition comprising:

5 (A) an ethylene copolymer comprising alkyl acrylate comonomer units,

(B) aluminum hydroxide as filler material

wherein the aluminum hydroxide is coated in the cable extruder with coating agent.

10 Fig. 1 shows the results of the flame spread test according to prEN 50399:2007 (FIPEC).

In the following the present invention is further illustrated by means of examples.

Examples

15 1. Measurement Methods

a) Melt Flow Rate

The melt flow rate MFR_2 was measured in accordance with ISO 1133 at 190°C and a load of 2.16 kg for ethylene homo- and copolymers.

b) Flame spread test

20 The flame spread was measured according to prEN 50399:2007 (FIPEC) with the exception that only the flame spread was measured during the test and the air flow was regulated to 5 m³ per minute.

c) determination of surface area of aluminum hydroxide

The determination of the specific surface area of aluminium hydroxide is done according to ISO 9277.

d) comonomer content

Comonomer content (wt%) was determined with Fourier transform
5 infrared spectroscopy (FTIR) determination calibrated with ^{13}C -NMR. All FTIR methods were run by FTIR a Perkin Elmer 2000, 1scan, resolution 4 cm^{-1} . The peak for the comonomer was compared to the peak of polyethylene (e.g. the peak for butyl acrylate at 3450 cm^{-1} was compared to the peak of polyethylene at 2020 cm^{-1} and the peak for silane at 945
10 cm^{-1} was compared to the peak of polyethylene at 2665 cm^{-1} . The calibration with ^{13}C -NMR is effected in a conventional manner which is well documented in the literature. Such calibrations are evident for a skilled person. As a reference for calibration, reference is made to Haslam J, Willis HA, Squirrel DC., "Identification and analysis of plastics", 2nd
15 Edition, London, Iliffe Books, 1972. The weight-% was converted to mol-% by calculation.

2. Compounding of compositions

Flame retardant polymer compositions according to the invention and for
20 comparative purpose were produced by mixing together the components in a BUSS-co-kneader at a temperature of 150°C . The "Screw" speed was 30 rpm.

3. Produced compositions

25 Inventive composition 1:

- 29.4 wt.% ethylene methyl acrylate (EMA) copolymer with a methyl acrylate content of 25 wt.%, density of 944 kg/m³, MFR₂ = 0.4 g/10 min
 - 10.4 wt.% of HDPE, density 958 kg/m³, MFR₂ = 1.2 g/10 min
 - 5 - 60 wt.% of aminosilane coated aluminum hydroxide with a surface area of 4 m²/g measured before coating (Martinal OL 104 I distributed by Martinswerk)
 - 0.2 wt.% Irganox 1010, distributed by Ciba Speciality Chemicals
- 10 Comparative composition 2:
- 24.4 wt.% ethylene methyl acrylate (EMA) copolymer with a methyl acrylate content of 25 wt.%, density of 944 kg/m³, MFR₂ = 0.4 g/10 min
 - 5 wt.% maleic anhydride grafted polyethylene, 0.5 wt.% maleic anhydride, density 934 kg/m³, MFR₂ = 1.3 g/10 min
 - 15 - 10.4 wt.% of HDPE, density 958 kg/m³, MFR₂ = 1.2 g/10 min
 - 60 wt.% of uncoated aluminum hydroxide with a surface area of 4 m²/g (Martinal OL 104 LE distributed by Martinswerk)
 - 0.2 wt.% Irganox 1010, distributed by Ciba Speciality Chemicals

20

4. Production of cables

The cables consist of three solid copper conductors with a cross section area of 1.5 mm² covered with an insulation with a thickness of 0.5 mm. The insulated conductors are twisted and covered with bedding. The total diameter of the conductors, insulation and bedding is 6.0 mm. The compositions 1 to 4 as described above are then put as a jacket on top of the bedding. The final diameter of the cable is 8.4 mm.

The insulation consists of a composition made of

- 51.8 wt % ethylene butylacrylate (BA) copolymer with BA content of 17 wt.%, MFR₂ = 1.1 g/10min;
- 10 - 5 wt % of silicone masterbatch with 40 wt % of polydimethylsiloxane and 60 wt % LDPE;
- 12.5 wt% of polypropylene with MFR₂, 230°C = 1.3 g/10min;
- 30 wt % CaCO₃ coated with stearic acid, having an average particle size (d₅₀-value) of 1.4 microns;
- 15 - 0.1 wt % Irganox MD 1024, distributed by Ciba Specialty Chemicals;
- 0.35 wt % Irganox 1010, distributed by Ciba Specialty Chemicals;
- 0.125 wt % Tinuvin 622, distributed by Ciba Specialty Chemicals;
- 0.125 wt % Chimisorb 944, distributed by Ciba Specialty
20 Chemicals.

The used bedding material was FM1239 distributed by Melos GmbH.

The jackets were extruded with wire guide with diameter of 7.9 mm and a die with a diameter of 14.6 mm.

5. Results

In a flame spread test according to prEN 50399:2007 the flame spread of inventive composition 1 is not more than 0.43 meters during the test. The flame spread rises to a maximum after 2 minutes, and after 6 minutes the flame spread is zero and not rising again.

Comparative composition 2 shows a constantly rising flame spread with time, the flame spread being more than 2.1 meters after 20 minutes.

Hence, the inventive composition show a lower flame spread than the comparative composition.

The results of the flame spread tests according to prEN 50399:2007 of inventive composition 1 and comparative composition 2 are shown in table 1 below. Further Fig. 1 shows the performance of inventive composition 1 and comparative composition 2 in the flame spread test according to prEN 50399:2007.

Table 1:

	time [min]										
	0	1	2	3	4	5	6	7	8	9	10
flame spread [m]											
Inventive composition 1	0	0.35	0.43	0.43	0.25	0.15	0	0	0	0	0
Comparative composition 2	0	0.4	0.43	0.43	0.43	0.43	0.64	0.86	0.64	0.86	1.07

Table 1 (continued):

	time [min]									
	11	12	13	14	15	16	17	18	19	20
flame spread [m]										
Inventive composition 1	0	0	0	0	0	0	0	0	0	0
Comparative composition 2	1.29	1.34	1.4	1.5	1.65	1.8	1.93	1.93	1.93	2.15

Thus, the bunches of cables comprising the inventive polymer compositions fulfill the requirements of class B2 or C according to the FIPEC test prEN 50399:2007.

Claims

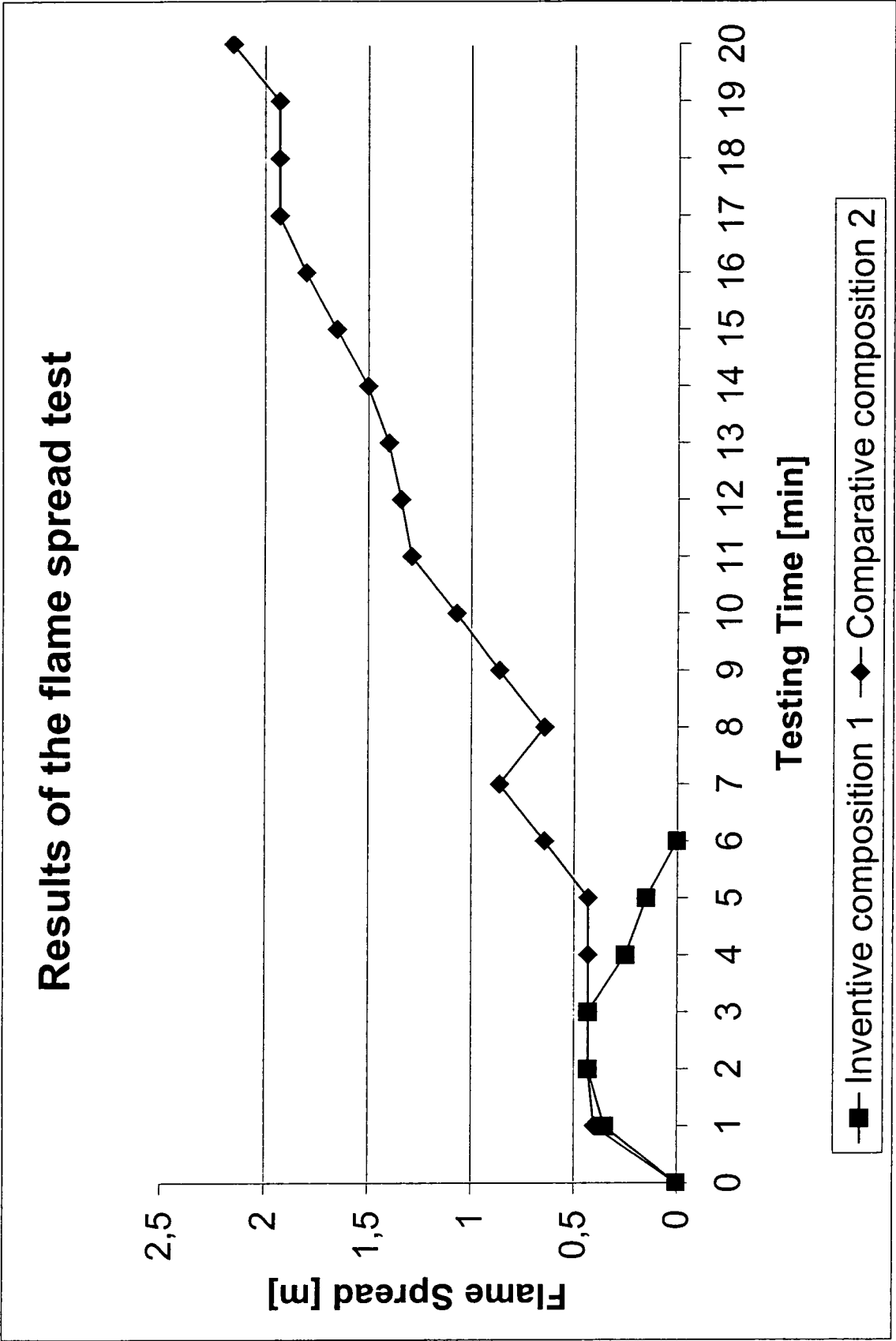
1. A flame retardant polymer composition comprising:
 - (A) a polar ethylene copolymer comprising alkyl acrylate comonomer units,
 - (B) coated aluminum hydroxide as filler material.
2. A flame retardant composition according to claim 1, wherein the alkyl acrylate comonomer units of component (A) are selected from C₁- to C₆- alkyl acrylates.
3. A flame retardant composition according to any of the preceding claims wherein the alkyl acrylate comonomer units of component (A) are methyl acrylate comonomers.
4. A flame retardant composition according to any of the preceding claims wherein component (A) is an ethylene methyl acrylate copolymer.
5. A flame retardant composition according to any of the preceding claims, wherein the amount of component (A) is from 10 to 50 wt.% of the total polymer composition.
6. A flame retardant composition according to any of the preceding claims, wherein component (A) has an comonomer content from 10 to 40 wt.%.
7. A flame retardant composition according to any of the preceding claims, wherein the amount of component (B) is from 40 to 70 wt.% of the total polymer composition.

8. A flame retardant composition according to any of the preceding claims, wherein the aluminum hydroxide has a surface area measured before coating of 3.0 m²/g or more.
- 5 9. A flame retardant composition according to any of the preceding claims, wherein the aluminum hydroxide is coated with an aminosilane.
- 10 10. A flame retardant composition according any of the preceding claims wherein the composition further comprises:
 - (C) an additional polymer selected from the group of polyolefins, polyesters, polyethers, polyurethanes, elastomeric polymers and silane-crosslinkable polymers or mixtures thereof in a total amount of up to 25 wt.% of the total polymer composition.
- 15 11. A flame retardant composition according to claim 10 wherein component (C) is an ethylene homopolymer.
12. A flame retardant composition according to any of the claims 10 or 11 wherein component (C) is a high density ethylene homopolymer.
13. Articles comprising the flame retardant polymer composition according to any of the preceding claims.
- 20 14. Wire or cable comprising a layer made of the flame retardant composition according to any of claims 1 to 12.
15. Use of a flame retardant polymer composition according to any of claims 1 to 12 in the production of a layer of a wire or cable.
- 25 16. Process for making a flame retardant polymer composition comprising:

(A) an ethylene copolymer comprising alkyl acrylate comonomer units,

(B) aluminum hydroxide as filler material

wherein the aluminum hydroxide is coated in the cable extruder with
5 coating agent.



INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2008/011004

A. CLASSIFICATION OF SUBJECT MATTER
 INV. C08K9/04 H01B3/44

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)

C08K H01B

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 practical, 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	DATABASE WPI Week 199301 Thomson Scientific, London, GB; AN 1993-005668 XP002484610 & JP 04 334811 A (HITACHI CABLE LTD) 20 November 1992 (1992-11-20) abstract -----	1-16
X	DATABASE WPI Week 199506 Thomson Scientific, London, GB; AN 1995-041497 XP002484611 & JP 06 322276 A (SUMITOMO ELECTRIC IND CO) 22 November 1994 (1994-11-22) abstract -----	1-16



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
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- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

* & * document member of the same patent family

Date of the actual completion of the international search

9 February 2009

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 4334811	A	20-11-1992	NONE

JP 6322276	A	22-11-1994	NONE
