

COMPOSITION FOR MANUFACTURING A LAYER OF A CABLE AND CABLE
COMPRISING SUCH A LAYER

The invention relates to a composition for
5 manufacturing a layer of a cable. The invention relates
more particularly, although not exclusively, to a
composition for manufacturing a layer of a
telecommunications cable or a power transport cable such as
an electric power transport cable.

10 The invention also relates to a cable comprising such
a layer.

TECHNICAL BACKGROUND OF THE INVENTION

Power transport or telecommunications cables generally
comprise at least three layers, namely a central electrical
15 conductor, surrounded by an intermediate electrical
insulator, which is itself protected from the outside
environment by an external protective sheath.

As it happens, for some applications, the external
sheaths must meet strict standards and must in particular
20 be flexible, fire-retardant, halogen-free and oil-
resistant.

To obtain these external sheaths, it is thus known
practice to start from a matrix comprising one or more
polymers based on ethylene vinyl acetate (EVA) with a relatively
25 high vinyl acetate content which is mixed with
peroxide. Peroxide crosslinking of said mixture is
subsequently brought about in order to obtain the sheath.

The peroxide crosslinking makes it possible to obtain
a sheath which is relatively flexible and oil-resistant
30 since this crosslinking route makes it possible in
particular to obtain a high degree of crosslinking of the
polymer matrix.

However, this manufacturing process requires the matrix and peroxide mixture to pass through a heated chamber under pressure in order for it to be possible for the peroxide crosslinking to take place, thereby greatly
5 complexifying said process.

In addition, the remainder of the layers of the cable must have specific properties so as not to deform in the chamber for the time the external sheath is hot-crosslinked under pressure. For example, the intermediate insulators
10 must be oversized in terms of thickness or else be composed of specific materials that are resistant to deformation under pressure in hot conditions.

This complexifies the cable manufacturing process and thus increases the cost thereof.

Moreover, it is not possible to use this process when
15 the cable comprises certain types of layers for which it is not yet known how to prevent or limit the deformation for the time the external sheath is hot-crosslinked under pressure. This is in particular the case when one of the
20 internal layers of the cable is composed of a metal sheath or a metal braid.

SUBJECT OF THE INVENTION

An objective of the invention is to provide a composition for manufacturing a layer of a cable which
25 makes it possible to facilitate the manufacturing of said layer.

An objective of the invention is also to provide a cable comprising such a layer.

BRIEF DESCRIPTION OF THE INVENTION

In view of the realizing of this objective, a
30 composition for manufacturing a layer of a cable such as a telecommunications cable or a power transport cable is provided, the composition comprising at least:

- a polymer matrix comprising at least two ethylene vinyl acetate (EVA) each with a vinyl acetate content greater than or equal to 50%,

- a crosslinking silane agent,

5 - a peroxide agent for initiating grafting of the silane agent onto the polymer matrix,

the composition comprising less than 2 parts by weight of peroxide agent per one hundred parts of the polymer matrix and between 3 and 30 parts by weight of silane agent per
10 one hundred parts of the polymer matrix.

The invention thus makes it possible to perform silane crosslinking to create the cable layer, silane-crosslinking of the polymer matrix being initiated by virtue of the presence of the grafting-initiating peroxide agent,
15 introduced with the silane agent. It is thus not necessary to work in pressurized chambers in order to bring about the crosslinking, thereby greatly simplifying the layer manufacturing process.

Furthermore, since the polymer matrix has a high vinyl
20 acetate content, the layer obtained from the invention has good characteristics, in particular in terms of resistance to oil and to hydrocarbons and in terms of flexibility. The layer is also halogen-free.

The invention thus makes it possible to obtain a layer
25 which has good characteristics with a relatively simple process.

The inventors have thus been able to manufacture a cable comprising an external sheath formed on the basis of the invention which adheres to the existing standards in
30 force at the time of the filing of the present patent application for offshore applications, namely standards

IEC 60092-360 and NEK TS 606: 2009. Of course, this application is not limiting and the composition according to the invention can be used to manufacture the layers of cables for numerous other applications.

5 It is noted that the invention makes it possible to work solely with silane crosslinking. The peroxide acts only as a free-radical generator, thereby initiating grafting of the silane in the polymer matrix, and thus allows silane crosslinking of the polymer. The layer formed
10 on the basis of the invention thus comprises siloxane bridges, whereas, in the case of peroxide crosslinking of the prior art, the bridges formed are carbon-carbon in nature.

For the present patent application, the vinyl acetate
15 content of an EVA corresponds to the ratio of the weight of vinyl acetate functions to the total weight of said EVA.

According to one particular embodiment, for one hundred parts of the polymer matrix, the polymer matrix comprises between 50 and 100 parts by weight of at least
20 the two EVA with a vinyl acetate content greater than or equal to 50%.

According to one particular embodiment, at least one of the two EVA is a EVA with a vinyl acetate content greater than or equal to 60%.

25 According to one particular embodiment, at least the two EVA are EVA with a vinyl acetate content greater than or equal to 60%.

According to one particular embodiment, the two EVA are a first EVA with a vinyl acetate content greater than
30 or equal to 50% and a second EVA with a vinyl acetate content greater than or equal to equal to 60%, a weight

ratio of said first EVA to said second EVA being strictly less than 1 (i.e. the ratio between, for one hundred parts of the polymer matrix, the parts in weight of the first EVA to the parts in weight of the second EVA).

5 In this case, the polymer matrix has a very high vinyl acetate content which allows the layer created from the composition to have good characteristics in particular in terms of resistance to oil (as drilling oils like aromatic oils, paraffinic oils and naphthenic oils) and
10 hydrocarbons.

According to one particular embodiment, the silane agent comprises an organo silane.

According to one particular embodiment, the organo silane is chosen from a vinyl silane, an alkyl silane or a
15 vinyl siloxane.

According to one particular embodiment, the composition comprises, for one hundred parts of the polymer matrix, between 3 and 15 parts by weight of silane agent.

According to one particular embodiment, the
20 composition comprises, for one hundred parts of the polymer matrix, between 5 and 15 parts by weight of silane agent.

According to one particular embodiment, the silane agent comprises an organo silane oligomer.

According to one particular embodiment, the peroxide
25 agent comprises a compound chosen from the following list: dicumyl peroxide, (tert-butyl)peroxy-3,5,5-trimethyl hexanoate, di(tert-butyl peroxyisopropyl)benzene or 2,5-dimethyl-2,5-di(tert.-butyl-peroxy)hexane.

According to one particular embodiment, the
30 composition comprises, for one hundred parts of the polymer

matrix, between 0.1 and less than 2 part(s) by weight of peroxide agent.

According to one particular embodiment, the composition comprises, for one hundred parts of the polymer matrix, between 0.3 and 1 part by weight of peroxide agent.

According to one particular embodiment, the composition comprises, for one hundred parts of the polymer matrix, less than one part by weight of peroxide agent.

According to one particular embodiment, the composition also comprises at least one fire-retardant compound, the composition comprising, for one hundred parts of the polymer matrix, between 80 and 200 parts by weight of said fire-retardant compound.

According to one particular embodiment, the composition comprises, for one hundred parts of the polymer matrix, between 90 and 190 parts by weight of said fire-retardant compound.

According to one particular embodiment, the ratio by weight of parts of silane agent to parts of peroxide agent, per one hundred parts of the polymer matrix, is in addition between 5 and 33.

According to one particular embodiment, the ratio by weight of parts of silane agent to parts of peroxide agent, per one hundred parts of the polymer matrix, is in addition between 10 and 17.

A cable comprising a layer manufactured from the abovementioned composition is also provided.

According to one particular embodiment, said layer forms the external sheath of said cable.

DETAILED DESCRIPTION OF THE INVENTION

The composition according to the particular embodiment of the invention comprises a polymer matrix composed of two EVAs, each having a vinyl acetate content greater than or equal to 50%. Preferably, the two EVAs are such that they have each a vinyl acetate content greater than or equal to 60%. For one hundred parts of the polymer matrix, the polymer matrix thus in this case comprises one hundred parts of a mixture of said two EVAs.

The composition also comprises a crosslinking silane agent. The silane agent in this case comprises a single compound which is silane-based. In particular, the compound is an organo silane. Preferably, said compound is a vinyl silane. In particular, the vinyl silane is chosen from the following list: VTMO (for vinyltrimethoxysilane), VTMOEO (for vinyltris(2-methoxyethoxy)silane) or VTEO (for triethoxyvinyl silane).

Thus, for one hundred parts of the polymer matrix, the composition comprises between 3 and 15 parts by weight of silane agent. Preferentially, for one hundred parts of the polymer matrix, the composition comprises between 5 and 15 parts by weight of silane agent.

Moreover, the composition comprises a peroxide agent for initiating grafting of the silane agent. The peroxide agent in this case comprises a single compound which is peroxide-based. In particular, said peroxide-based compound is chosen from the following list: dicumyl peroxide, TBPIN (for (tert-butyl)peroxy-3,5,5-trimethyl hexanoate), di(tert-butyl-peroxyisopropyl)benzene or 2,5-dimethyl-2,5-di(tert.-butyl-peroxy)hexane.

For one hundred parts of the polymer matrix, the composition comprises less than 2 parts by weight of

peroxide agent. Preferentially, for one hundred parts of the polymer matrix, the composition comprises between 0.1 and less than 2 part(s) by weight of peroxide agent.

5 Preferentially again, for one hundred parts of the polymer matrix, the composition comprises less than one part by weight of peroxide agent.

Preferably, for one hundred parts of the polymer matrix, the composition comprises between 0.3 and 1 part by weight of peroxide agent.

10 The composition also comprises at least one fire-retardant compound in order to improve the fire-resistance of the layer manufactured from this composition. The fire-retardant compound comprises in this case one or more mineral fillers. Said fillers are, for example, based on
15 precipitated silica, magnesium hydroxide, aluminium hydroxide or else antimony trioxide (Sb_2O_3). For one hundred parts of the polymer matrix, the composition preferably comprises between 80 and 200 parts by weight of the fire-retardant compound. Preferentially, for one
20 hundred parts of the polymer matrix, the composition comprises between 90 and 190 parts by weight of the fire-retardant compound.

In summary, according to the particular embodiment of the invention, the composition comprises, for one hundred
25 parts of the polymer matrix:

- between 5 and 15 parts by weight of silane agent comprising a single silane-based compound,
- between 0.3 and 1 part by weight of peroxide agent comprising a single peroxide-based compound,
- 30 - between 90 and 190 parts by weight of the fire-retardant compound.

Preferably, the composition is also chosen such that the ratio by weight of parts of silane agent to parts of peroxide agent, for one hundred parts of the polymer matrix, is between 10 and 17.

5 This makes it possible to have very good quality crosslinking of the polymer matrix.

 The layer manufacturing process will presently be described.

10 The abovementioned composition is mixed, before being extruded. By virtue of heating, the peroxide agent and the silane agent react, which will lead to grafting of the silane agent onto the polymer matrix. The crosslinking is in this case carried out after the addition of a catalyst to the extrusion, by heating in a humid environment.

15 A final layer made of a crosslinked material which confers advantageous properties on said layer, in particular in terms of flexibility and of resistance to oils and hydrocarbons, is thus obtained.

20 The silane crosslinking allows the extrusion to be carried out using tools that do not require working under pressure.

25 The mixture of the composition can for example firstly be created, and optional other fillers or additives during the manufacturing of the layer in the mixer and/or the extruder.

30 Preferably, the composition according to the invention makes it possible to form an external sheath of the cable or an electrically insulating intermediate layer of said cable. The cable is for example a cable such as a telecommunications cable or a power transport cable. Indeed, by virtue of its properties (flexibility,

resistance to hydrocarbons and/or oils, fire-resistance, halogen-free, etc.), the layer formed by the composition of the invention mentioned above proves to be very suitable for forming an external sheath or an electrically insulating intermediate layer for telecommunications or power transport applications.

Of course, the invention is not limited to the embodiment described and implementation variants may be introduced therein without departing from the context of the invention as defined by the claims.

Thus, although here the polymer matrix comprises two EVAs with a vinyl acetate content greater than or equal to 50%, the composition may comprise a different number of EVAs with a vinyl acetate content greater than or equal to 50% provided that it comprises at least two of them. The polymer matrix may comprise other additional components Different from two EVA with a vinyl acetate content greater than or equal to 50%, for instance an EVA with a vinyl acetate content less than 50% or any other polymer such as a polyolefin. The two EVA of the polymer matrix could be a first EVA with a vinyl acetate content greater than or equal to 50% and a second EVA with a vinyl acetate content greater than or equal to 60%, a weight ratio of the first EVA to the second EVA being strictly less than 1.

Thus, preferably, but in a non-limiting manner, the polymer matrix will be such that, for 100 parts of the polymer matrix, the polymer matrix will comprise between 50 and 100 parts by weight of EVA with a vinyl acetate content greater than or equal to 50%.

Although here the silane agent comprises a single silane-based compound, the silane agent may comprise more

silane-based compounds. The silane agent may thus comprise several vinyl silanes. In addition, the silane agent may comprise, in addition to or as a replacement for one or more vinyl silanes, other silane-based organo silanes such as one or more alkyl silanes and/or one or more vinyl siloxane polymers. In addition, the silane agent may comprise, in addition to or as a replacement for one of the abovementioned organo silanes, other silane-based compounds such as organo silane oligomers. In this case, the composition will preferably, but in a non-limiting manner, comprise, for one hundred parts of the polymer matrix, between 5 and 20 parts by weight of silane agent. In any event, the silane agent will comprise only silane-based compounds.

Likewise, although here the peroxide agent comprises a single peroxide-based compound, the peroxide agent may comprise more peroxide-based compounds. In any event, the peroxide agent will comprise only peroxide-based compounds.

The composition may also comprise several fire-retardant compounds and/or other additional compounds other than a fire-retardant compound, such as one or more stabilizing compounds, or one or more catalysts.

CLAIMS

1. Composition for manufacturing a layer of a cable such as a telecommunications cable or a power transport cable, the composition comprising at least:

5 - a polymer matrix comprising at least two ethylene vinyl acetate (EVA), each with a vinyl acetate content greater than or equal to 50%,

- a crosslinking silane agent,

10 - a peroxide agent for initiating grafting of the silane agent onto the polymer matrix,

the composition comprising less than 2 parts by weight of peroxide agent per one hundred parts of the polymer matrix and between 3 and 30 parts by weight of silane agent per one hundred parts of the polymer matrix.

15 2. Composition according to Claim 1, in which, for one hundred parts of the polymer matrix, the polymer matrix comprises between 50 and 100 parts by weight of at least the two EVA with a vinyl acetate content greater than or equal to 50%.

20 3. Composition according to Claim 1 or Claim 2, in which at least one of the two EVA is a EVA with a vinyl acetate content greater than or equal to 60%.

25 4. Composition according to one of the preceding claims, in which at least the two EVA are EVA with a vinyl acetate content greater than or equal to 60%.

30 5. Composition according to one of the preceding claims, in which the two EVA of the polymer matrix are a first EVA with a vinyl acetate content greater than or equal to 50% and a second EVA with a vinyl acetate content greater than or equal to 60%, a weight ratio of the first EVA to the second EVA being strictly less than 1.

6. Composition according to one of the preceding claims, in which the silane agent comprises an organo silane.

7. Composition according to Claim 6, in which the organo silane is chosen from a vinyl silane, an alkyl silane or a vinyl siloxane.

8. Composition according to either of Claims 6 and 7, in which the composition comprises, for one hundred parts of the polymer matrix, between 3 and 15 parts by weight of silane agent.

9. Composition according to Claim 8, in which the composition comprises, for one hundred parts of the polymer matrix, between 5 and 15 parts by weight of silane agent.

10. Composition according to one of the preceding claims, in which the silane agent comprises an organo silane oligomer.

11. Composition according to one of the preceding claims, in which the peroxide agent comprises a compound chosen from the following list: dicumyl peroxide, (tert butyl)peroxy-3,5,5-trimethyl hexanoate, di(tert-butyl-peroxyisopropyl)benzene or 2,5-dimethyl-2,5-di(tert.-butyl-peroxy)hexane.

12. Composition according to one of the preceding claims, in which the composition comprises, for one hundred parts of the polymer matrix, between 0.1 and less than 2 part(s) by weight of peroxide agent.

13. Composition according to Claim 12, in which the composition comprises, for one hundred parts of the polymer matrix, between 0.3 and 1 part by weight of peroxide agent.

14. Composition according to claim 12 or claim 13, in which the composition comprises, for one hundred parts of the polymer matrix, less than one part by weight of peroxide agent.

5 15. Composition according to one of the preceding claims, also comprising at least one fire-retardant compound, the composition comprising, for one hundred parts of the polymer matrix, between 80 and 200 parts by weight of said fire-retardant compound.

10 16. Composition according to Claim 15, in which the composition comprises, for one hundred parts of the polymer matrix, between 90 and 190 parts by weight of said fire-retardant compound.

15 17. Composition according to one of the preceding claims, in which the ratio by weight of parts of silane agent to parts of peroxide agent, for one hundred parts of the polymer matrix, is in addition between 5 and 33.

20 18. Composition according to Claim 17, in which the ratio by weight of parts of silane agent to parts of peroxide agent, for one hundred parts of the polymer matrix, is in addition between 10 and 17.

19. Cable comprising a layer manufactured from the composition according to one of Claims 1 to 18.

25 20. Cable according to Claim 19, in which said layer forms the external sheath of said cable.