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(54) **Title:** FRICTION MATERIAL COMPOSITION FOR COATING PVC ELECTRICAL WIRE

(57) **Abstract:** The present invention relates to a friction material composition for use in coating a PVC electrical wire, which can significantly reduce frictions between an outermost layer of the PVC electrical wire and a surface which comes into contact with said layer.



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FRICITION MATERIAL COMPOSITION FOR COATING PVC ELECTRICAL WIRE**Field of the invention**

5 The present invention relates to a friction material composition for coating a PVC electrical wire, which can significantly reduce frictions between an outermost layer of the PVC electrical wire and a surface in contact with said outermost layer.

Background of the invention

10 In industrial sites using electrical wires, for example a shipyard where ships are manufactured, a lot of electrical wires are placed in a situation that they should be frequently installed, pulled, moved and/or removed in order to operate or shift power supply devices and communication equipments. In this case, frictions occur between the electrical wires and the various surfaces such as a deck of ship or a concrete floor. Due to such frictions, more labor force and time are required for spreading, moving and removing electrical wires. If one can effectively reduce frictions occurred as in the above, working time becomes shortened and thus working efficiency would be improved. As one of methods for this, it has been considered to form a lubricant layer within an electrical wire.

25 Korean Patent Publication no. 10-2007-0093903 discloses an electrical line comprising an electrical conductor and a layer of thermoplastic material, wherein the layer of thermoplastic material consists of at least one inner layer and at least one outer layer. The inner layer of thermoplastic material contains a lubricant, and the lubricant then migrates to the outer layer over a certain

period of time. Thus, there is still a need to improve a friction reduction effect by letting the lubricant to migrate directly to the surface of electrical wire, not to the outer layer among several layers consisting of the electrical wire.

Korean Patent Registration no. 10-0747932 discloses a composition for preparing an insulating material for coating an electrical wire, comprising EVA copolymer, EEA copolymer, EMMA copolymer or EBA copolymer as a base resin, wherein the composition comprises a lubricant such as fatty acid amide. However, it discloses only a use for insulation of composition, and the fatty acid amide is merely disclosed as one example of lubricants listed in parallel.

Meanwhile, a halogen-free resin composition has been developed as a material for electrical wire in the art since it is reported that halogen is harmful to human bodies. However, since the halogen-based PVC has much better properties than the halogen-free resin in terms of cost and efficiency, it is still used widely in the art. For this reason, it is preferable to maintain the facilities and processes previously established for preparing PVC electrical wires which are most widely used in the art. Thus, it is required to coat the outermost layer of the conventional PVC electrical wires by using a lubricant as a form of additive, in order to minimize frictions between electrical wires and surfaces.

Detailed description of the invention

The purpose of the present invention is to provide a friction material composition which can be coated on PVC

electrical wire, in order to reduce frictions between the PVC electrical wire and the surface in contact with said wire.

5 This purpose of the present invention is achieved by a friction material composition being consisted of PVC (polyvinylchloride) and fatty acid amide. The friction material composition according to the present invention is coated on an outermost layer of the commercially available
10 PVC electrical wires. Therefore, the fatty acid amide moves, at certain temperatures, directly to the frictional contact surface in a shorter time than the above-mentioned prior arts, and thus a faster effect can be obtained. Moreover, since a lubricant layer is formed on the
15 outermost layer of PVC electrical wire, a better friction reduction effect can be obtained, and the thermal stability at a given temperature is excellent.

The expression "PVC electrical wire" in the description
20 means an electrical wire surrounded by a PVC (polyvinylchloride) coating.

Said PVC coating is well known by the person skilled in the art, and can be made from a PVC polymer matrix, optionally with additive(s) and/or filler(s).

25 In a first embodiment, said PVC coating can be directly in physical contact with the electrical wire.

In a second embodiment, said PVC coating can surround at least one insulated electrical wire, so that the PVC coating is not directly in physical contact with the
30 electrical wire as such.

In a preferred embodiment, the composition comprises 5 to 15 parts by weight of the fatty acid amide, based on 100

parts by weight of the PVC.

In another preferred embodiment, the fatty acid amide is selected from the group consisting of oleamide, stearamide
5 and oleyl palmitamide.

Another object of the invention is a friction material composition comprising PVC and fatty acid amide, as defined in the present invention, wherein said friction material
10 composition is used in coating an electrical wire, so that said electrical wire being directly in physical contact with said coating. More preferably, said coating can be the outermost layer of the electrical wire, so that said electrical wire can be surrounded by said coating only.

15 Another object of the invention is an electric cable comprising a PVC electrical wire surrounded by a coating as outermost layer of the electric cable, characterized in that said coating is obtained from a friction material composition comprising PVC and fatty acid amide, as defined
20 in the present invention.

Advantageous Effects

Since a friction material composition according to the present invention is extruded and coated on the outermost
25 layer of traditional PVC electrical wires, it can be applied without changing the composition of traditional PVC electrical wires. Therefore, in accordance with the present invention, the previously established facilities
30 for traditional PVC electrical wires can be used as they are. And also, it costs much less and can be easily applied industrially. On the contrary, in order to reduce frictions between electrical wires and surfaces in the

prior art, an electrical wire with different compositions or different layers should be newly prepared, and thus it needs a lot of costs for facilities and manufactures.

5 Furthermore, since the friction material composition according to the present invention is coated on the outermost layer of PVC electrical wires, a lubricant layer is directly formed on the PVC electrical wire surface, which will be in direct contact with surfaces of ships,
10 after a certain period of time. In other words, a lubricant layer is formed directly between an electrical wire and a surface in contact with the electrical wire, and more particularly between a PVC electrical wire and a surface in contact with the PVC electrical wire. Thus, the
15 lubricant effect is much more improved, and accordingly the friction reduction effect becomes more excellent.

Moreover, even in the case that the friction material composition according to the present invention is coated on
20 the outermost layer of PVC electrical wires, the flexibility of electrical wire is not affected. Additionally, no physical changes occur in view of its external diameter, weight, etc.

25 In addition, the electrical wire, and more particularly the PVC electrical wire, coated with the friction material composition according to the present invention can maintain continuity of sliding during a certain period of time, and achieve 20% reduction effect of friction coefficient which
30 is actually required in industrial sites (especially, a shipyard where ships are built). Accordingly, one can avoid spending unnecessary manpower and time in pulling, moving and removing cables when building ships in a

shipyard. Thus, cables can be installed even with less power, and working hours are significantly reduced.

Examples

The present invention is described in further detail in the following Examples which are not in any way intended to limit the scope of the invention as claimed. In addition, it will appear to a person skilled in the art that various modifications may be made to the disclosed embodiments, and that such modifications are intended to be within the scope of the present invention.

The inventors extruded a composition comprising PVC and fatty acid amide, on the outermost layer of PVC cable (i.e. PVC electrical wire), and such coated specimen was used as an experimental group. Components and contents of said composition are present in Table 1 below.

A specimen of PVC cable (i.e. PVC electrical wire) not coated with a composition comprising PVC and fatty acid amide, was used as a control group.

Table 1

Composition of outermost layer of PVC cable	Content
PVC resin	100 parts by weight
Plasticizer	45 to 55 parts by weight
Stabilizer	4 to 6 parts by weight
Halogen-based flame retardant	20 to 50 parts by weight
Filler : GCC (ground calcium carbonate), PCC (precipitated calcium carbonate), talc, clay, etc.	20 to 80 parts by weight
Carbon	1 to 5 parts by weight
Fatty acid amide	5 to 15 parts by weight

The specimens prepared as an experimental group and a control group were cut in the length of 10m respectively, and then slip tests were carried out.

5 The inventors installed a tensile tester equipped with a motor which can pull from the ground to the vertical height 5m at a constant rate under the laboratory temperature 7°C. In order to generate frictions on the PVC cables according to the experimental group and to the control group, two
10 steel bars with diameter of 20cm were installed at the place vertically 50cm from the ground, with a space of 1m between two steel bars.

Each of the prepared specimens was attached to the tensile
15 tester, and then pulled up to 5m high at a constant rate. The cable was placed such that it is in contact with both the bottom side of one steel bar and the top side of the other steel bar at the same time. As a result, it came in contact with two steel bars and was subjected to frictions.

20 Tensile loads at the measuring point 1 (vertically 1.6m from the ground), the measuring point 2 (vertically 3.2m from the ground), and the measuring point 3 (vertically 5.0m from the ground) were shown on the electronic scale of
25 the tensile tester. The same experiments were repeated three times, and each of measured tensile loads (unit: kg) is present in Table 2 below.

Table 2

Test no.	Measuring point	Control group specimen	Experimental group specimen
	1	41.2	35.5
	2	52.6	42.0

No. 1	3	53.8	45.2
	Maximum	64.1	45.2
	Average	56.8	44.1
No. 2	1	39.3	40.6
	2	55.6	46.0
	3	64.6	46.2
	Maximum	62.7	47.8
	Average	61.0	46.7
No. 3	1	37.9	36.3
	2	49.9	48.1
	3	48.7	43.8
	Maximum	61.0	49.4
	Average	53.2	47.1

In Table 2, the tensile load of control group specimens is 60.33kg at average, and the tensile load of experimental group specimens is 45.96kg at average. Based on these results, friction coefficients for the control group specimen and the experimental group specimen were calculated as follows:

* friction coefficient of control group specimen μ

$$\begin{aligned}
 &= \text{frictional force } F / \text{normal force } N \\
 &= 60.33\text{kg} / 28.98\text{kg} \\
 &= 2.082
 \end{aligned}$$

* friction coefficient of experimental group specimen μ

$$\begin{aligned}
 &= \text{frictional force } F / \text{normal force } N \\
 &= 45.96\text{kg} / 28.98\text{kg} \\
 &= 1.587
 \end{aligned}$$

As a result, the friction coefficient of experimental group specimen was reduced by about 23%, compared to that of control group specimen. Thus, the frictional force between a PVC cable surrounded by the outermost layer according to the present invention (cf. experimental group) and a surface was remarkably reduced, and accordingly the efficiency of work can be much better.

For example, when the standard handling weight per person is supposed to be 30kg, about 2 persons are needed to carry a PVC cable according to the control group, whereas only about 1.53 persons are needed to carry a PVC cable surrounded by the outermost layer according to the present invention. As another example, when it is supposed that the same person carries a PVC cable, the PVC cable according to the control group will be moved 10m per hour, whereas the PVC cable surrounded by the outermost layer according to the present invention will be moved at a distance of more than 10m per hour.

Claims

1. A friction material composition comprising PVC and fatty acid amide, wherein it is used in coating an
5 outermost layer of PVC electrical wire.

2. The friction material composition according to claim 1, characterized in that it comprises 5 to 15 parts by weight of the fatty acid amide, based on 100 parts by
10 weight of the PVC.

3. The friction material composition according to claim 1, characterized in that the fatty acid amide is selected from the group consisting of oleamide, stearamide and oleyl
15 palmitamide.

4. A PVC electrical wire, characterized in that the friction material composition according to claim 1 is coated on an outermost layer of the electrical wire.
20

5. Electric cable comprising a PVC electrical wire surrounded by a coating as outermost layer of the electric cable, characterized in that said coating is obtained from a friction material composition according to claim 1.