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(54) **Use of aminoxides as antistatic agents**

Verwendung von Aminoxiden als antistatischen Agenzien

Utilisation d'aminoxides comme agents antistatiques

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The file contains technical information submitted after the application was filed and not included in this specification

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Description

The present invention relates to the use of aminoxide as antistatic agents for reducing the propensity of fabrics to accumulate electrostatic charges.

Many types of fabric have a tendency to accumulate electrical charges. Clothes which are manufactured using such fabrics are then likely to become carriers of electrostatic charges. This is unpleasant for the person who is wearing the clothing, as the mutual attraction of oppositely charged surfaces may lead to clinging of the clothing to the body and to undergarments. Furthermore, static charges may contribute to the soiling of garments, draperies and other textile products by attracting oppositely charged particles of dust and dirt from the atmosphere onto the charged fabric.

The generation of electrostatic charges on fabrics is also undesirable in manufacturing processes of sheets, films, filaments, etc, as the charges tend to cause the articles to cling together or to the processing equipment. Electrostatic charges are particularly dangerous in the manufacturing process of integrated circuits, especially of the MOS-type, as these may be irreversibly damaged by such charges. It is therefore essential that the protective clothing which is worn by the laborers in this branch of industry is treated in such way that accumulation of electrostatic charges is prevented or effectively reduced.

In order to reduce the propensity of fabrics to accumulate electrostatic charges it is known to provide the fabric with a finish of substances which have a high conductivity, such as quaternary ammonium compounds. Such antistatic agents may be added to the fabric in the rinse cycle of the fabric washing process and may provide a surface resistivity in the order of 10^9 ohm/square.

However, it was found that the use of quaternary ammonium compounds as antistatic agents for fabrics may lead to serious chemical damage to the fabric upon repeated washing, especially if the fabric comprises polyester. This damage was found to increase with the amount of quaternary ammonium compound used, such that a compromise must be made between an effective antistatic treatment and an economically acceptable amount of damage to the protective clothing.

We have now found that this damage may be reduced or obviated when an aminoxide is used for reducing the propensity of fabrics to accumulate electrostatic charges.

US-A-4014,800 corresponding to FR-A-2230790 discloses lubricating compositions for fibres for use in the manufacturing and processing of those fibres by such methods as knitting and weaving. The lubricant compositions incorporate amine oxides as anti-static agents.

GB-A-1066763 discloses amine oxides and a number of uses of them including use as softening agents for textiles and as shampoos with anti-static effect.

US-A-3447956 equivalent to FR-A-1545719 teaches a process of introducing amine oxide, which is dissolved in lower alkanols, into fibrous material and then causing the amine oxide to swell the fibres as a means of strengthening the material.

US-A-3501335 teaches the softening of fabrics with amine oxides.

According to a first aspect, the present invention relates to the use of aminoxides for treating fabrics according to claim 1, especially when the fabrics comprise polyester.

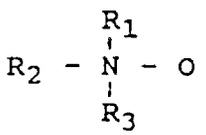
According to a second aspect, the invention provides a method for reducing the propensity of fabrics to accumulate electrostatic charges according to claim 3.

According to a third aspect, the invention provides an aqueous antistatic composition comprising:

10 to 80% by weight of aminoxide, and
2.5 to 20% by weight of a lower alkanol,

wherein the aminoxide is a mixture of a dimethyl alkyl aminoxide and a bis-(2-hydroxyethyl) alkyl aminoxide, in which the alkyl groups comprise 12 to 18 carbon atoms.

Aminoxides are well-known surfactants having a cationic character at low and neutral pH and a nonionic character at alkaline pH. Aminoxides which are advantageously used in the present invention correspond to the general formula:



wherein R_1 and R_3 are independently CH_3 or C_2H_4OH and R_2 is an alkyl group having 12 to 18 carbon atoms. Preferably, R_2 is an alkyl group having 14 to 16 carbon atoms.

Such aminoxides are commercially available, for instance from AKZO Chemie under the trade name "Aromox".

They are supplied as solutions having an active content of 30 to 40% by weight in water/isopropanol (50/50) or in water.

The antistatic compositions that are used in the process of the present invention are aqueous compositions comprising 10 to 80% by weight of aminoxide and 2.5 to 20% by weight of a lower alkanol, preferably isopropanol. Preferably they comprise 20 to 40% aminoxide and 5 to 10% isopropanol.

Surprisingly, it was also found that such antistatic compositions in which the aminoxide is a mixture of a dimethyl alkyl aminoxide and a bis-(2-hydroxyethyl) alkyl aminoxide, wherein the alkyl groups comprise 12 to 18 carbon atoms, exhibit a more pronounced antistatic effect than compositions which contain either one of these aminoxides alone.

It is advantageous when the antistatic compositions used according to the invention further comprise an anti-foam agent, preferably a silicone oil, in an amount of 0.01 to 1.0 wt%, calculated on the total composition.

The compositions may be used after or in the rinse cycle of a wash process for the treatment of fabrics in an amount of 1 to 100 g, preferably 3 to 20 g per kg wash load. Although not exclusively, the process of the present invention is primarily suitable for industrial applications, such as the industrial cleaning of overalls.

However, according to the invention, the anti-static compositions may also be used in the pre-wash cycle of such a fabric washing process. In that case it was surprisingly found that the number of fluffs was significantly reduced. This proved to be a significant advantage for the washing of coloured linen for surgery rooms were conventional wash processes inevitably leave a large number of fluffs which have to be removed manually.

The invention will now be further illustrated by means of the following examples in which the amounts are given as % by weight, unless otherwise indicated. In the Examples, the following abbreviation is used:

ISA : Isopropanol

The following aminoxide products were used which are commercially available from Akzo Chemie:

Aromox T/12 :	bis-(2-hydroxyethyl) tallow aminoxide
Aromox DMCD :	dimethyl coconut aminoxide
Aromox DM16D :	dimethyl hexadecyl aminoxide
Aromox DMMCD-W :	dimethyl coconut aminoxide, purified
Aromox DM14D-W :	dimethyl tetradecyl aminoxide

Aromox T/12, DMCD and DM16D contain 40 % by weight of aminoxide in a solvent mixture consisting of 50 % isopropanol and 50 % water. Aromox DMMCD-W and DM14D-W contain 30 % by weight of aminoxide in water.

EXAMPLES 1-21

28 kg overalls made of polyester comprising fabric were subjected to a conventional industrial fabric washing process in a Spencer O.E. washing machine. The dosage of detergent product was 5 g/kg and the water hardness was 0 degrees German Hardness. The process consisted of a prewash of 2.5 minutes at 40 °C, a main wash of 6.5 minutes at 55 °C followed by two rinse cycles of 2.5 minutes each. After the last rinse cycle, the wash load was treated for 5 minutes at 18 °C with the amounts of the various antistatic compositions as indicated in Table I. After draining the overalls were removed and dried for 20 minutes in a tumble dryer at a temperature of 50 °C. The surface resistivity of the overalls was then determined by measuring the resistance of the fabric according to British Standard 5958:1980 using a Philips Model 262 resistivity meter. The results are also shown in Table I. In all cases, the chemical damage which the fabrics incurred after several washes was much less than when a conventional quaternary ammonium antistatic composition was used.

In the Examples set out in Table I below, Examples 10 to 21 all illustrate the use aspect of the present invention, Examples 1 to 9 which are not according to the invention illustrating the use of single aminoxides and Examples 10 to 21 illustrating the use of combinations of aminoxides which give rise to synergistic antistatic effects. Examples 10 to 13 and 16 to 21 (but not Examples 1 to 9 and 14 and 15) are illustrative of antistatic compositions within the scope of the third, composition, aspect of the invention, the methods of use of these particular compositions being illustrative of methods within the scope of the second, method, aspect of the invention.

TABLE I

Ex.	Type of Aminoxide	Content: aminoxide	Content: isopropanol	Content: water	Dosage (g/kg)	Resistivity (log ohm/square)
1.	Aromox T/12	40	30	30	16	9
2.	Aromox T/12	40	30	30	24	9
3.	Aromox T/12	40	30	30	32	9
4.	Aromox DMCD	40	30	30	16	9
5.	Aromox DMCD	40	30	30	24	8-9
6.	Aromox DMCD	40	30	30	32	8-9
7.	Aromox DMMCD-W	30	--	70	16	9-10
8.	Aromox DMMCD-W	30	--	70	24	9-10
9.	Aromox DMMCD-W	30	--	70	32	9-10
10.	Aromox T/12: Aromox DM16D: water (10:20:70)	12	9	79	8	9
11.	Idem,				16	9
12.	Aromox T/12: Aromox DM16D: water (20:40:40)	24	18	58	8	9
13.	Idem,				10	8-9
14.	Aromox T/12: Aromox DMCD: water (5:10:85)	6	4.5	89.5	8	9-10
15.	Idem,				16	9-10
16.	Aromox T/12: Aromox DMCD: water (10:20:70)	12	9	79	8	9-10
17.	Idem,				16	9-10
18.	Aromox T/12: Aromox DM14D-W: water (20:40:40)	20	6	74	10	7-8
19.	Aromox T/12: Aromox DM14D-W: water: isopropanol (20:40:30:10)	20	16	64	10	7-8
20.	Idem, (10:20:65:5)	10	8	82	5	8
21.	Idem,				10	8

EXAMPLES 22-24

The effect of an anti-static composition according to the invention was compared with the effect caused by a

conventional anti-static agent of the quaternary ammonium type. Samples of three different types of polyester fabrics were soaked for 10 minutes at 40°C and at a liquid to cloth ratio of 20 to 1, using 2 g anti-static agent per litre. Subsequently, the samples were dried for 20 minutes at 60°C. This procedure was repeated 25 times and then the tensile strength of a test cloth having a width of 5 cm was measured (in kg) on a Louis Schopper tensile strength meter Type MT34. The tensile strength is believed to be a good measure of the chemical damage due to the anti-static treatment. The results for three different polyester fabrics are shown below.

TABLE II

Example 22 - Polyester Fabric I.			
Anti-static Agent:	None	Conventional	Example 20
Tensile Strength:			
in kg/5 cm	140.0	137.2	139.5
% difference	0.0	2.0	0.4
Example 23 - Polyester Fabric II			
Anti-static Agent:	None	Conventional	Example 20
Tensile Strength:			
in kg/5 cm	116.5	112.6	113.4
% difference	0.0	3.3	2.7
Example 24 - Polyester Fabric III			
Anti-static Agent:	None	Conventional	Example 20
Tensile Strength:			
in kg/5 cm	143.7	140.0	143.6
% difference	0.0	2.6	0.1

These results show that the composition of Example 20 according to the invention leads to less chemical damage on all three different types of polyester fabric then the conventional anti-static agent of the quaternary ammonium type.

Claims

1. Use of aminoxide for treating fabrics in order to reduce the propensity of the fabrics to accumulate electrostatic charges, wherein the aminoxide is a mixture of a dimethyl alkyl aminoxide and a bis-(2-hydroxyethyl) alkyl aminoxide, in which the alkyl groups comprise 12 to 18 carbon atoms.

2. Use according to claim 1, wherein the fabrics comprise polyester.

3. Method for reducing the propensity of fabrics to accumulate electrostatic charges which comprises so treating the fabrics with an aqueous liquor formed by adding to water an aqueous antistatic composition comprising:

   10 to 80% by weight of aminoxide, and
   2.5 to 20% by weight of a lower alkanol, wherein the aminoxide is a mixture of a dimethyl alkyl aminoxide and a bis-(2-hydroxyethyl) alkyl aminoxide, in which the alkyl groups comprise 12 to 18 carbon atoms.

4. Method according to claim 3 wherein the treatment of the fabrics takes place during or after the rinse cycle of a wash process.

5. Method according claim 3 or 4 wherein the lower alkanol is isopropanol.

6. Method according to any one of claims 3 to 5 wherein the liquor further comprises an anti-foam agent.

7. Method according to claim 6 wherein the anti-foam agent is a silicone oil.

8. Aqueous antistatic composition comprising:

10 to 80% by weight of aminoxide, and
2.5 to 20% by weight of a lower alkanol,

wherein the aminoxide is a mixture of a dimethyl alkyl aminoxide and a bis-(2-hydroxyethyl) alkyl aminoxide, in which the alkyl groups comprise 12 to 18 carbon atoms.

9. Antistatic composition according to claim 8 wherein the lower alkanol is isopropanol.

10. Antistatic composition according to claim 8 or claim 9 which further comprises an anti-foam agent.

11. Antistatic composition according to claim 10 wherein the anti-foam agent is a silicone oil.

Patentansprüche

1. Verwendung von Aminoxid zum Behandeln von Geweben zur Verminderung der Neigung der Gewebe zur Akkumulation elektrostatischer Ladungen, wobei das Aminoxid eine Mischung eines Dimethylalkylaminoxids und eines Bis-(2-hydroxyethyl)-alkylaminoxids, worin die Alkylgruppen 12 bis 18 Kohlenstoffatome umfassen, ist.

2. Verwendung nach Anspruch 1, wobei die Gewebe Polyester enthalten.

3. Verfahren zur Verminderung der Neigung von Geweben zur Akkumulation elektrostatischer Ladungen durch Behandeln der Gewebe mit einer wäßrigen Flüssigkeit, die durch Eintragen einer wäßrigen antistatischen Zusammensetzung, umfassend

10 bis 80 Gew.-% Aminoxid und
2,5 bis 20 Gew.-% eines niedrigen Alkanols

in Wasser gebildet wurde, wobei das Aminoxid eine Mischung eines Dimethylalkylaminoxids und eines Bis-(2-hydroxyethyl)-alkylaminoxids, worin die Alkylgruppen 12 bis 18 Kohlenstoffatome umfassen, ist.

4. Verfahren nach Anspruch 3, wobei die Behandlung der Gewebe während oder nach dem Spülzyklus eines Waschverfahrens stattfindet.

5. Verfahren nach Anspruch 3 oder 4, wobei das niedrige Alkanol Isopropanol ist.

6. Verfahren nach einem der Ansprüche 3 bis 5, wobei die Flüssigkeit des weiteren ein Anti-Schaummittel umfaßt.

7. Verfahren nach Anspruch 6, wobei das Anti-Schaummittel ein Siliconöl ist.

8. Wäßrige antistatische Zusammensetzung, die

10 bis 80 Gew.-% Aminoxid und
2,5 bis 20 Gew.-% eines niedrigen Alkanols

umfaßt, wobei das Aminoxid eine Mischung eines Dimethylalkylaminoxids und eines Bis-(2-hydroxyethyl)-alkylaminoxids, worin die Alkylgruppen 12 bis 18 Kohlenstoffatome umfassen, ist.

9. Antistatische Zusammensetzung nach Anspruch 8, worin das niedrige Alkanol Isopropanol ist.

10. Antistatische Zusammensetzung nach Anspruch 8 oder Anspruch 9, die des weiteren ein Anti-Schaummittel umfaßt.

11. Antistatische Zusammensetzung nach Anspruch 10, wobei das Anti-Schaummittel ein Siliconöl ist.

Revendications

1. Utilisation d'un aminoxyde pour le traitement des textiles en vue de réduire la tendance des textiles à accumuler des charges électrostatiques, dans laquelle l'aminoxyde est un mélange d'un aminoxyde diméthylalkylique et d'un aminoxyde bis-(2-hydroxyéthyl)-alkylique, dans lequel les radicaux alkyle comprennent de 12 à 18 atomes de carbone.

2. Utilisation selon la revendication 1, dans laquelle les textiles comprennent un polyester.

3. Procédé pour réduire la tendance des textiles à accumuler des charges électrostatiques, qui consiste à traiter les textiles avec une liqueur aqueuse qu'on obtient en ajoutant à l'eau une composition anti-statique aqueuse comprenant :

   10 à 80 % en poids d'aminoxyde et
   2,5 à 20 % en poids d'un alcanol inférieur,

   dans laquelle l'aminoxyde est un mélange d'un aminoxyde diméthylalkylique et d'un aminoxyde bis-(2-hydroxyéthyl)-alkylique, les radicaux alkyle comprenant 12 à 18 atomes de carbone.

4. Procédé selon la revendication 3, dans lequel le traitement des textiles a lieu pendant ou après le cycle de rinçage d'un processus de lavage.

5. Procédé selon la revendication 3 ou 4, dans lequel l'alcanol inférieur est l'isopropanol.

6. Procédé selon l'une quelconque des revendications 3 à 5, dans lequel la liqueur comprend en outre un agent d'anti-moussage.

7. Procédé selon la revendication 6, dans lequel l'agent d'anti-moussage est une huile siliconique.

8. Composition aqueuse anti-statique comprenant :

   10 à 80 % en poids d'un aminoxyde, et
   2,5 à 20 % en poids d'un alcanol inférieur,

   dans laquelle l'aminoxyde est un mélange d'aminoxyde diméthylalkylique et d'aminoxyde bis-(2-hydroxyéthyl)alkylique, dont les radicaux alkyle comprennent de 12 à 18 atomes de carbone.

9. Composition anti-statique selon la revendication 8, dans laquelle l'alcanol inférieur est l'isopropanol.

10. Composition anti-statique selon la revendication 8 ou 9, qui comprend en outre un agent anti-moussage.

11. Composition anti-statique selon la revendication 10, dans laquelle l'agent d'anti-moussage est une huile siliconique.