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MAGNETIC RECORDING MEDIA

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6 Claims

ABSTRACT OF THE DISCLOSURE

Magnetic recording media comprising a non-magnetic support and a magnetic layer based on a magnetic pigment dispersed in a binder and containing a small amount of a liquid mixture of branched fatty acids having at least 95% by weight of C₁₂ to C₁₈ fatty acids and at least 40% by weight of branched C₁₈ fatty acids.

The present invention relates to improved magnetic recording media, particularly magnetic tapes which have improved resistance to aging and abrasion and cause less corrosion.

Magnetic tapes are often used on recording equipment for many hours under widely varying climatic conditions, for example at high altitudes while exposed to the action of strong ultraviolet radiation, under conditions of high temperature and humidity or even at temperatures below freezing. Sometimes equipment with the magnetic tape thereon is stored for long periods under unfavorable climatic conditions so that the occurrence of corrosion phenomena on the metal parts with which the tape comes into contact would be very detrimental. These are however very likely to occur when binders containing chlorine are employed.

Modern magnetic recording media are also required not to exhibit any ageing of the magnetic layer when stored in the air, particularly in air enriched with ozone. Finally, the magnetic recording media should deposit as little as possible parts of the equipment and at the same time should exhibit low sliding friction.

It is known that lubricants such as wax, petroleum jelly, esters or amides of fatty acids and paraffin wax may be added to magnetic layers. As disclosed in German Printed Application No. 1,278,513, many of the prior art lubricants, such as the esters of fatty acids, readily exude and cause undesirable tackiness of the layer. The addition of esters of fatty acids such as stearyl stearate also gives unsatisfactory electroacoustic results. Moreover, these additives as well as added fatty acids such as n-stearic acid or mixtures of fatty amides and paraffin wax tend to form deposits on those parts of the equipment with which the tape comes into contact.

We have now found that magnetic recording media comprising a non-magnetizable base and a firmly adherent layer of particulate magnetic pigment dispersed in a binder with or without additives are particularly advantageous and exhibit improved resistance to abrasion and ageing and cause less corrosion when the magnetic layer contains as an additive from 2 to 10% by weight, based on the dry weight of the magnetic layer, of a mixture of predominantly branched, fatty acids containing at least 95% by weight of fatty acids having twelve to eighteen carbon atoms and at least 40% by weight of branched fatty acids having eighteen carbon atoms, which mixture is liquid at room temperature.

The mixture of predominantly, preferably to the extent of at least 80%, branched fatty acids which contains at

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least 95% by weight, preferably from 97 to 98% by weight, of fatty acids having twelve to eighteen carbon atoms and which is liquid at room temperature should contain at least 40% by weight, preferably from 50 to 80% by weight, of branched fatty acids having eighteen carbon atoms. A very suitable mixture of predominantly branched fatty acids consists of about 1 to 3% by weight of C₁₂ fatty acids, 6 to 15% by weight of C₁₄ fatty acids, 12 to 20% by weight of C₁₆ fatty acids, 50 to 80% by weight of C₁₈ fatty acids which are branched to the extent of at least 95%, preferably 99%, and about 1 to 3% by weight of higher fatty acids. It is liquid at room temperature, for example at from 10° to 27° C. It is preferred to use methylated fatty acids such as isostearic acid as the branched C₁₈ fatty acid, although more markedly branched fatty acids are also suitable. The proportion of linear fatty acids should preferably not exceed 20% by weight and in particular should not exceed 15% by weight of the total mixture.

The said mixtures are advantageously used in the production of the magnetic layer in an amount of from 2 to 10% by weight, preferably from 3 to 8% by weight based on the dry weight of the magnetic layer. Amounts of 9 to 10 parts by weight of magnetic pigment, particularly iron oxide, about 3 parts by weight of binder and about 0.5 to 1.2 parts by weight of fatty acid mixture to be added according to the invention have proved to be very suitable.

It has proved to be advantageous in the production of the magnetic layer in the conventional equipment to disperse the magnetic pigment with the binder together with an amount of an organic solvent sufficient for setting up a favorable viscosity and with the fatty acid mixture used according to this invention. After the components have been dispersed, the dispersion of the magnetic pigment can be applied by a conventional coating machine to a non-magnetizable base or another appropriate support. It is advantageous to orientate the magnetic particles after the dispersion has been applied to the backing by passing the applied coating through a magnetic field.

Suitable organic solvents for the production of the dispersions are organic solvents known for this purpose, particularly aromatic hydrocarbons, such as benzene, toluene or xylene; alcohols, such as propanol or butanol; ketones such as acetone or methyl ethyl ketone; ethers, such as tetrahydrofuran; and mixtures thereof and other solvents or solvent mixtures commonly used for binders for surface coatings.

Particulate rod-shaped gamma-iron (III) oxide having an average particle size of 0.1 to 2 microns, particularly from 0.1 to 0.9 micron, is preferred as magnetic pigment. Cube-shaped gamma-iron (III) oxide, particulate alloys of heavy metals known for this purpose, particularly alloys of iron, cobalt and/or nickel, and ferromagnetic chromium dioxide are also suitable as magnetic pigments for magnetic recording media according to this invention.

Other fillers or pigments, such as carbon black, graphite, quartz powder and/or non-magnetizable powder based on silicates, as further additives, may be added in a conventional manner to the dispersions for the production of the magnetic layers, but the amount of these additives should advantageously not exceed 12% by weight and preferably should not exceed 8% by weight, based on the dry weight of the magnetic layer.

The binders for the dispersion of the particulate magnetic pigment may be any of the binders conventionally used in the production of magnetic layers which are substantially compatible with the said fatty acid mixtures, such as copolyamides soluble in alcoholic solvents, polyurethanes or mixtures of polyisocyanates and relatively high molecular weight polyhydroxyl compounds, particularly vinyl chloride polymers having a predominant

amount of vinyl chloride units in the molecule, for example polyvinyl chloride or vinyl chloride copolymers with comonomers, such as vinyl esters of monocarboxylic acids having two to nine carbon atoms, esters of aliphatic alcohols having one to nine carbon atoms and ethylenically unsaturated carboxylic acids having three to five carbon atoms, such as acrylic acid, methacrylic acid or maleic acid, or these carboxylic acids themselves, and vinyl chloride copolymers containing hydroxyl groups which may be prepared by partial hydrolysis of copolymers of vinyl chloride and vinyl esters or direct copolymerization of vinyl chloride with monomers containing hydroxyl groups, such as allyl alcohol or 4-hydroxybutyl acrylate or 2-hydroxyethyl acrylate or the corresponding methacrylates. Vinyl chloride polymers of the said types are particularly suitable as binders for the magnetic layer of magnetic recording media according to the invention.

In the production of flexible magnetic recording media using binders based on vinyl chloride polymers, generally about 2.5 to 4.5 parts by weight of binder is used for about 10 to 13 parts by weight of gamma-iron (III) oxide as magnetic pigment. When the type of binder and/or magnetic pigment is changed, their ratio to each other is adapted to the change in the specific density of the magnetic pigment and/or binder.

Conventional non-magnetizable backings or supports for the magnetic layer may be used, preferably flexible bases such as film or tape based on polyvinyl chloride or polyesters, such as polyethylene terephthalate film of the usual thickness. Application of an adhesion-promoting intermediate layer, for example a layer based on a vinylidene chloride copolymer, to the backing prior to application of the magnetic layer is possible and sometimes advantageous.

After the magnetic layer has been applied, its surface may advantageously be finished in a conventional manner and the coated film can then be cut to the desired tape width in equipment conventionally used for the production of magnetic recording media.

Magnetic recording media according to the invention are superior to prior art magnetic recording media of comparable type in that they have a longer life and exhibit great reliability in operation, even when climatic conditions fluctuate and atmospheric humidity is high. Magnetic tapes according to the invention can be used at 95% relative humidity and 40° C. in an endurance test of more than five days without the tape guides or heads (which comprise, inter alia, easily corroded zinc injection moldings) exhibiting corrosion phenomena or deposits in the form of abraded material from the magnetic layer. In a test at room temperature, a magnetic recording medium according to the invention in the form of a 760 meter tape with a 10 kc./s. signal was played back on a four-track tape recorder at a speed of 9.5 cm./second, the tape being reversed automatically to rapid rewind or renewed playback for a period of ten days. During the ten-day test, there were no short-term or long-term decreases in the output level which exceeded 10% and after the ten-day test all parts of the equipment, which had been in contact with the tape such as heads, capstans or tape guides, were so clean that no cleaning was required.

Repetition of the test in a chamber in which a powerful ultraviolet lamp provided an atmosphere enriched with ozone did not give any indication of a detrimental change in tapes according to this invention.

Magnetic recording media according to this invention in tape form are moreover distinguished by improved recording of high frequencies.

The invention is illustrated by the following examples in which the parts and percentages are by weight unless otherwise stated. Parts by weight bear the same relation to parts by volume as the kilogram to the liter. The wear properties of the magnetic recording media in sustained operation were tested at room temperature and at 40° C.

and 95% relative humidity on a wide variety of commercial tape recorders, as described above.

EXAMPLE 1

900 parts of a particulate acicular gamma-ferric oxide having a mean needle length of less than 0.8 micron is dispersed with 850 parts of tetrahydrofuran and 850 parts of toluene in which is dissolved 280 parts of a copolymer having 91% of vinyl chloride units, 3% of vinyl acetate units and 6% of vinyl alcohol units in a ball mill having a capacity of 6000 to 10,000 parts by volume and filled with 8000 to 12,000 parts of steel balls, with an addition of a 75 parts of a liquid mixture of 2% of C₁₂ fatty acids, 9% of C₁₄ fatty acids, 15% of C₁₆ fatty acids, 72% of C₁₈ fatty acids consisting to the extent of 99% of branched fatty acids and 2% of higher fatty acids which consists to the extent of about 92% of branched fatty acids, until a smooth, homogeneous surface is obtained when the dispersion is applied with a hand coater. After the dispersion has been filtered through a layer of cellulosic and asbestos fibers, it is applied to a polyethylene terephthalate film, passed through a magnetic field to orient the particles and dried at about 100° C. The finished magnetic layer has a thickness of 10 microns. The film is cut into tapes 6.25 mm. in width which are tested as described above. Neither after five days at 40° C. and more than 95% relative humidity, nor after ten days at room temperature are there deposits or corrosion on the parts of the equipment coming into contact with the tape or any other defects in the quality of reproduction of the recording. Exudation of the added fatty acid mixture was not observed. The tapes also exhibit a particularly favorable recording sensitivity for short wavelengths.

Comparative tests 1 and 2

Example 1 is repeated but in Test 1 isopropyl myristate and in Test 2 stearyl stearate is used instead of the mixture of branched fatty acids. Audio tapes made therewith are distinctly inferior in sensitivity to those made according to Example 1 and exhibit distortion. Moreover, they clog the heads and cause appreciable deposits on those parts of the apparatus with which they come into contact.

EXAMPLE 2

Example 1 is repeated and 900 parts of the same iron oxide is dispersed for a number of days together with 300 parts of a copolymer of 80% of vinyl chloride, 10% of diethyl maleate and 10% of dimethyl maleate and 2800 parts of a mixture of equal parts of tetrahydrofuran and toluene with an addition of 20 parts of very fine carbon black and 100 parts of the fatty acid mixture of Example 1. The production of the magnetic recording medium with the resulting dispersion is carried out as described in Example 1. Magnetic recording media are obtained which in the endurance tests have practically the same good properties as the tapes made according to Example 1.

Comparative tests 3 and 4

The procedure of Example 2 is repeated but in Test 3 n-stearic acid and in Test 4 a mixture of stearic acid with paraffin wax is used instead of the mixture of branched fatty acids. Audio tapes prepared therewith, as compared with the magnetic recording media according to the invention, cause, in the endurance tests, marked deposits on the heads as well as on the capstans which deposits are responsible to a particular extent for flutter and wow and other defects in the quality of reproduction.

We claim:

1. Magnetic recording media comprising a non-magnetizable support and a firmly adherent layer based on a particulate magnetic pigment dispersed in a binder and including from 2 to 10% by weight, based on the dry weight of the magnetic layer of a lubricant, said lubricant

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consisting essentially of a mixture of predominantly branched fatty acids containing at least 95% by weight of fatty acids having twelve to eighteen carbon atoms and at least 40% by weight of branched fatty acids having eighteen carbon atoms, which mixture is liquid at room temperature. 5

2. Magnetic recording media as in claim 1 wherein the mixture of fatty acids contains at least 80% by weight of branched fatty acids having twelve to eighteen carbon atoms. 10

3. Magnetic recording media as in claim 1 containing a mixture of about 1 to 3% by weight of C₁₂ fatty acids, 6 to 15% by weight of C₁₄ fatty acids, 12 to 20% by weight of C₁₆ fatty acids, 50 to 80% by weight of C₁₈ fatty acids which are branched to the extent of at least 95%, and about 1 to 3% by weight of higher fatty acids. 15

4. Magnetic recording media as in claim 1 wherein said binder is a vinyl chloride polymer having a predominant amount of vinyl chloride units in the polymer chain.

5. Magnetic recording media as in claim 1, wherein the branched fatty acid having eighteen carbon atoms is isostearic acid. 20

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6. Magnetic recording media as in claim 1, wherein the mixture of predominantly branched fatty acids contains 50 to 80% by weight of isostearic acid.

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