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Traub et al.

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[54] RECORDING TAPE WITH PARTIALLY OXIDIZED ALUMINUM FILM

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[58] **Field of Search** ..... 346/135, 76 R; 117/201, 215, 117/217

[56] **References Cited**

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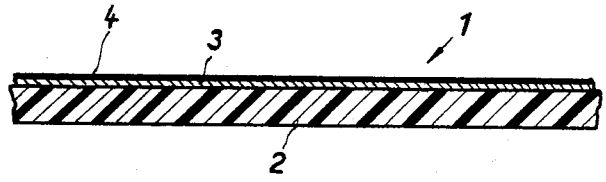
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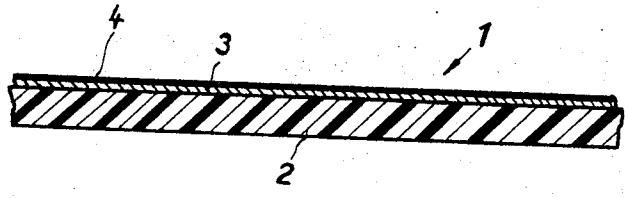
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[57] **ABSTRACT**

This invention is concerned with a recording tape in which the information becomes visible as a result of burning away a trace from a metallic film deposited on the carrier. The metallic film consists of metallic aluminum containing imbedded therein quantities of aluminum oxide and aluminum oxyhydrate. The presence of the oxide and the oxyhydrate decreases both the required writing pressure and the voltage necessary for producing a current sufficiently high to burn away the metallic layer.

6 Claims, 1 Drawing Figure





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RECORDING TAPE WITH PARTIALLY OXIDIZED ALUMINUM FILM

BACKGROUND OF THE INVENTION

In the process of recording by the use of a writing electrode in contact with a metal layer on the surface of a tape, wherein a current of high current density is used to melt and vaporize a portion of the surface layer, it is known to make the film as thin as possible in order to reduce the energy necessary to produce a visible trace and thereby to achieve the highest possible recording rate. The lower boundary of the thickness of the metal layer is established by the requirements that the layer should be opaque in order to make the writing trace visible and that the layer should have sufficient electrical conductivity to carry the required current for burning out the trace.

Conventional recording tapes meet these requirements by the use of a metal film of a thickness ranging from 0.1 to 0.01 micro-meters. Such layers, as a rule, are deposited by vacuum evaporation on an insulating tape. Such recording tapes, for the most part, are made of nickel or of a zinc cadmium alloy. Traces on the nickel product are not always clearly visible due to low contrast, while the metal layer of the zinc-cadmium alloy has a low chemical stability.

On the other hand, it has been found that a metal film of aluminum, because of its high specific electrical conductivity, optical reflection power and chemical stability, is superior to the previously employed metal films. The use of a recording tape with an aluminum layer however introduces difficulties due to the oxidation of the surface of the aluminum layer. The aluminum oxide constitutes a protective layer on the surface of the metal layer, but its electrical conductivity is low. As a result, the writing electrode must be pressed against the tape with a pressure of at least 220 mp and a voltage higher than 40 volts must be used in order that the writing electrode will make contact with the metal layer and produce a readily visible trace.

SUMMARY OF THE INVENTION

It is an object of the present invention to produce a recording tape using an aluminum layer which can readily be burnt away to produce a readily detectable trace.

It is a further object of the present invention to produce a writing tape with an aluminum layer which is oxidation-resistant.

It is yet another object of the invention to produce a recording tape with an aluminum layer which can be burned away at a low contact pressure and low voltage.

The objectives of the present invention are met by providing an insulating base, with a layer of aluminum containing preferably at least 15 per cent by weight of aluminum oxide and/or aluminum oxyhydrate embedded, i.e., intercalated therein. Previous practice for obtaining a readily detectable trace on a metal layer has been to use a metal with the highest possible specific electrical conductivity. It is therefore surprising that by the use of a metal in accordance with the present invention, despite the lowering of the conductivity as a result of the content of aluminum oxide and hydroxide therein, the trace is more clearly detectable than when aluminum is used without the intercalated oxides. Moreover, the resistance to corrosion of the modified metal layer is substantially higher than of metal layers previously made by standard practices.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

The single FIGURE shows in cross-sectional view a recording tape with a metallic layer thereon, in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the single FIGURE, the reference numeral **1** indicates a recording tape in cross section on a greatly enlarged scale. It consists of a paper strip **2** with a 0.1 micro-meter thick layer of metal **3** made of aluminum-containing aluminum oxide and aluminum oxyhydrate. The strip **2** may also be of a suitable insulater such as a polymer.

The metal layer **3** is produced by evaporating aluminum in the presence of water vapor onto the paper strip **2**. Depending on the evaporation conditions, the content of aluminum oxide and aluminum oxyhydrate may be controlled between about 15 per cent and about 30 per cent by weight.

As a result of the inclusion of the oxides and oxyhydrate, the structure of the conducting metal layer **3** is such that its surface **4**, shown as a heavy line for the sake of clarity, is rendered more sensitive to the mechanical and electrical stresses produced during the writing process by the writing electrode.

Consequently, it is possible to write with a pressure of only 50 mp between the writing electrode and the tape, and with a voltage difference of only 5 volts. This is due to the fact that there is a continually renewed contact formed between the writing electrode and the metal layer **3**, and an easily detectable trace is produced.

Recording tapes using the conventional aluminum layer become unusable after storage for **14** days at 20° C and at a relative humidity of 95 per cent, as a result of severe corrosion. Recording tapes made according to the present invention, in contrast, show absolutely no corrosion at the end of **14** days under the same conditions.

Although the conductive layer has been described as consisting of aluminum, aluminum oxide, i.e., Al_2O_3 and aluminum oxyhydrate, i.e., AlO(OH), and although chemical analysis tends to bear out this description, nevertheless it is recognized that at least some of the oxygen and hydrogen present in this system may actually be present in non-stoichiometric form. Consequently, this invention is not to be limited by the form in which the oxygen and hydrogen are present in the system. Rather, the conductive layer of this invention is characterized by the fact that oxygen and hydrogen are present in chemically bonded form in an amount corresponding to aluminum oxide and aluminum oxyhydrate totaling 15 to 30 per cent by weight of the total. Naturally, the hydrogen is bonded to aluminum through oxygen.

Following are conductive layer compositions which have given satisfactory performance. All values are percentages:

	Aluminum	Al_2O_3	AlO(OH)
Example 1	85	10	5
Example 2	70	25	5

While the invention has been illustrated and described as embodied in recording tape with partially oxidized aluminum film, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended

1. A recording medium for use in a recording system, comprising a tape consisting of an insulating material and a conductive layer, including aluminum, aluminum oxide, and aluminum oxyhydrate.

2. A recording medium as defined in claim **1**, wherein the aluminium oxide and aluminium oxyhydrate contents total preferably at least 15% by weight of said conductive layer.

3. A recording medium as defined in claim 1 wherein the aluminum content of said conductive layer lies between about 70 and about 85%.

4. A recording medium as defined in claim 1, wherein the aluminum oxide and aluminum oxyhydrate contents total from about 15 to about 30% of said conductive layer.

5. A recording medium as defined in claim 1 wherein the aluminum oxide content totals from about 10 to about 25% of said conductive layer.

6. A recording medium as defined in claim 1 wherein said aluminum oxide and said aluminum oxyhydrate are intercalated with said aluminum in said conductive layer.

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