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" A PROCESS TO MAKE ORDINARY WRITING PAPER ELECTRICALLY  
CONDUCTING FOR USE AS BASE PAPER IN ZINC OXIDE  
PAPER BASED ELECTROPHOTOGRAPHIC PROCESS"

" COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH,  
Rafi Marg, New Delhi-1, India, an Indian  
registered body incorporated under the  
Registration of Societies Act  
( Act XXI of 1860)

The following specification describes the nature of this  
invention.

This is an invention by Chittari Venkata Suryanarayana,  
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Price Rs. 2.00

This invention relates to improvements in or relating to the formulation of the conductive coating composition to be applied on to ordinary writing paper so as to enhance its electrical conductivity.

For good performance of a zinc oxide electrophotographic paper, the resistivity of the base paper (bearing the sensitive zinc oxide coating) should be brought down to 10 - 100 meg ohms/square, which condition is satisfied by the papers subjected to treatment as described in these specifications.

Low resistivity, of the order of 10 - 100 meg ohm/square, is an important requirement of the base paper on which sensitive zinc oxide electrophotographic layer is applied, in the process generally known as zinc oxide paper-based electrophotography. A non-conductive base does not leak away the photocurrent thus interfering with satisfactory electrostatic image formation. Abroad, many types of polymeric materials and salt humectants are reported to be used to impart conductivity to paper but details regarding this technology are very scanty in literature.

To the best of our knowledge, preparation of conductive papers, for the purpose described, has not so far been taken up in India. This patent will serve to fill up the gap.

To these ends, the invention broadly consists in the formulation of a solution consisting of a water soluble binder resin, a combination of salt humectant and a chemical to impart enhanced conductivity to ordinary paper, the combination being an alkali chloride or perchlorate with similar anions of group II elements, preferably II a, and a wetting agent in some cases, when the latter is impregnated with the solution just described. The impregnation is effected by dipping or immersing the paper in the solution kept in a tray till it is

completely wetted. Then the paper is taken out and allowed to air dry. Also, after the excess solution has dripped, the paper may be heated in an oven at 105°C for about 30 min or it can be dried by blowing hot air.

The following typical examples are given to illustrate the invention:

#### EXAMPLE 1

A solution of the composition  
2% with respect to polyvinyl alcohol  
5% with respect to ammonium perchlorate  
3% with respect to magnesium perchlorate  
and 2% with respect to sodium chloride is prepared in water. This solution is kept in a tray and the paper to be impregnated is immersed in it such that the paper is thoroughly wetted. Then the paper is taken out, the excess solution allowed to drip and the paper is left in an oven for 30 min at 105°C. Then the paper is kept in the room ambient for a few hours to attain equilibrium with the surroundings.

The values of surface resistivity obtained are given below:

6.5 meg ohm/square at 40% relative humidity

3.6 meg ohm/square at 45% relative humidity

#### EXAMPLE 2

A solution of the composition  
2% with respect to polyvinyl alcohol  
5% with respect to ammonium perchlorate  
2% with respect to lithium chloride is prepared and used for treating the paper as given under example 1.

The values of surface resistivity obtained are given below:

2.2. meg ohm/square at 49% relative humidity

6.0 meg ohm/square at 45% relative humidity

#### EXAMPLE 3

A solution of the composition

2% with respect to polyvinyl alcohol

3% with respect to magnesium perchlorate

2% with respect to sodium chloride is prepared and used for treating the paper as given under example 1.

The values of surface resistivity obtained are given below:

20 meg ohm/square at 40% relative humidity

11 meg ohm/square at 45% relative humidity

3.5 meg ohm/square at 50% relative humidity

#### EXAMPLE 4

A solution of the composition

2% with respect to polyvinyl alcohol

2% with respect to sodium toluene sulphonate

4% with respect to sodium chloride is prepared and used for treating the paper under example 1.

The values of surface resistivity obtained are given below:

5 meg ohm/square at 49% relative humidity

The compositions mentioned in the above examples can be varied to some extent without affecting the end result very much. Thus, for example, instead of 2% PVA, one may use 4% PVA in the composition and such changes in concentrations of the other

components may also be effected without deleteriously affecting the end product.

The following are among the main advantages of the invention:

1 The conductive paper is of great use in the zinc oxide based electrophotographic process, wherein the sensitive coating is applied on to this conductive base paper. If the sensitive composition is coated on ordinary paper (that is, which has not been treated to impart higher conductivity to it), in dry conditions charging is slower and may be less uniform due to the presence of more resistive areas in the base. A highly resistive base paper also raises the apparent saturation potential of the layer and gives a rapid initial dark decay.

2 The paper so treated will improve copy contrast, reduce mottling in dense areas and tender pic<sup>k</sup>-up on the exposed background, when making electrophotographic prints.

3 Also, when the zinc oxide electrophotographic layer is applied, the abovesaid treatment controls the penetration of solvent (a component of the zinc oxide coating composition) into the paper base thereby resulting in a more even photosensitive layer.

4 On the reverse of the zinc oxide coated papers, the abovesaid treatment reduces the absorption of the dispersant of the fluid developer in the copying machine, thus facilitating quick drying of the print.

Dated this 11th day of February, 1976.

Sd. xxx  
ASST. PATENTS OFFICER,  
COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

## THE PATENTS ACT , 1970

## COMPLETE SPECIFICATION

(Section - 10)

- IMPROVEMENTS IN OR RELATING TO MAKING ORDINARY WRITING PAPER ELECTRICALLY CONDUCTING FOR USE AS BASE PAPER IN ZINC OXIDE PAPER BASED ELECTROPHOTOGRAPHIC PROCESS "

COUNCIL OF SCIENTIFIC &amp; INDUSTRIAL RESEARCH

Rafi Marg, New Delhi-1. India, an Indian registered body incorporated under the Registration of Societies Act.

(ACT XXX of 1860)

The following specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed:-

This is an invention by CHITTARI VENKATA SURYANARAYANA, Scientist, ALUR SUNDARAM LAKSHMANAN, Scientist, and JAGANNATHAN KUPPUSAMI, Scientist, all of the Central Electrochemical Research Institute, Karaikudi, Tamil Nadu, India, all Indians.

This invention relates to a process for the production of an electrically conductive paper used as a substrate for applying zinc oxide electrophotographic layers on, and has particular reference to the formulation of a conductive composition to be impregnated in ordinary writing paper so as to enhance its electrical conductivity.

This invention relates to the branch of reprography, known as zinc oxide based electrostatic photography.

The hitherto known processes were invented abroad and not much information on this technology is available in literature. Even where some little details are given, the types of materials used for imparting electrical conductivity are not available in this country. Some of the materials used abroad and not available in our country are, for example, "Calgen" conductive polymer "261 LVF", Dew conductive resin "QX 2611.7" and "Cray Valley" conductive resin. To the best of our knowledge, the preparation of electrically conductive paper, for the purpose described, has not so far been taken up in India. This invention will serve to fill up the gap.

The main object of the invention concerns a formulation for imparting enhanced electrical conductivity to ordinary writing paper for use as base paper for zinc oxide coatings in electrophotography.

The main finding underlying the invention is the evolution of a treating composition to make ordinary writing paper electrically conducting by impregnation.

To the best of our knowledge, the manufacture of electrically conductive paper, for use as base stock for the preparation of zinc oxide coated electrostatic photographic papers, has not so far been done in India. This invention serves to make available a method for the preparation of such papers for exploitation by the zinc oxide electrostatic photographic paper manufacturing industry and this patent will remove the necessity of import of the special conducting base papers.



The invention thus provides a process for the production of an electrically conductive paper used as a substrate for applying zinc oxide electrophotographic layers by impregnating paper with an aqueous solution followed by drying the paper characterized in that the paper is impregnated with an aqueous solution of a combination of a salt humectant and a chemical to impart enhanced electrical conductivity to ordinary writing paper, the combination being an alkali chloride or perchlorate (2-7% by wt) with similar anions of group II or IIIa elements, preferably IIIa, and a water soluble binder resin, (2-5% by wt) prior to drying the paper.

In some cases, a wetting agent may be added to the aqueous solution to enhance the wettability of the paper by the solution.

The impregnation is effected by dipping or immersing the paper in the solution kept in a tray till it is completely wetted. Then the paper is taken out and allowed to air dry. Also, after the excess solution has dripped, the paper may be heated in an air oven at 105°C for about 10 mt or it can be dried by blowing hot air.

The ingredients in the composition are of indigenous origin.

The following typical examples are given to illustrate the invention:

A solution of the composition,

2% with respect to polyvinyl alcohol.

5% with respect to ammonium perchlorate

3% with respect to magnesium perchlorate and

2% with respect to sodium chloride

is prepared in water. This solution is kept in a tray and the paper to be impregnated is immersed in it such that the paper is thoroughly wetted. Then the paper is taken out, the excess solution allowed to drip and the paper is left in an oven for 10 min at 105°C. Then the paper is kept in the room ambient for a few hours to attain equilibrium with the surroundings.

The values of surface resistivity obtained are given below:

6.5 megohm/square at 40% relative humidity

3.6 megohm/square at 49% relative humidity

#### EXAMPLE 2

A solution of the composition

2% with respect to polyvinyl alcohol

5% with respect to ammonium perchlorate and

2% with respect to lithium chloride

is prepared and used for treating the paper as given under example 1.

The values of surface resistivity obtained are given below:

6.0 megohm/square at 45% relative humidity

2.2 megohm/square at 49% relative humidity

#### EXAMPLE 3

A solution of the composition

2% with respect to polyvinyl alcohol

3% with respect to magnesium perchlorate

2% with respect to sodium chloride

is prepared and used for ~~the~~ treating the paper as given under example 1.

The values of surface resistivity obtained are given below:

20 megohm/square at 40% relative humidity

11 megohm/square at 45% relative humidity

3.5 megohm/square at 50% relative humidity

EXAMPLE 4

A solution of the composition

2% with respect to polyvinyl alcohol

2% with respect to sodium toluene sulphonate and

4% with respect to sodium chloride

is prepared and used for treating the paper as given under example 1.

The value of surface resistivity obtained is given below:

5 megohm/square at 49% relative humidity.

The compositions mentioned in the above examples can be varied to some extent without affecting the end result very much. Thus, for example, instead of 2% PVA, one may use 4% PVA in the composition and such changes in the concentration of the other components may also be effected without deleteriously affecting the end product.

The following are among the main advantages of the invention:

1. This conductive paper is useful in the zinc oxide based electrophotographic process, wherein the sensitive coating is applied on to this conductive base paper. If the sensitive zinc oxide composition is coated on ordinary writing paper (that is, which has not been treated to impart higher conductivity to it), in dry conditions charging is slower and may be less uniform due to the presence of more resistive areas in the base and a print may not be obtained. A highly resistive base paper also raises the apparent saturation potential of the layer and gives a rapid initial dark decay.

2. The papers so treated will improve copy contrast, reduce mottling in dense areas and toner pick-up on the exposed background, when making electrophotographic prints.

3. Also, when the zinc oxide electrophotographic layer is applied, the above said treatment controls the penetration of solvent ( a component of the zinc oxide coating composition) into the paper base thereby resulting in a more even photo-sensitive layer of zinc oxide.

4. On the reverse of the zinc oxide coated papers, the above said treatment reduces the absorption of the dispersant of the fluid developer in the copying machine, thus facilitating quick drying of the print.

In summary, the invention broadly consists in the formulation of a solution consisting of a water soluble binder resin, a combination of a salt humectant and a chemical to impart enhanced electrical conductivity to ordinary writing paper (the ~~combination~~ <sup>combination</sup> being an alkali chloride or perchlorate with similar anions of group II or IIA elements and a wetting agent) when the paper is impregnated with the solution just described, by dipping or immersing in the solution kept in a tray till completely wetted. Then the paper is taken out and dried.

Slight variations in the compositions do not affect the end result much.

The product thus prepared is not merely an admixture, resulting in the aggregation of the properties of the components thereof. It has synergetic action.

Thus, the formulation of a composition for impregnation in ordinary writing paper to enhance its electrical conductivity, the formulation comprising of a solution consisting of a water soluble binder resin, a combination of a salt humectant and a chemical to impart enhanced electrical conductivity to ordinary writing paper, the ~~combination~~ <sup>combination</sup> being an alkali chloride

or perchlorate with similar anions of group II or IIIa elements and a wetting agent in some cases, when the paper is impregnated with the solution just described, by either dipping or immersing it in the solution till completely wetted and drying the paper either by keeping it in an air oven at 105°C for about 10 mt. or by blowing hot air.

The end product of the process is an electrically conducting base paper used as a substrate for coating zinc oxide electrophotographic layers on.

The essential steps of the process are as follows:

1. The formulation of a composition, consisting of all indigenous materials in water.
2. Impregnation of ordinary writing paper by dipping or immersing in the above described solution kept in a tray or other vessel till the paper is completely wetted.
3. Drying of the paper either by keeping it in an air oven at 105°C for 10 mt. or by blowing hot air.

Steps 2 and 3 are present in the process known abroad.

Step 1 is our own.

Step 1 is present only in the invented process but not present in the known process abroad.

The choice of materials in the process described in this specification imparts characteristic novelty to the invented process—all the materials used are indigenously available.

An electrically conductive paper, entirely of indigenous origin is obtained as a result of the invented step 1 useful as a substrate for coating zinc oxide electrophotographic layer.

We Claim:

1. A process for the production of an electrically conductive paper used as a substrate for applying zinc oxide electrophotographic layers by impregnating paper with an aqueous solution followed by drying the paper characterised in that the paper is impregnated with an aqueous solution of a combination of a salt humectant and a chemical to impart enhanced electrical conductivity to ordinary writing paper, the combination being an alkali chloride or perchlorate (2-7% by wt) with similar anions of group II or IIs elements, preferably II a and a water soluble binder resin. (2-5% by wt) prior to drying the paper.
2. A process as claimed in claim 1 wherein a wetting agent is added to the aqueous solution.
3. A process as claimed in claim 1 or 2 wherein the impregnation is effected by dipping or immersing the paper in the solution kept in a tray, <sup>it</sup> it is completely wetted, then the paper is taken out and allowed to air dry.
4. A process as claimed in any of the preceding claims wherein after the excess solution has dripped, the paper is heated in an air oven at 105°C for about 10 mt or it is dried by blowing hot air.
5. A process for the production of an electrically conductive paper used as a substrate for applying zinc oxide electrophotographic layers substantially as hereinbefore described.

Dated this 19th day of March, 1977

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