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(54) Dielectric sheet material.

(57) A dielectric sheet material for use on electrographic machines comprises a base sheet having a first coating of a cationic conductive polymer and a second coating overlying the first coating of a polymeric material with affinity for an electrostatic printing toner.

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DIELECTRIC SHEET MATERIAL

This invention relates to dielectric sheet materials, which may be in the form of individual sheets, a continuous web or a roll (hereinafter referred to as "sheet materials"), and more especially to such materials for use with electrostatic printer/plotter machines (sometimes referred to as electrographic machines).

In an electrostatic printer/plotter process an image is produced on a dielectric coated sheet material which is normally either a dielectric coated paper or polyester film. The dielectric coated sheet passes over a fixed writing head with conducting styli equally spaced in rows. When a stylus is energised by a computer generated signal it places an electrostatic charge on the paper at the point of stylus contact. A toner is then applied to the sheet material and toner particles adhere to the charged areas so that a permanent, high contrast image is produced.

The dielectric sheet materials currently used with printer/plotter machines are usually polyester films coated with a surface layer providing a greater affinity for the toner than is provided by the polyester itself and having on each a continuous narrow strip of carbon particles. The application of these carbon strips is a costly operation and consequently carbon edged dielectric printing films are extremely expensive materials.

This invention provides a dielectric sheet material for use with electrostatic printer/plotter machines which does not have carbon strips on its two longitudinal edges.

According to the invention a dielectric sheet material comprises a base sheet or film having a first coating of a cationic conductive polymer and a second coating of a polymeric material with affinity for an electrostatic printing toner.

The base sheet or film may be of any material and may be transparent, translucent or opaque and may be either wholly or partially through-conductive or non-conductive.

The top coating may cover the whole area of the coating of cationic polymeric polymer or, especially when the base sheet is non-conductive there may be left a longitudinal edge strip of

uncoated cationic polymer on one or both sides of the sheet material.

As non-conductive base materials there may be mentioned, for example, polyethylene terephthalate (polyester) film or nylon film. Polyolefin films may be mentioned as an example of partially through-conductive materials. As through-conductive materials there may be mentioned, for example, paper and the various synthetic paper-like materials produced, for example, by biaxially orienting and at least partially whitening such materials as polyolefins, for example, polyethylene and polypropylene. As an example of such a paper-like material there may be mentioned the materials sold under the trade marks Synteape, Yupo and Polyart.

As the cationic conductive polymers for use in the process there may be mentioned quaternary nitrogen containing salts of polymers such as, for example, polyvinyl benzyl trimethyl ammonium chloride, polydiallyl dimethyl ammonium chloride, poly(2-methacryloyloxy ethyl trimethyl ammonium chloride), poly(N-acrylamide propyl-3-trimethyl ammonium chloride), poly(N,N-dimethyl-3,5,-methylene piperidinium chloride, poly 4-vinyl-N methylpyridinium chloride, quaternised polyethyleneimine and the tri-methylamine derivative of polyepichlorhydrin.

The conductive polymer is preferably applied from aqueous solution which may contain a minor amount of organic solvent.

The thickness of the coating applied should be sufficient to give a continuous uniform coating on the surface and preferably to flatten any surface irregularities, for example, such as those produced by fibers projecting from the surface of paper. Moreover the coating must be such as to allow the production of a uniform charge over the entire coated surface of the sheet. Preferably, the amount of polymer applied in the conductive coating is within the range of 0.8 to 2.5 gram per square metre. Similarly the thickness of the top coating should be such as to give a continuous uniform coating over the surface of the conductive coating. Preferably, the amount of polymer applied in the top coating is within the range of 4 to 10 gram per square metre.

The top coating may be produced from any soluble film-forming polymeric material which affords an affinity to the toner particles,

and may be, for example, a vinyl acetate copolymer, a polyvinylbutyral, a styrene polymer or copolymer or a thermoplastic polyester or mixtures of any two or more thereof. Preferably, the top coating is a coating of a soluble linear thermoplastic copolyester, preferably a copolyester from polybasic aromatic acids and aliphatic polyhydroxy compound(s).

Advantageously, the top coating polymer has a surface resistivity of from 100 to 5000 megohm per square at 20% relative humidity and from 5 to 150 megohm per square at 50% relative humidity, a charge acceptance using a 500V corona bar between 200 and 490V and a charge decay rate of 6 to 20V per second.

These polymers may be applied from solution in organic solvents or mixtures of solvents such as, for example, methylethylketone toluene or ethanol. The polymers may be used in admixture with a minor proportion of other resins and may be used in conjunction with small amounts of fillers, for example, silica fillers.

The conductive and top coating may be applied by any desired technique, for example, an air-knife Meyer rod, roller, trailing blade, or Gravure technique.

It will be seen that the invention provides inter alia a dielectric sheet for use with printer/plotter machines which is based on polypropylene. It has not previously been possible to produce electrostatic images in such materials. Since paper-like polypropylene sheet is cheaper than polyester film and especially very much cheaper than carbon edged polyester film and moreover is available as translucent or opaque sheet, this represents a considerable advance in the art.

Moreover, according to the invention it becomes possible to produce images on synthetic materials using printer/plotter designed for use with paper only.

The following examples illustrate the invention:-

Conductive and top coating formulations were made up as follows:

Conductive Coating (1)

Water	95 parts by weight
Polyvinylbenzyltrimethyl Ammonium Chloride	5 parts by weight

Conductive Coating (2)

Water	95 parts by weight
Polydiallyldimethyl Ammonium Chloride	5 parts by weight

Conductive Coating (3)

Water	94 parts by weight
Polydiallyldimethyl Ammonium Chloride	5 parts by weight
Silica	1 part by weight

Top Coating (1)

Partially hydrolised poly vinyl acetate (20% vinyl alcohol)	30 parts by weight
Toluene	40 parts by weight
Ethanol	25 parts by weight
Silica	5 parts by weight

Top Coating (2)

Thermoplastic polyester (Dynapol 206)	30 parts by weight
Toluene	40 parts by weight
Ethanol	25 parts by weight
Silica	5 parts by weight

Top Coating (3)

Polystyrene (Picolastic A 75	20 parts by weight
Poly vinyl butyral (Monsanto Butivar B 72.MW ca 200000)	10 parts by weight
Silica	5 parts by weight
Toluene	50 parts by weight
Methyl Ethyl Ketone	15 parts by weight

Top Coating (4)

Polystyrene (Picolastic A75)	10 parts by weight
Thermoplastic copolyester (Dynapol 206)	20 parts by weight
Silica	3 parts by weight
Methyl Ethyl Ketone	67 parts by weight

Top Coating (5)

Soluble vinyl chloride/vinyl acetate/ vinyl alcohol copolymer (Bakelite VAGH)	30 parts by weight
Silica	3 parts by weight
Toluene	40 parts by weight
Methyl Ethyl Ketone	27 parts by weight

Cationic coating compositions 1, 2 and 3 were coated onto polyethylene terephthalate film, polypropylene film and the synthetic paper-like material Polyart II using an air-knife coating technique in an amount of 1.5 grams per square metre. After the conductive coating had dried one of top coating formulations 1 to 5 was applied to each coated sample using an air-knife in an amount of 7.5 grams per square metre. In each case, a dielectric sheet material with properties making it eminently suitable for use in electrographic machines was obtained.

C L A I M S

1. A dielectric sheet material comprising a base sheet or film having a first coating of a cationic conductive polymer and a second coating of a polymeric material with affinity for an electrostatic printing toner.

2. A dielectric sheet material according to claim 1, wherein the first coating is a coating of a polymer containing quaternary nitrogen atoms.

3. A process according to claim 2, wherein the first coating is a coating of polyvinyl benzyl trimethyl ammonium chloride, polydiallyl dimethyl ammonium chloride, poly(2-methacryloyloxy ethyl trimethyl ammonium chloride), poly(N-acrylamide propyl-3-trimethyl ammonium chloride), poly(N,N-dimethyl-3,5-methylpiperidinium chloride, poly (4-vinyl-N methylpyridinium chloride), quaternised polyethyleneimine or the tri-methylamine derivative of polyepichlorhydrin.

4. A dielectric sheet material according to any one of claims 1 to 3, wherein the thickness of the coating is sufficient to give a continuous film on the surface and to allow the production of a uniform charge over the entire coated surface of the base sheet.

5. A dielectric sheet material according to any one of claims 1 to 4, wherein the second coating is a coating of a soluble film-forming polymer.

6. A dielectric sheet material according to claim 6, wherein the second coating is a coating of a vinylacetate copolymer, a polyvinyl butyral, a styrene polymer or copolymer or a thermoplastic polyester preferably a linear thermoplastic copolyester from poly basic aromatic acid(s) and aliphatic polyhydroxy compound(s).

7. A dielectric sheet material according to any one of claims 1 to 6, wherein the base sheet or film is wholly or partially non-conductive and the second coating does not cover the complete area of the first coating, there being left a longitudinal edge band of uncovered cationic conductive polymer on at least one edge of the sheet or film.

8. A dielectric sheet material according to claim 7, wherein the base sheet or film is of polyethylene terephthalate, nylon or polyolefin.

9. A dielectric sheet material according to any one of claims 1 to 8, wherein the base sheet or film is through-conductive and the second coating covers the complete area of the underlying coating of cationic conductive polymer.

10. A dielectric sheet material according to claim 9, wherein the through-conductive base material is paper or a synthetic paper-like material, preferably a synthetic paper-like material produced by biaxially orientating and stress whitening polypropylene or polyethylene.