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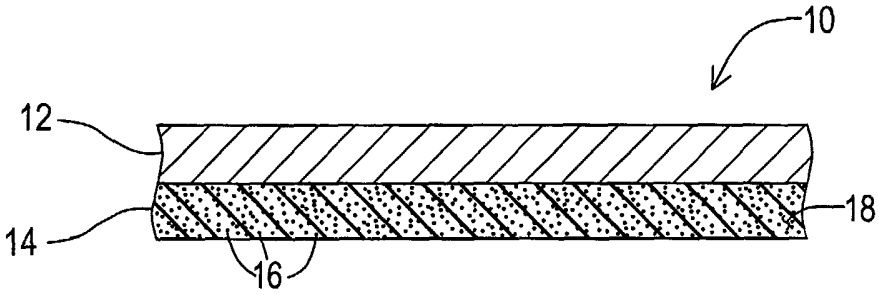
(54) Title: PRINTABLE MAGNETIC SHEET



(57) Abstract: A high-temperature resistant printable magnetic stock material (10) is a laminate of a printable layer (12) having a major surface capable of being printed by a xerographic process, and a magnetizable layer (14) having magnetic particles (16) dispersed in a synthetic resin matrix, wherein the matrix having a softening point high enough to avoid substantial deformation when contacted with a heated surface at a temperature appropriate for using a xerographic toner.

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TITLE: PRINTABLE MAGNETIC SHEET

BACKGROUND OF THE INVENTION

Field of the Invention:

[0001] This invention relates to a high temperature stable, laminated sheet comprising a magnetic layer containing suspended magnetic particles bonded to at least one imprintable layer. More particularly, it comprises a magnetic laminated print stock sheet that can be used in a laser printer without being damaged by heated fusing rollers and drums.

Brief Description of the Prior Art:

[0002] Magnetically mountable signs, displays and the like have come to be widely used because they permit convenient display of information, decorative materials, and the like. Magnetic signs and displays can be mounted on any magnetically attractive surface by simply applying them thereto; no special surface preparation or adhesives are necessary. Accordingly, they are useful for a variety of purposes from advertising and identification on motor vehicles to simple decoration or information in the home via attachment to a refrigerator door. Conversely, magnetically mounted displays may simply be removed when they are no longer needed or when they are to be changed. When removed they leave no residue, e.g., of adhesive, on the

mounting surface, which is immediately available for mounting another display.

[0003] Magnetically mounted signs and the like have conventionally been prepared by printing or embossing the surface of a substrate, which may itself be magnetizable or which is attached to a magnetizable material. Often the printable substrate is a paper or plastic sheet laminated to a relatively thin magnetic sheet. Such magnetic sheets typically comprise a dispersion of magnetizable particles in a binder, e.g., a synthetic resin binder, i.e., plastic, rubber, and the like.

[0004] Typically, the printable layer in such a magnetic display article has been made from paper or other printable material. The surface of the printable layer is then printed or decorated by conventional printing techniques, and the layer is laminated to the magnetic layer. This procedure is followed in order to avoid passing the laminate through a printing press or the like, with the possibility of distortion and/or damage to the display article. If the printable layer is first laminated to the magnetic layer, other printing or decorating techniques can be used, e.g., silk screen printing or the like. However, all of the conventional methods of preparing an image on the printable substrate have required the skill and equipment available only to professional printers.

[0005] More recently, personal computers capable of desktop typesetting and graphics creation and computer printers capable of rapidly generating paper documents embodying those creations have become widely available. This equipment has made it possible for individuals to prepare creative documents and images without the need for professional printing facilities. It has even become possible to produce high-quality photographic prints using a personal computer and an appropriate high-resolution printer.

[0006] This capability has suggested the possibility of preparing magnetic display materials by desktop publishing techniques using direct printing from a computer-generated document to an attached computer printer. It is, of course, possible to print a computer-generated image onto a conventional medium, e.g., paper, cardstock, or the like, and then laminate the printed sheet to a magnetizable sheet. However, it has been proposed to print directly on a prelaminated stock comprising a printable layer and a magnetic layer.

[0007] Ogikubo, U.S. Patent 5,994,990, discloses a magnetic display sheet stock comprising a printable layer laminated to a magnetic layer. The stock is disclosed as suitable for use with a personal computer and associated printer to prepare printed display materials that can be mounted on a magnetically attractive substrate. Alternatively, the magnetic printing

stock is said to be usable to prepare magnetically mountable display materials using an office copier.

[0008] However, the Ogikubo patent is silent regarding problems associated with using conventional laminated magnetic printable stock in a xerographic printer such as an office copier or laser printer. Such xerographic printing engines typically form an electrostatic image on a semiconductive substrate such as a drum or belt, decorate the image with a powdered toner, and transfer the toner to a printable stock by contact. The stock is then passed through a fusing section, typically comprising heated rolls, that heats the stock and toner to a temperature that causes the toner to melt and bond with the paper, etc. Such a printing process presents no problems when printing on a conventional paper stock. However, if the paper stock is prelaminated to a conventional magnetic layer comprised of magnetic particles dispersed in a synthetic resin binder, the binder is subjected to the same high temperature conditions as the printable sheet and toner as the laminated stock passes through the fuser section of the copier or laser printer. Because the binder of the magnetic layer is typically a synthetic resin, it is subject to the problems associated with heating such materials to an elevated temperature. If heated to too high a temperature, the binder of the magnetic layer may distort, outgas, melt, or stick to the heated rolls of the fuser section. Evidently, such

behavior may prevent the printer or copier from producing a printed article, or, at least, may result in an inferior printed article. It is even possible that the printer or copier may be damaged if the matrix melts in contact with the heated fuser rolls.

[0009] Consequently, the formulation of a magnetic display sheet for use in a xerographic printing process involves formulation of a magnetic layer that can withstand exposure to the conditions experienced in the fuser section of a xerographic printer or copier. Laminated magnetic printing stock suitable for use with printers that do not include a heated fuser section, e.g., ink-jet printers, and the like, are, in general, not suited for use in a xerographic printing process such as is found in laser printers and office copiers. The Ogikubo reference is completely silent regarding even the problem experienced in preparing a laminated magnetic printing stock that is suitable for use in laser printers and the like, and provides the practitioner with no teaching of how to prepare such a printing stock material.

[0010] Accordingly, a need has continued to exist for a laminated magnetic printing stock known to be useful for printing in xerographic printing apparatus such as laser printers and photocopiers.

SUMMARY OF THE INVENTION

[0011] The deficiencies of conventional laminated magnetic printing stock materials, have now been alleviated by the material of the invention comprising

a printable layer having a major surface capable of being printed by a xerographic process, and

a magnetizable layer comprising magnetic particles dispersed in a synthetic resin matrix, said matrix having a softening point high enough to avoid substantial deformation when contacted with a heated surface at a temperature appropriate for fusing a xerographic toner.

[0012] Accordingly, it is an object of the invention to provide a magnetic laminated print stock.

[0013] A further object is to provide a magnetic laminated print stock that can be used in laser printers.

[0014] A further object is to provide a magnetic laminated print stock that can be used in xerographic copiers.

[0015] A further object is to provide a magnetic laminated print stock that can be used in printing and copying equipment having surfaces that are brought in contact with the magnetic laminated print stock and which surfaces are heated to temperatures greater than about 190°C.

[0016] A further object is to provide a magnetic laminated print stock that can be used in printing and copying equipment having surfaces that are brought in contact with the magnetic

laminated print stock and which surfaces are heated to temperature as high as about 235°C

[0017] Further objects of the invention will become apparent from the description of the invention which follows.

BRIEF DESCRIPTION OF THE DRAWING

[0018] The sole figure is an elevational cross-section of an embodiment of the printable high-temperature resistant magnetic sheet of the invention.

DETAILED DESCRIPTION OF THE INVENTION AND PREFERRED EMBODIMENTS

[0019] As shown in the sole figure, a printable magnetic sheet or print stock 10 of the invention comprises a printable layer 12 laminated to a magnetizable layer 14. The layer of magnetizable material comprises magnetizable particles 16 in a matrix 18 capable of withstanding fuser temperatures in conventional xerographic printing apparatus for a period of time at least long enough for the fuser to heat the toner and cause it to fuse and adhere to the printable substrate.

[0020] The printable layer 12 may be made from any conventional printable material suitable as a substrate for xerographic printing. A wide variety of substrate materials is available for use as the printable layer 12. The only operative conditions placed on such material is that it must have a printable surface to which the xerographic toner will

adhere after the fusing step and that it must be stable at the temperature used in the fusing step, at least for the relatively short time interval required for that step. Such materials as paper, synthetic resin webs, cardstock and the like are suitable, provided that they can be printed by a conventional xerographic process. The printable layer will typically have a thickness ranging from about 0.05 mm to about 0.15 mm. The printable layer is ordinarily relatively opaque in order to conceal the color and texture of the magnetic layer 14 beneath. The thickness, color, etc. of the printable layer can be varied, as is well-known in the art, to provide a substrate suitable for any image, text or graphics, that can be formed thereon by a conventional xerographic process, e.g., such as is used in conventional office copiers and laser printers.

[0021] The magnetic layer 14 comprises magnetic particles 16 dispersed in a synthetic resin binder. The magnetic layer 14 must be thin enough so that the combined printable magnetic sheet can be printed by conventional xerographic procedures. Accordingly, the magnetic layer 14 will have a thickness ranging from about 0.05 mm to about 0.15 mm. The magnetic layer 14 will typically be sufficiently flexible so that the combined printable magnetic sheet can be handled by the various mechanisms used in office copiers and laser printers without itself being damaged and without damaging the printing

equipment. The total thickness of the printable magnetic stock of the invention will ordinarily not exceed about 0.45 mm, in order to avoid problems in handling in conventional printing and copying equipment. It is not excluded, however, that the printable magnetic stock may be of greater thickness if that would be advantageous in a particular practical application and appropriate printing equipment were available.

[0022] The magnetizable layer 14 must be capable of withstanding the temperatures that it will experience in the fusing step of a xerographic printing process. Accordingly, magnetizable layer 14 comprises a suspension of generally conventional magnetic particles in a synthetic resin matrix capable of withstanding the fuser temperatures. Typically, the fusing step of a xerographic printer, such as a laser printer, operates at a temperature range of from about 190°C to about 235°C (375°F to 455°F). Accordingly, any magnetizable particles having a Curie temperature above the temperature to which the sheet will be exposed in the fusing step are suitable. Conventional barium and strontium ferrites are usable as the magnetic particles in the magnetizable layer. Preferred magnetic particles are strontium ferrite.

[0023] The synthetic resin matrix in which the magnetic particles are dispersed must be capable of withstanding contact with the hot surfaces of the fuser rolls and the like when it passes through the fuser section of a xerographic printer. The

matrix material must not melt, soften excessively or be distorted by passing through the fuser, and must not stick to the hot surfaces of the fuser rolls. Although some dimensional change, e.g., shrinkage, is permissible the matrix material should be devoid of permanent deformation by contact with hot fuser rolls to the extent that printable sheet is cosmetically unacceptable or will not conform smoothly to the substrate to which it is magnetically attached. Furthermore, it must remain sufficiently flexible at room temperature to pass smoothly through the colder portions of the printer. It must also be capable of easy handling without cracking, tearing, etc., during its subsequent use, e.g., when it is being mounted on a magnetically attractive surface, repositioned thereon, or removed therefrom.

[0024] Any synthetic resin material fulfilling these requirements is suitable for the matrix of the magnetic layer of the invention. Any curable rubber or synthetic resin material that in its cured form has a softening temperature high enough to fulfil the above requirements is satisfactory. Suitable materials include synthetic resins and elastomers having a sufficiently high softening point such as nylon, polyester resins such as poly(ethylene terephthalate), fluorinated polymers, silicone rubber, melt-processable rubbers, and the like. Accordingly such a material will have a softening temperature not less than about 190°C and preferably

not less than about 235°C. When using such a curable resin matrix, the magnetic particles are mixed with the uncured resin, and the mixture is extruded, calendered, or otherwise formed into a sheet, and the sheet so formed is cured. A preferred embodiment of the matrix material for use in the magnetic layer of the invention is a melt-processable rubber or high temperature synthetic resin. Such materials can be formed by extruding, calendering, molding, or other forming processes, conducted at a temperature above their softening temperature and then fixed in their final form simply by cooling below their softening temperature. Such materials are especially useful because, unlike cured materials, they can be reprocessed simply by remelting. A preferred material for use as the matrix of the magnetizable layer is a partially cross-linked halogenated olefin interpolymer alloy. A specific example of such a matrix material is a melt-processable rubber product supplied by Advanced Polymer Alloys, Inc., Wilmington, Delaware, under the registered trademark ALCRYN®.

[0025] The magnetizable layer can be made by conventional procedures. For example, ferrite particles and the matrix resin, e.g., a partially cross-linked halogenated olefin interpolymer alloy, may be mixed together and the mixture may be formed into a thin sheet by conventional methods such as extrusion or calendering. If the matrix resin is a curable resin, the magnetic layer may then be cured, e.g., by cross-

linking. If the matrix resin is a melt-processable material, the mixing will be conducted above the melting temperature of the resin and the magnetizable sheet will be solidified by cooling after it has been formed by, e.g., extrusion or calendering.

[0026] The magnetizable layer may be combined with the printable layer by any conventional procedure. For example, the magnetizable layer may be extruded onto one major surface of the printable layer or calendered onto the surface. In this case the printable layer is directly adhered to the magnetizable layer, as illustrated in the drawing. It is also possible to form the magnetizable layer separately and combine it with the printable layer afterwards with an interposed layer of adhesive. Such an adhesive layer will ordinarily be of negligible thickness and is not shown in the drawing.

[0027] The magnetizable layer may be magnetized before it is combined with the printable layer to form the magnetic printing sheet of the invention. Alternatively, the magnetizable layer may be combined with the printable layer and magnetized thereafter. The magnetized printable magnetic sheet is then packaged and distributed to consumers. The user can prepare text and/or images with a computer and send the material so prepared to a laser printer while feeding a magnetic printable sheet of the invention into the printer. The printed sheet is then ready for mounting on a magnetically attractant surface,

e.g., a steel panel of an appliance, a metal door, metal wall panel, or the like. It is also possible to print an unmagnetized sheet according to the invention and magnetize the sheet afterwards. This procedure might be used in an industrial setting, in which magnetizing equipment is available, to manufacture preprinted magnetic signs and the like.

[0028] The invention having now been fully described, it should be understood that it may be embodied in other specific forms or variations without departing from its spirit or essential characteristics. Accordingly, the embodiments described above are to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than the foregoing description, and al changes which come within the meaning and range of equivalence of the claims are intended to be embraced therein.

WE CLAIM:

1. A high temperature-resistant magnetizable sheet comprising magnetic particles dispersed in a synthetic resin matrix, said matrix being devoid of permanent distortion or melting when contacted with a heated surface having a temperature in the range of from about 190°C to about 235°C.

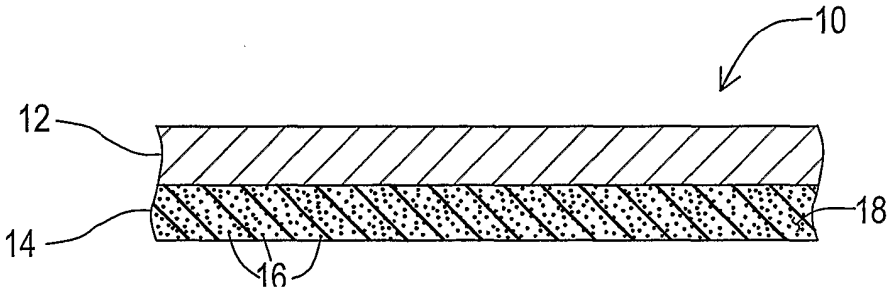
2. The high temperature-resistant magnetizable sheet of Claim 1 wherein said matrix is comprised of a partially cross-linked halogenated olefin interpolymer alloy.

3. A printable high temperature-resistant printable magnetic sheet stock material comprising a printable layer and a magnetizable layer, said printable layer having a major surface capable of being printed by a xerographic process, said magnetizable layer comprising magnetic particles dispersed in a synthetic resin matrix, said matrix having a softening point not less than about 190°C.

4. The printable high temperature-resistant printable magnetic sheet stock material of Claim 3, wherein said matrix has a softening point not less than about 235°C.

5. The printable high temperature-resistant magnetizable sheet of Claim 3 wherein said matrix is comprised of a partially cross-linked halogenated olefin interpolymer alloy.

6. The printable high temperature-resistant magnetizable sheet of Claim 4 wherein said matrix is comprised of a partially cross-linked halogenated olefin interpolymer alloy.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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US02/18814

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G08B 13/14; G11C 11/15
US CL : 428/900; 335/302-306; 148/100, 103; 235/449

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 428/900; 335/302-306; 148/100, 103; 235/449

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
none

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
none

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4,586,729 A (BEYLERIAN) 06 May 1986 (06.05.1986), see entire document.	1-6
Y	US 5,083,112 A (PIOTROWSKI et al.) 21 January 1992 (21.01.1992), see entire document.	1-6
Y	US 5,949,050 A (FOSBENNER et al.) 07 September 1999 (07.09.1999), see entire document.	1-6

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

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