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(71) Applicant *(for all designated States except US)*: **DONGJIN SEMICHEM CO., LTD** [KR/KR]; Gajwa-dong 472-2, Seo-gu, Incheon-city, 404-250 (KR).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **KIM, Bong-Gi** [KR/KR]; 625-3 Yodang-ri, Yanggam-myeon, Hwaseong-city, Gyeonggi-do, 445-931 (KR). **JEON, Seung-Hun** [KR/KR]; 625-3 Yodang-ri, Yanggam-myeon, Hwaseong-city, Gyeonggi-do, 445-931 (KR). **BAEK, Na-Young** [KR/KR]; 625-3 Yodang-ri, Yanggam-myeon, Hwaseong-city, Gyeonggi-do, 445-931 (KR). **LEE, Jong-Wook** [KR/KR]; 625-3 Yodang-ri, Yanggam-myeon, Hwaseong-city, Gyeonggi-do, 445-931 (KR). **PARK, Chan-Seok** [KR/KR]; 625-3 Yodang-ri, Yanggam-myeon, Hwaseong-city, Gyeonggi-do, 445-931 (KR). **BYUN, Kyung-Rock** [KR/KR]; 625-3 Yodang-ri, Yanggam-myeon, Hwaseong-city, Gyeonggi-do 445-931 (KR). **JUNG, Il-Bong** [KR/KR]; 625-3 Yodang-ri, Yanggam-myeon, Hwaseong-city, Gyeonggi-do 445-931 (KR).

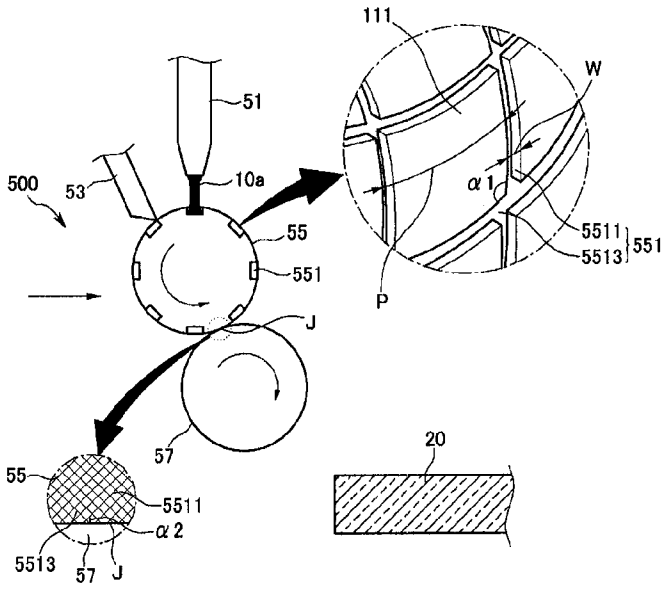
(74) Agent: **YOU ME PATENT & LAW FIRM**; Seolim bldg., 649-10, Yoksam-dong, Kangnam-ku, Seoul, 135-080 (KR).

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(54) Title: METHOD FOR MANUFACTURING A FILTER FOR SHIELDING ELECTROMAGNETIC INTERFERENCE AND METHOD FOR MANUFACTURING A DISPLAY DEVICE PROVIDED WITH THE FILTER FOR SHIELDING ELECTROMAGNETIC INTERFERENCE

FIG. 1



(57) Abstract: The present invention relates to a method for manufacturing a filter for shielding electromagnetic interference. The method for manufacturing a filter for shielding electromagnetic interference includes i) providing a gravure roll in which a mesh-shaped groove is formed; ii) filling the groove with a conductive paste; iii) providing a blanket roll that is opposed to the gravure roll and rotates in a direction that is opposite to a rotating direction of the gravure roll; iv) transferring the conductive paste to the blanket roll while rotating the gravure roll; v) providing a glass substrate; vi) coating the conductive paste on the glass substrate while the blanket roll moves on the glass substrate; and vii) forming a shielding member of a single layer that shields electromagnetic interference on the glass substrate by plasticizing the conductive paste.

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METHOD FOR MANUFACTURING A FILTER FOR SHIELDING ELECTROMAGNETIC INTERFERENCE AND METHOD FOR MANUFACTURING A DISPLAY DEVICE PROVIDED WITH THE FILTER FOR SHIELDING ELECTROMAGNETIC INTERFERENCE

Technical Field

The present invention relates to a method for manufacturing a filter for shielding electromagnetic interference and a method for manufacturing a display device provided with the filter for shielding electromagnetic interference using an offset printing method.

Background Art

Recently, various kinds of display devices have been developed. For example, a plasma display device (PDP), a liquid crystal display device (LCD), an organic light emission display device (OLED), etc. have been developed. Since these display devices have a small thickness and a low weight, they are used in many products that are necessary for displaying images.

Meanwhile, electromagnetic interference (EMI) is emitted from many electric elements included in the display device. The electromagnetic interference causes malfunction of the display device and harm to a human body. Therefore, a filter for shielding electromagnetic interference is attached to the display device for shielding the electromagnetic interference.

DISCLOSURE

Technical Problem

A method for manufacturing a filter for shielding electromagnetic interference using an offset printing method is provided. In addition, a method for manufacturing a display device provided with the above-described filter for shielding electromagnetic interference is provided.

Technical Solution

A method for manufacturing a filter for shielding electromagnetic interference according to an embodiment of the present invention includes i) providing a gravure roll in which a mesh-shaped groove is formed; ii) filling the groove with a conductive paste; iii) providing a blanket roll that is opposed to the gravure roll and rotates in a direction that is opposite to a rotating direction of the gravure roll; iv) transferring the conductive paste to the blanket roll while rotating the gravure roll; v) providing a glass substrate; vi) coating the conductive paste on the glass substrate while the blanket roll moves on the glass substrate; and vii) forming a shielding member of a single layer that

shields electromagnetic interference on the glass substrate by plasticizing the conductive paste.

The groove may include at least one first groove portion that extends along one direction, and at least one second groove portion that crosses the first groove portion during the providing of a gravure roll. A width of the first groove portion may be over 0 and is not more than 50㎛. The width of the first groove portion may be in a range of 15㎛ to 30㎛.

The at least one first groove portion may include a plurality of first groove portions, and an average pitch of the plurality of first groove portions may be over 0 and is not more than 500㎛. The average pitch of the plurality of first groove portions may be in a range of 200㎛ to 400㎛.

The groove may extend along an oblique direction. An angle between the first groove portion and a contact line formed when the gravure roll meets the blanket roll may be in a range of 20 degrees to 70 degrees. The angle may be in a range of 35 degrees to 55 degrees.

The at least one first groove portion may include a plurality of first groove portions, and the at least one second groove portion may include a plurality of second groove portions. First groove portions neighboring each other among the plurality of first groove portions and second groove portions neighboring each other among the plurality of second groove portions may meet each other, thereby forming a polygon. Lengths of all of edges forming the polygon may be substantially the same. The polygon may be substantially a square.

The first and second groove portions may meet with each other to form an angle, and the angle is in a range of 60 degrees to 120 degrees. The angle may be in a range of 80 degrees to 100 degrees. The angle may be substantially 90 degrees.

The conductive paste may contain a conductive metal during the filling of the groove with a conductive paste. The conductive metal may be at least one element selected from a group of silver, copper, and nickel.

A method for manufacturing a filter for shielding electromagnetic interference according to an embodiment of the present invention may further include providing an edge layer on the glass substrate along an edge of the glass substrate. A method for manufacturing a filter for shielding electromagnetic interference according to an embodiment of the present invention may further include providing a ground member that is connected to an end of the shielding member to ground the shielding member. The

conductive paste may be plasticized at a temperature in a range of 500℃ to 540℃ during the forming of the shielding member.

A method for manufacturing a display device according to an embodiment of the present invention includes i) providing a gravure roll in which a mesh-shaped groove is formed; ii) filling the groove with a conductive paste; iii) providing a blanket roll that is opposed to the gravure roll and rotates on a direction that is opposite to a rotating direction of the gravure roll; iv) transferring the conductive paste to the blanket roll while rotating the gravure roll; v) providing a glass substrate; vi) coating the conductive paste on the glass substrate while the blanket roll moves on the glass substrate; vii) forming a shielding member of a single layer that shields electromagnetic interference on the glass substrate by plasticizing the conductive paste; viii) providing a display panel that displays an image; and ix) providing the glass substrate to the display panel.

The providing of a display panel may include i) providing first and second substrates that are opposed to each other; ii) forming a black layer between the first and second substrates; and iii) charging a discharge gas between the first and second substrates.

A method for manufacturing a display device according to an embodiment of the present invention may further include providing the shielding member to the second substrate while locating the shielding member on the second substrate.

The groove may include at least one first groove portion that extends along one direction, and at least one second groove portion that crosses the first groove portion during the providing of the gravure roll. A width of the first groove portion may be over 0 and is not more than 50㎛. The width of the first groove portion may be in a range of 15㎛ to 30㎛.

The at least one first groove portion may include a plurality of first groove portions, and an average pitch of the plurality of first groove portions may be over 0 and is not more than 500㎛. The average pitch of the plurality of first groove portions may be in a range of 200㎛ to 400㎛.

The at least one first groove portion may include a plurality of first groove portions, and the at least one second groove portion may include a plurality of second groove portions. First groove portions neighboring each other among the plurality of first groove portions and second groove portions neighboring each other among the plurality of second groove portions may meet each other, thereby forming a polygon. Lengths of all of edges forming

the polygon may be substantially the same. The polygon may be substantially a square.

The first and second groove portions may meet with each other to form an angle, and the angle may be in a range of 60 degrees to 120 degrees. The angle may be in a range of 80 degrees to 100 degrees. The angle may be substantially 90 degrees.

The groove may extend along an oblique direction during the providing of a gravure roll. An angle between the first groove portion and a contact line formed when the gravure roll meets the blanket roll may be in a range of 20 degrees to 70 degrees. The angle may be in a range of 35 degrees to 55 degrees.

A method for manufacturing a display device according to an embodiment of the present invention may further include providing an edge layer on the glass substrate along an edge of the glass substrate. A method for manufacturing a display device according to an embodiment of the present invention may further include providing a ground member that is connected to an end of the shielding member to ground the shielding member. The conductive paste may be plasticized at a temperature in a range of 500℃ to 540℃ during the forming of the shielding member.

Advantageous Effects

A filter for shielding electromagnetic interference can be manufactured by using an offset printing method that has a simpler manufacturing process than other processes and a low cost.

In addition, an effect for shielding electromagnetic interference of the display device can be maximized when the display device provided with the above-described filter for shielding electromagnetic interference is manufactured.

DESCRIPTION OF DRAWINGS

FIGs. 1 to 5 are schematic views sequentially illustrating methods for manufacturing a filter for shielding electromagnetic interference according to an embodiment of the present invention.

FIG. 6 is a schematic perspective view of the filter for shielding electromagnetic interference manufactured by using the method for manufacturing the filter for shielding electromagnetic interference of FIGs. 1 to 5.

FIG. 7 is a schematic perspective view of a display device provided with the filter for shielding electromagnetic interference of FIG. 6.

FIG. 8 is an enlarged photograph of a glass substrate that is offset

printed according to a first exemplary example of the present invention.

FIG. 9 is an enlarged photograph of a manufactured filter for shielding electromagnetic interference according to a first exemplary example of the present invention.

BEST MODE

Exemplary embodiments of the present invention will be explained in detail below with reference to the attached drawings in order for those skilled in the art in a field of the present invention to easily perform the present invention. However, the present invention can be realized in various forms and is not limited to the embodiments explained below. In addition, like reference numerals refer to like elements in the present specification and drawings.

All terms including technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and the present disclosure, and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

It will be understood that when an element is referred to as being "on" another element, it can be directly on the other element or intervening elements may be present therebetween. In contrast, when an element is referred to as being "directly on" another element, there are no intervening elements present.

It will be understood that, although the terms first, second, third, etc., may be used herein to describe various elements, components, regions, layers, and/or sections, these elements, components, regions, layers, and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer, or section from another element, component, region, layer, or section. Thus, a first element, component, region, layer, or section discussed below could be termed a second element, component, region, layer, or section without departing from the teachings of the present invention.

FIGs. 1 to 5 sequentially show methods for manufacturing a filter 100 for shielding electromagnetic interference according to an embodiment of the present invention. The filter 100 for shielding electromagnetic interference can be manufactured by using an offset printing device 500. The method for manufacturing the filter 100 for shielding electromagnetic interference will be

sequentially explained below with reference to FIGs. 1 to 5.

Firstly, FIG. 1 schematically shows a process in which a conductive paste 10a is discharged from a dispenser 51. An upper enlarged circle of FIG. 1 shows a magnified surface of a gravure roll 55 while a lower enlarged circle of FIG. 1 shows a surface contour of the gravure roll 55.

As illustrated in FIG. 1, the offset printing device 500 includes the dispenser 51, a doctor blade 53, the gravure roll 55, and a blanket roll 57. The offset printing process using the offset printing device 500 includes an off process and a set process. A conductive paste 10a is removed from the gravure roll 55 in the off process. The removed conductive paste 10a is coated on a glass substrate 20 in the set process. The dispenser 51 discharges the conductive paste 10a with a predetermined time interval. The conductive paste 10a discharged from the dispenser 51 is received in a groove 551 formed in the gravure roll 55.

The conductive paste 10a may contain organic materials with elasticity, conductive metal, flux, binder and so on. Materials with a boiling point not less than 200℃ may be used as a flux and a glass frit may be used as a binder. The organic materials may contain acrylate resin, acryl resin, polyester, polyurethane, an oligomer, and so on. The organic materials are removed during plasticizing of the glass substrate 20. The conductive paste 10a may further contain a black pigment.

Since the conductive metal can absorb electromagnetic interference passing through the filter 100 for shielding electromagnetic interference, the effect of shielding electromagnetic interference is excellent. Silver, copper, nickel, or alloys thereof can be used as the conductive metals Since the above conductive metals have good electrical conductivity, they can effectively shield the electromagnetic interference.

As illustrated in the upper enlarged circle of FIG. 1, grooves 551 are formed on a surface of the gravure roll 55. The grooves 551 include first and second groove portions 5511 and 5513. The first and second groove portions 5511 and 5513 cross each other. The first and second groove portions 5511 and 5513 meet each other to form an angle $\alpha 1$. The angle $\alpha 1$ may be in a range of 60 degrees to 120 degrees. If the angle $\alpha 1$ is too large or too small, an opening ratio of the shielding member 10 (shown in FIG. 6) may become too small since a distance between the first and second groove portions 5511 and 5513 becomes too small. More preferably, the angle $\alpha 1$ may be in a range of 80 degrees to 100 degrees. In this case, a distance between the first and second groove

portions 5511 and 5513 can be suitably maintained. In addition, most preferably, the angle α1 is substantially 90 degrees.

In an embodiment of the present invention, the mesh-shaped shielding member 10 (shown in FIG. 6) is manufactured by using a gravure roll 55 (shown in FIG. 3) in which a mesh-shaped groove 551 is formed. If a rotating direction of the gravure roll 55 and a direction along which the groove 551 extends cross each other at a right angle, the conductive paste 10a received in the groove 551 is not removed well from the groove 551.

That is, since the conductive paste 10a is little influenced by a rotating power of the gravure roll 55, it is not easy to remove the conductive paste 10a from the gravure roll 55. On the contrary, if the rotating direction of the gravure roll 55 is the same as a direction along which the groove 551 extends, the conductive paste 10a can be removed well from the groove 551 by rotating power of the gravure roll 55.

As illustrated in an upper enlarged circle of FIG. 1, the first groove portions 5511 neighboring each other and the second groove portions 5513 neighboring each other meet with each other to form a polygon 111. The polygon 111 substantially has a square shape. In this case, the shape of the shielding member 10 (shown in FIG. 6) is optimized, and thereby an effect of shielding electromagnetic interference can be maximized.

Lengths of the four edges forming the polygon 111 are substantially the same. Since lengths of the four edges are substantially the same, the shape of the shielding member 10 is regular. As a result, since the intensity of light emitted through an opening 105 (shown in FIG. 6) corresponding to the polygon 111 is uniform, a uniform image can be displayed. Meanwhile, the polygon 111 is shown to have a square shape in the enlarged circle of FIG. 1, this is merely to illustrate the present invention and the present invention is not limited thereto. Therefore, a polygon 111 with a different shape such as a rectangle, a lozenge shape, and so on can be formed.

As illustrated in the upper enlarged circle of FIG. 1, a resolution of the display can be enhanced by forming a width W of the first groove portion 5511 be small and then maximizing the opening ratio. For this, the width W of the first groove portion 5511 may be over 0 and not more than 50㎛. In this case, the shielding member 10 (shown in FIG. 6) formed by the first groove portion 5511 cannot be observed with a naked eye. If the width W of the first groove portion 5511 is too large, resolution of the display is deteriorated since an opening ratio is reduced. More specifically, the width W of the first groove

portion 5511 is preferably in a range of 15㎛ to 30㎛.

Meanwhile, an average pitch P of the first groove portion 5511 may be over 0 and not more than 500㎛. If the average pitch P of the first groove portion 5511 is too large, the electromagnetic interference may not be absorbed but is discharged outside since the shielding member 10 is not densely formed. As a result, an effect of shielding electromagnetic interference is reduced. More specifically, the average pitch P of the shielding member 10 is preferably in a range of 200㎛ to 400㎛.

If the groove is formed only along a direction corresponding to a rotating direction of the gravure roll, it is impossible to form a mesh-shaped shielding member as in the embodiment of the present invention. That is, the mesh has a rectangular shape. The conductive paste is difficult to transfer to the blanket roll since a groove should also be formed along a direction perpendicularly crossing the rotating direction of the gravure roll.

As illustrated in the lower enlarged circle of FIG. 2, the first and second groove portions 5511 and 5513, which extend along an oblique direction and cross each other, are formed in the gravure roll 55. Therefore, since the groove portion is not formed along a direction perpendicular to a rotating direction of the gravure roll 55, the conductive paste 10a can be effectively transferred to the blanket roll 57.

The first groove portion 5513 extending along an oblique direction forms an angle α2 with a contact line J that is formed by the gravure roll 55 and the blanket roll 57 meeting each other. Here, the angle α2 may be in a range of 20 degrees to 70 degrees. If the angle α2 is too large or too small, the groove portion is formed along a direction immediately beside a direction to be parallel to the contact line J, and thereby the conductive paste 10a cannot be effectively transferred to the blanket roll 57. More specifically, the angle α2 may be in a range of 35 degrees to 55 degrees.

Next, FIG. 2 schematically shows a process of removing an overflowed conductive paste 10a from the groove 551.

As shown in FIG. 2, since an amount of the conductive paste 10a received in the groove 551 is large, the conductive paste 50a may overflow outside of the groove 551. Therefore, the overflowed conductive paste 10a is removed by the doctor blade 53 while the gravure roll 55 rotates along a direction indicated by an arrow (counterclockwise direction). Since the doctor blade 53 contacts an outer surface of the gravure roll 55, the conductive paste 10a that has overflowed outside of the groove 551 can be effectively removed.

Therefore, the conductive paste 10a can be suitably filled in the groove 551 of the gravure roll 55 without overflowing of the conductive paste 10a.

FIG. 3 schematically shows a process of transferring the conductive paste 10a received in the groove 551 to the blanket roll 57.

As illustrated in FIG. 3, the blanket roll 57 is located opposed to the gravure roll 55. The blanket roll 57 rotates in a direction (clockwise direction) to be opposite to a rotating direction of the gravure roll 55. As a result, the conductive paste 10a received in the groove 551 is transferred to the blanket roll 57 when the gravure roll 55 meets the blanket roll 57. Therefore, the conductive paste 10a is attached to an outer surface of the blanket roll 57.

FIG. 4 schematically shows a process in which the blanket roll 57 coats the conductive paste 10a on the glass substrate 20.

As illustrated in FIG. 4, the blanket roll 57 coats the conductive paste 10a on a glass substrate while moving on the glass substrate 20 along a direction indicated by an arrow. Therefore, the mesh-shaped conductive paste 10a is formed on the glass substrate 20 for forming the shielding member 10 (shown in FIG. 1).

FIG. 5 schematically shows a process in which the glass substrate 20 coated with the conductive paste 10a is plasticized. The conductive paste 10a may also be dried before undergoing the plasticizing process.

As illustrated in FIG. 5, the glass substrate 20 is loaded into a heating furnace 90 to be heated at a temperature of a range of 500℃ to 540℃, and thereby organic materials contained in the conductive paste 10a are removed as indicated by arrows. If the heating temperature of the glass substrate 20 is less than 500℃, organic materials contained in the conductive paste 10a are not removed well, and thereby electrical conductivity of the manufactured shielding member is too low. Therefore, the shielding member cannot perform the electromagnetic interference shielding function. On the contrary, if the heating temperature of the glass substrate 20 is over 540℃, shock resistance of the glass substrate 20, mostly formed of reinforced glass, is reduced. In an embodiment of the present invention, the glass substrate 20 is plasticized at a relatively low temperature. Since the shielding member is formed of a single layer, the glass substrate 20 can be plasticized at a relatively low temperature and the shock resistance of the glass substrate 20 can be maintained by preventing reinforcement of the glass substrate 20 from being reduced.

As described above, the glass substrate 20 is heated to remove the organic materials and the shielding member can be directly formed. That is, a

filter for shielding electromagnetic interference of a single layer is directly formed without performing other processes such as etching of the conductive paste 10a. Therefore, manufacturing cost of the filter for shielding electromagnetic interference can be reduced since the process is simple.

Since an offset printing method used in manufacturing of the filter for shielding electromagnetic interference according to an embodiment of the present invention includes a plasticizing process, a resin substrate, which is vulnerable to heat, cannot be used in the offset printing method. Therefore, the glass substrate 20 is used instead of the resin substrate. Since other contents of the offset printing method can be understood by those skilled in the art, detailed description thereof is omitted.

When a filter for shielding electromagnetic interference is manufactured by using a photolithography method instead of an offset printing method, a copper film is firstly attached to a resin film. Next, a dry film resist is laminated on the copper film, and an exposing process, a developing process, an etching process, and an exfoliation process are performed to form a pattern. Therefore, the manufacturing process is complicated and the productivity is not good.

In addition, when a filter for shielding electromagnetic interference is manufactured by using a plating method, desired electric conductivity should be obtained by forming a pattern on the resin film and plating copper thereon. However, wasted liquid occurring during the plating causes environmental pollution.

A pattern cannot be directly formed on the glass substrate by using the above-described photolithography method or a plating method. For example, a mother substrate that is wound in a form of a roll is submerged in a plating bath of the plating method. However, since the glass substrate cannot be wound in a form of a roll, it is impossible to form a shielding member by plating a glass substrate. In addition, when the glass substrate is used, the process is complicated since the pattern should be attached to the glass substrate. The offset printing method can solve the above problem. That is, since the shielding member 10 of a single layer is directly formed on the glass substrate 20 in the offset printing method, the process is simplified to reduce manufacturing cost. On the contrary, since the shielding member formed of a plurality of layers is formed in a non-electrolytic plating method and so on, the manufacturing cost is high. Further, since harmful materials are not discharged in the offset printing method, pollution does not occur.

FIG. 6 shows a filter 100 for shielding electromagnetic interference manufactured according to a manufacturing method of the filter for shielding electromagnetic interference of FIGs. 1 to 5. An internal portion of the filter 100 for shielding electromagnetic interference is magnified to be shown in an enlarged circle of FIG. 6.

As illustrated in FIG. 6, the filter 100 for shielding electromagnetic interference includes the glass substrate 20, the shielding member 10, an edge layer 30, and a ground member 40. The shielding member 10 is connected to the ground member 40 to be grounded. Therefore, the shielding member 10 can absorb electromagnetic interference to be removed. As a result, the shielding member 10 functions as a filter for shielding electromagnetic interference. The edge layer 30 is formed along an edge of the glass substrate 20, and the grounding member 40 is located at both ends of the glass substrate 20 along an x-axis direction in order to ground the shielding member 10.

As illustrated in the enlarged circle of FIG. 6, the shielding member 10 is formed to be mesh-shaped. The filter 100 for shielding electromagnetic interference is mainly used in a display device. Accordingly, the shielding member 10 is formed to be mesh-shaped in order to display an image emitted from the display device to the outside. Since the shielding member 10 has openings 105, an image can be seen through the openings 105 while electromagnetic interference is shielded.

FIG. 7 shows a display device 200 provided with the filter 100 for shielding electromagnetic interference of FIG. 6. An enlarged circle of FIG. 7 shows an internal sectional structure of the display device 200.

As shown in FIG. 7, the filter 100 for shielding electromagnetic interference is fixed on a display panel 600 by using a supporting member 110. Therefore, the filter 100 for shielding electromagnetic interference can be stably received in the display device 200.

An enlarged circle of FIG. 7 shows a plasma display panel as the display panel 600. The plasma display panel shown in the enlarged circle of FIG. 7 is merely to illustrate the present invention and the present invention is not limited thereto. Therefore, other display panels in which it is necessary to use the filter for shielding electromagnetic interference can be also used.

The display panel 600 includes first and second substrates 610 and 620, display electrodes 680, address electrodes 640, sidewalls 660, a phosphor layer 670, a dielectric layer 630, a protective layer 635, and a black layer 651. An internal space of the display panel 600 is filled with a discharge gas. The first

and second substrates 610 and 620 are opposed to each other. The sidewalls 660 form a plurality of discharge cells and a phosphor layer is formed in the discharge cells. The dielectric layer 630 protects the address electrodes 640 and the display electrodes 680 from electrons. The protective layer 635 protects the dielectric layer 630 located thereon.

When a voltage is applied to the address electrodes 640 and the display electrodes 680, a discharge occurs between the address electrodes 640 and the display electrodes 680. Ultraviolet rays generated by the discharge collide with the phosphor layer 670 and then visible rays are emitted therefrom. Meanwhile, the black layer 651 is formed on the sidewalls 660 to improve the contrast ratio. The black layer 651 is located between the first and second substrates 610 and 620. Since the black layer 651 is located on the sidewall 660 that does not emit light, it can reduce a loss of light emitted from the phosphor layer 670.

As shown in the enlarged circle of FIG. 7, the filter 100 for shielding electromagnetic interference is located on the display panel 600. Therefore, the filter 100 for shielding electromagnetic interference can shield electromagnetic interference emitted from the display panel 600. Since the shielding member 10 contacts the second substrate 620 to be opposed thereto, it is not exposed to the outside. Therefore, the shielding member 10 can be prevented from being harmed and the appearance is prevented from being deteriorated due to the shielding member 10.

The present invention will be explained in detail with reference to the exemplary examples below. The exemplary examples are merely to illustrate the present invention and the present invention is not limited thereto.

Exemplary Example 1

A conductive paste containing a high molecule resin at 7wt%, butylcarbitol acetate (BCA) at 7wt%, glass powder at 4wt%, silver at 80wt%, and a dispersion agent at 2wt% was manufactured. Here, the molecular weight of the high molecule resin was 25,000, where a ratio of weight of methyl acrylate (MA), butyl methacrylate (BM), hydroxyethyl methacrylate (HEMA), and methyl methacrylate (MMA) was 30:20:10:40. The glass powder was a Bi-based glass powder and an average particle size thereof was 1.5㎛. The silver had a sphere shape and the average particle size thereof was 1.0㎛. An organic dispersion agent containing an amine group was used as the dispersion agent.

Exemplary Example 2

A conductive paste was manufactured by using a black pigment as a

mixture thereof without using a dispersion agent. The conductive paste contained glass powder at 3wt%, silver at 78wt%, and black pigment at 5wt%. A Co-based black pigment was used as the black pigment. The remaining experimental conditions were the same as those of the above-described Exemplary Example 1.

Exemplary Example 3

A conductive paste was manufactured without using a black pigment. The remaining experimental conditions were the same as those of the above described Exemplary Example 2 except for using BCA at 12wt%.

Experimental Results

A mesh-shaped conductive paste was formed on the glass substrate by using an offset printing device that is the same as that shown in FIG. 1.

FIG. 8 is a photograph showing a state in which the above-described conductive paste was formed on the glass substrate. The left photograph of FIG. 8 shows a 200X enlarged conductive paste, while the right photograph of FIG. 8 shows a 1200X enlarged conductive paste. The width of the conductive paste was 20㎛ and the pitch thereof was 300㎛. Next, the conductive paste formed on the glass substrate was maintained at 500℃ for 15 minutes during a plasticizing process, and thereby organic materials were vaporized.

FIG. 9 is a photograph showing a state in which a shielding member having undergone the plasticizing process was formed on the glass substrate. The left photograph of FIG. 9 shows a 200X enlarged shielding member, while the right photograph of FIG. 9 shows a 1400X enlarged shielding member. The width of the conductive paste was reduced to 15㎛ after the conductive paste had undergone the plasticizing process, and the pitch of 300㎛ was maintained without a change.

Performance of the filters for shielding electromagnetic interference that were manufactured according to the above-described first to third exemplary examples was estimated. The estimations are shown in Table 1 below.

[Table 1]

NO	Classification	Estimated item	Exemplary Example 1	Exemplary Example 2	Exemplary Example 3
1	Light characteristics	Transmissivity	86.4%	86.4%	86.8%
		Haze	1.5	1.5	1.6
2	Electric characteristics	Electric resistance	0.2~0.6 Ω/□	0.6Ω/□	0.6Ω/□

3	Mechanical characteristics	Pencil hardness	7H or more	6H or more	6H or more
4	Chemical resistance	Alcohol resistance	Excellent	Excellent	Excellent
		Acetone resistance	Excellent	Excellent	Excellent
5	Black degree	L value	N/A	31	55

As shown in the above Table 1, light characteristics, electrical characteristics, mechanical characteristics, chemical characteristics, and black degree of the filter for shielding electromagnetic interference according to the first to third exemplary examples were all excellent. Therefore, the filter for shielding electromagnetic interference with a simple manufacturing method can be provided by using the offset printing method.

While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

CLAIMS

1. A method for manufacturing a filter for shielding electromagnetic interference, the method comprising:

providing a gravure roll in which a mesh-shaped groove is formed;

filling the groove with a conductive paste;

providing a blanket roll that is opposed to the gravure roll and rotates in a direction that is opposite to a rotating direction of the gravure roll;

transferring the conductive paste to the blanket roll while rotating the gravure roll;

providing a glass substrate;

coating the conductive paste on the glass substrate while the blanket roll moves on the glass substrate; and

forming a shielding member of a single layer that shields electromagnetic interference on the glass substrate by plasticizing the conductive paste.

2. The method of Claim 1, wherein the groove comprises at least one first groove portion that extends along one direction, and at least one second groove portion that crosses the first groove portion during the providing of a gravure roll.

3. The method of Claim 2, wherein a width of the first groove portion is over 0 and is not more than 50㎛.

4. The method of Claim 3, wherein the width of the first groove portion is in a range of 15㎛ to 30㎛.

5. The method of Claim 2, wherein the at least one first groove portion comprises a plurality of first groove portions and an average pitch of the plurality of first groove portions is over 0 and is not more than 500㎛.

6. The method of Claim 5, wherein the average pitch of the plurality of first groove portions is in a range of 200㎛ to 400㎛.

7. The method of Claim 2, wherein the groove extends along an oblique direction.

8. The method of Claim 7, wherein an angle between the first groove portion and a contact line formed when the gravure roll meets with the blanket roll is in a range of 20 degrees to 70 degrees.

9. The method of Claim 8, wherein the angle is in a range of 35 degrees to 55 degrees.

10. The method of Claim 2, wherein the at least one first groove portion comprises a plurality of first groove portions and the at least one second groove portion comprises a plurality of second groove portions,

wherein first groove portions neighboring each other among the plurality of first groove portions and second groove portions neighboring each other among the plurality of second groove portions meet each other, thereby forming a polygon.

11. The method of Claim 10, wherein lengths of all of edges forming the polygon are substantially the same.

12. The method of Claim 11, wherein the polygon is substantially a square.

13. The method of Claim 2, wherein the first and second groove portions meet each other to form an angle, and the angle is in a range of 60 degrees to 120 degrees.

14. The method of Claim 13, wherein the angle is in a range of 80 degrees to 100 degrees.

15. The method of Claim 14, wherein the angle is substantially 90 degrees.

16. The method of Claim 1, wherein the conductive paste contain a conductive metal during the filling of the groove with a conductive paste.

17. The method of Claim 16, wherein the conductive metal is at least one element selected from a group of silver, copper, and nickel.

18. The method of Claim 1, further comprising providing an edge layer on

the glass substrate along an edge of the glass substrate.

19. The method of Claim 18, further comprising providing a ground member that is connected to an end of the shielding member to ground the shielding member.

20. The method of Claim 1, wherein the conductive paste is plasticized at a temperature in a range of 500℃ to 540℃ during the forming of the shielding member.

21. A method for manufacturing a display device, the method comprising:

providing a gravure roll in which a mesh-shaped groove is formed;

filling the groove with a conductive paste;

providing a blanket roll that is opposed to the gravure roll and rotates in a direction that is opposite to a rotating direction of the gravure roll;

transferring the conductive paste to the blanket roll while rotating the gravure roll;

providing a glass substrate;

coating the conductive paste on the glass substrate while the blanket roll moves on the glass substrate;

forming a shielding member of a single layer that shields electromagnetic interference on the glass substrate by plasticizing the conductive paste;

providing a display panel that displays an image; and

providing the glass substrate to the display panel.

22. The method of Claim 21, wherein the providing of a display panel comprises:

providing first and second substrates that are opposed to each other;

forming a black layer between the first and second substrates; and

charging a discharge gas between the first and second substrates.

23. The method of Claim 22, further comprising providing the shielding member to the second substrate while locating the shielding member on the second substrate.

24. The method of Claim 21, wherein the groove comprises at least one first

groove portion that extends along one direction, and at least one second groove portion that crosses the first groove portion during the providing of the gravure roll.

25. The method of Claim 24, wherein a width of the first groove portion is over 0 and is not more than 50㎛.

26. The method of Claim 25, wherein the width of the first groove portion is in a range of 15㎛ to 30㎛.

27. The method of Claim 24, wherein the at least one first groove portion comprises a plurality of first groove portions, and an average pitch of the plurality of first groove portions is over 0 and is not more than 500㎛.

28. The method of Claim 27, wherein the average pitch of the plurality of first groove portions is in a range of 200㎛ to 400㎛.

29. The method of Claim 24, wherein the at least one first groove portion comprises a plurality of first groove portions and the at least one second groove portion comprises a plurality of second groove portions,

wherein first groove portions neighboring each other among the plurality of first groove portions and second groove portions neighboring each other among the plurality of second groove portions meet each other, thereby forming a polygon.

30. The method of Claim 29, wherein lengths of all of edges forming the polygon are substantially the same.

31. The method of Claim 30, wherein the polygon is substantially a square.

32. The method of Claim 24, wherein the first and second groove portions meet each other to form an angle, and the angle is in a range of 60 degrees to 120 degrees.

33. The method of Claim 32, wherein the angle is in a range of 80 degrees to 100 degrees.

34. The method of Claim 33, wherein the angle is substantially 90 degrees.

35. The method of Claim 21, wherein the groove extends along an oblique direction during the providing of a gravure roll.

36. The method of Claim 35, wherein an angle between the first groove portion and a contact line formed when the gravure roll meets the blanket roll is in a range of 20 degrees to 70 degrees.

37. The method of Claim 36, wherein the angle is in a range of 35 degrees to 55 degrees.

38. The method of Claim 21, further comprising providing an edge layer on the glass substrate along an edge of the glass substrate.

39. The method of Claim 21, further comprising providing a ground member that is connected to an end of the shielding member to ground the shielding member.

40. The method of Claim 21, wherein the conductive paste is plasticized at a temperature in a range of 500℃ to 540℃ during the forming of the shielding member.

FIG. 1

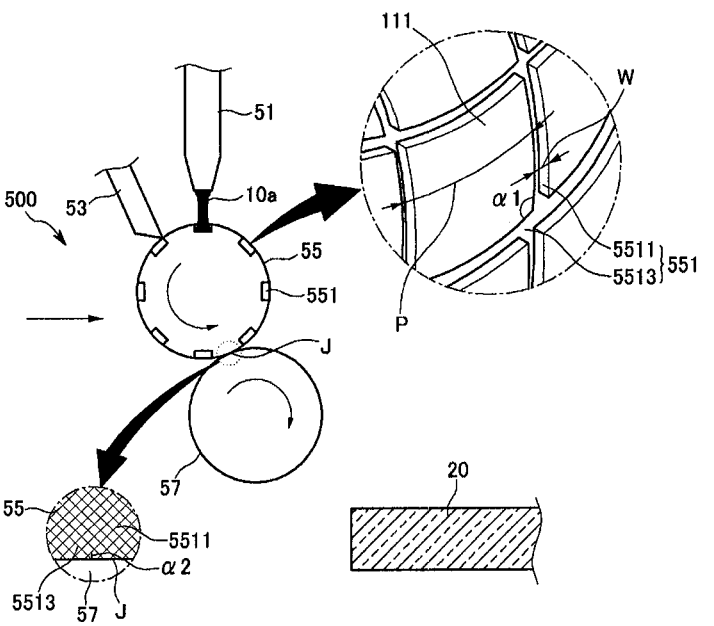

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FIG. 2

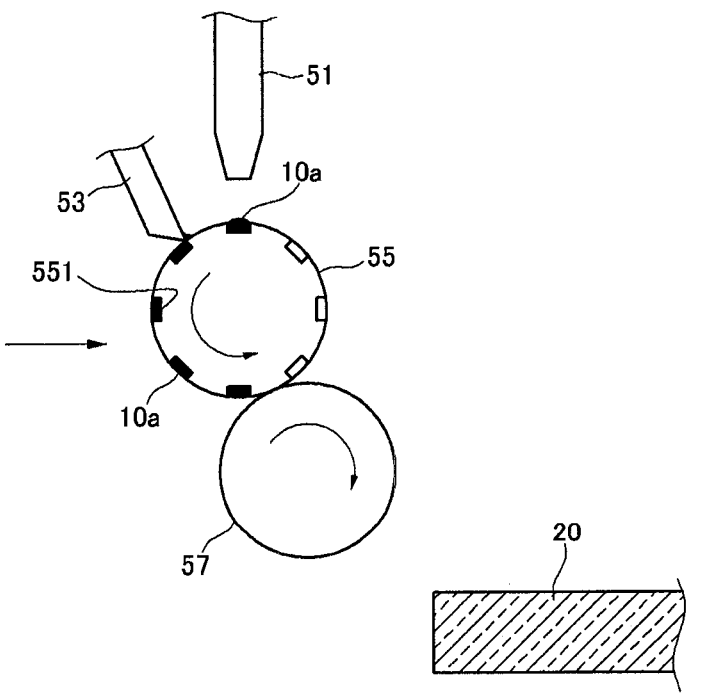

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FIG. 3

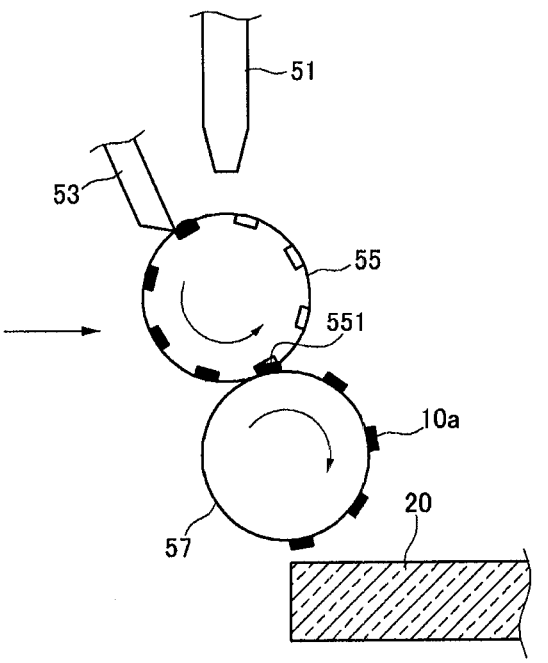


FIG. 4

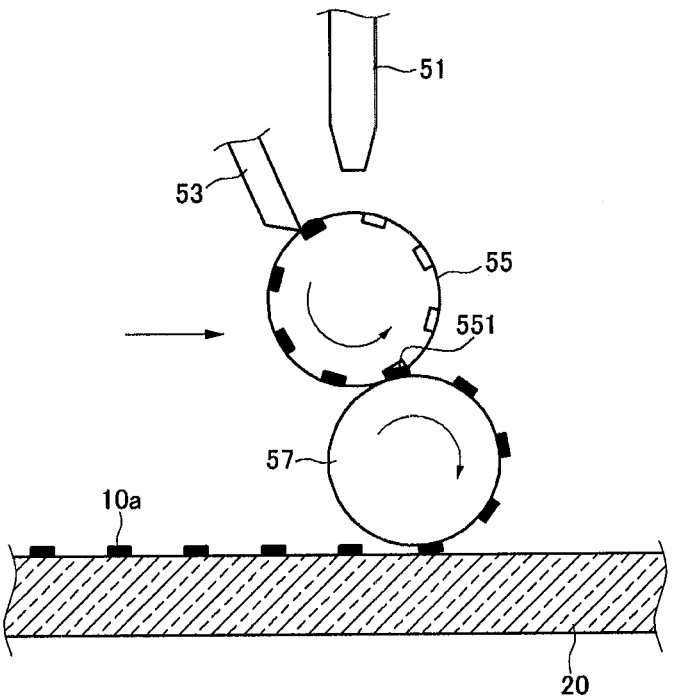


FIG. 5

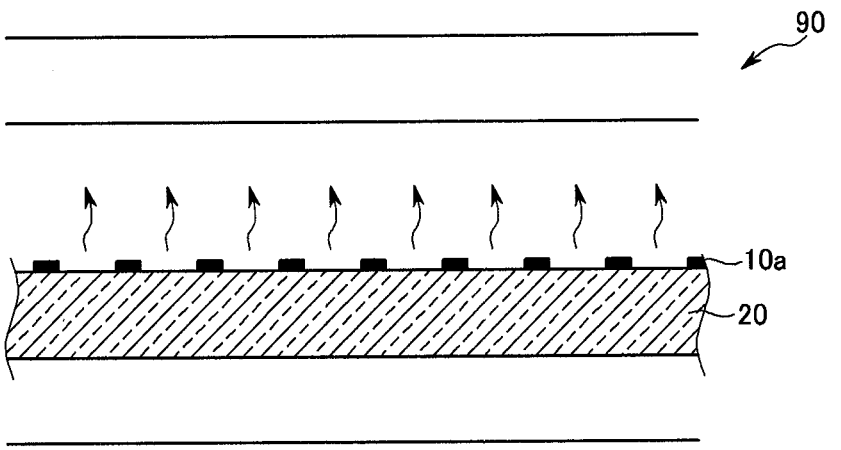


FIG. 6

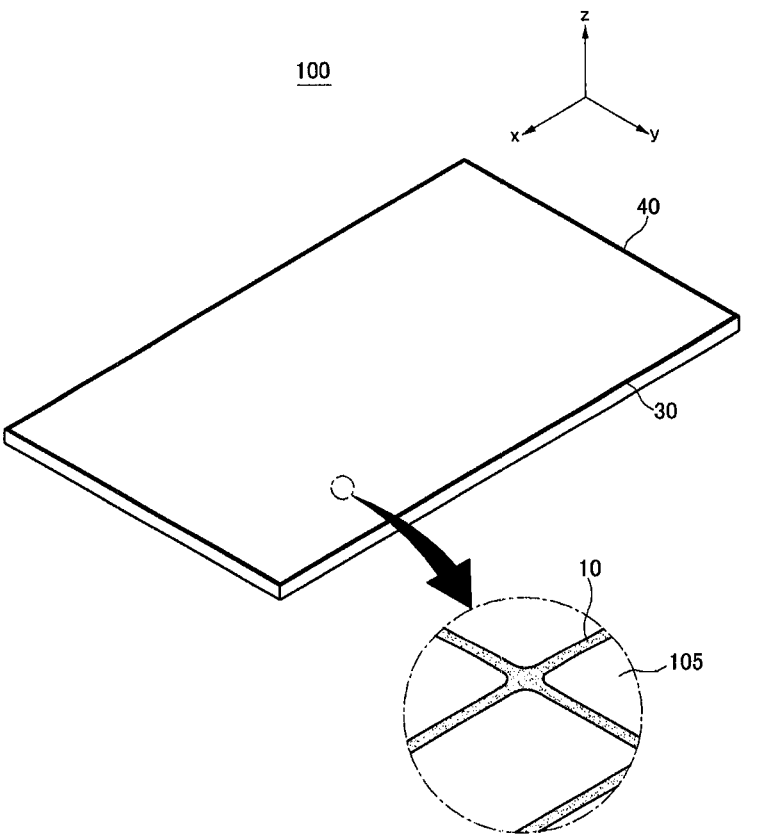


FIG. 7

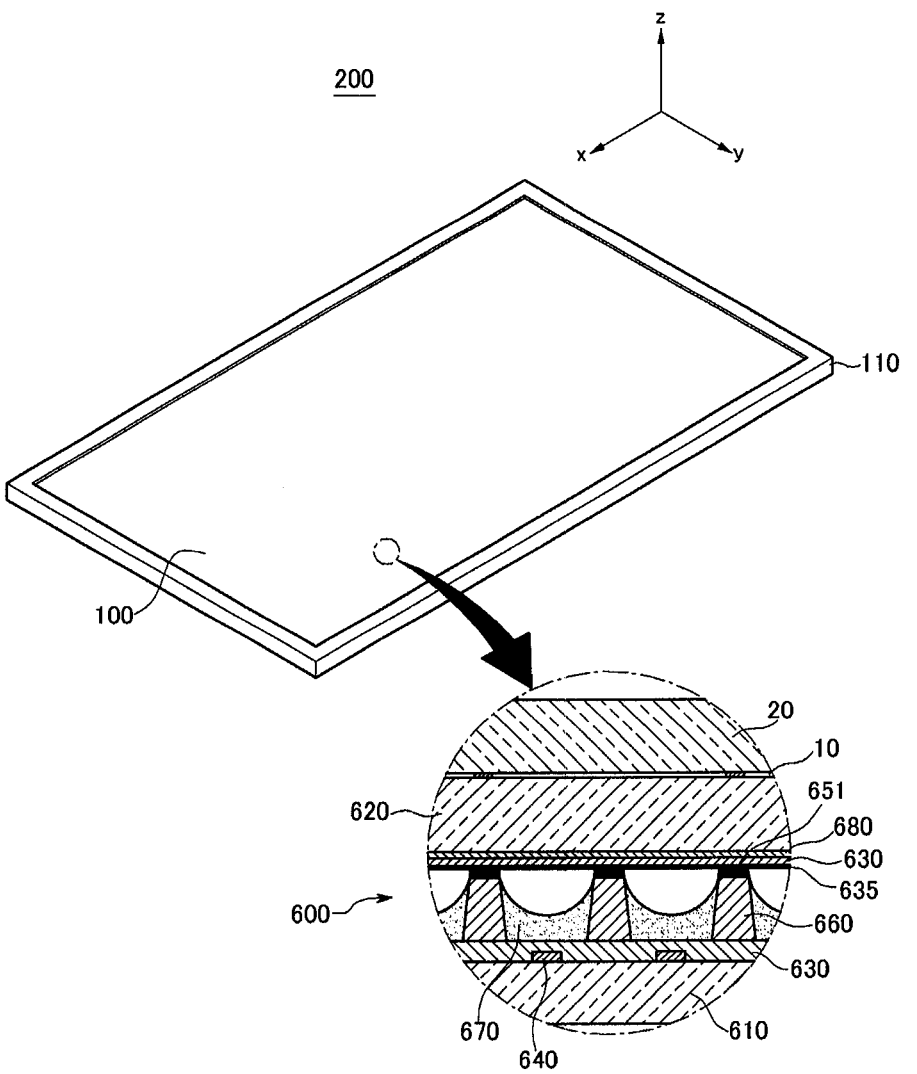


FIG. 8

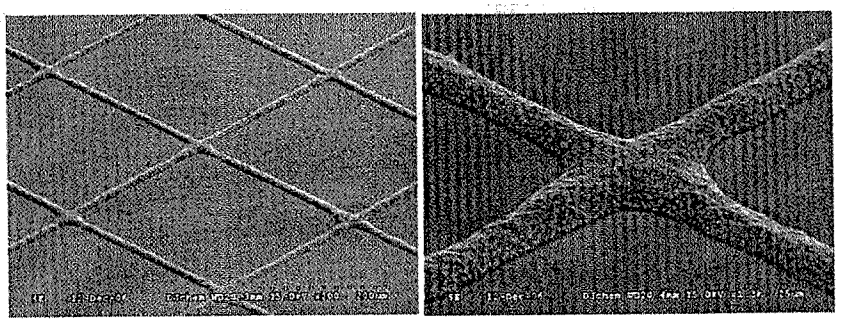
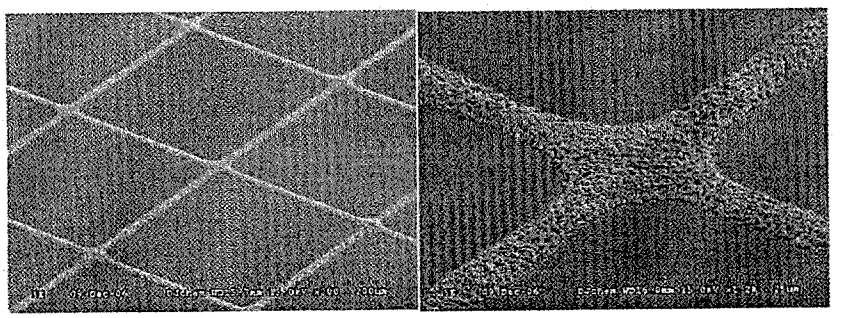


FIG. 9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2008/000900

A. CLASSIFICATION OF SUBJECT MATTER

H01J 17/49(2006.01)i

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)

IPC 8 : H01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for Utility models since 1975

Japanese Utility models and applications for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKIPASS(KIPO internal) "Keyword: gravure, roll, plasma display, filter, mesh"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 10-2006-0001723 A (SAMSUNG SDI CO., LTD.) 06 January 2006 See the abstract, claim 1, 4, and figure 3, 5a-5d.	1-40
A	JP 11-135916 A2 (CORNING INC.) 21 May 1999 See paragraph [13]-[18] and figure 1.	1-40
A	WO2005069068A1 (KONINKL PHILIPS ELECTRONICS NV, et al.) 28 July 2005 See column 9, line 24-column 11, line 15. and figure 2.	1-40
A	JP 15-023290 A (DAINIPPON PRINTING CO., LTD.) 24 January 2003 See paragraph [35].	1-40

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 MAY 2008 (29.05.2008)	**29 MAY 2008 (29.05.2008)**

Name and mailing address of the ISA/KR

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Government Complex-Daejeon, 139 Seonsa-ro, Seo-gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

CHOI, Hoon Young

Telephone No. 82-42-481-8365

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2008/000900

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		US 6152033 A	28.11.2000
WO 2005069068 A1	28.07.2005	EP 01704441 A1	27.09.2006
		KR 10-2006-0125831 A	06.12.2006
		CN 1906526 A	31.01.2007
		GB 200400107 A0	04.02.2004
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		TW 558940 A	21.10.2003
		US 20030094296 A1	22.05.2003