(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
31 May 2019 (31.05.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/101080 A1

(51) International Patent Classification:
B32B 27/30 (2006.01) *B32B 38/14* (2006.01)
B32B 27/06 (2006.01) *B32B 37/10* (2006.01)
B32B 33/00 (2006.01)

(21) International Application Number:
PCT/CN2018/116564

(22) International Filing Date:
21 November 2018 (21.11.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
201711167163.9 21 November 2017 (21.11.2017) CN

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,

(54) Title: SMART CARD WITH RASTER EFFECT ON SURFACE AND PRODUCTION METHOD THEREOF

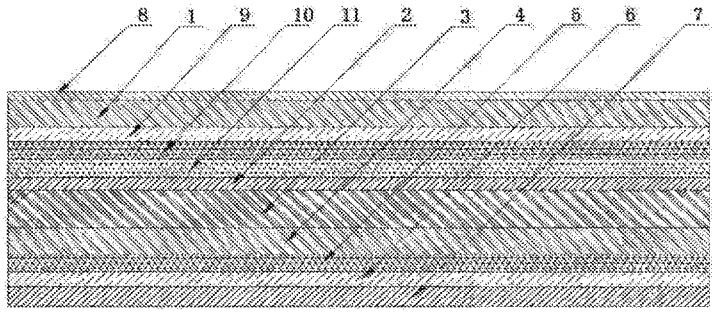

Fig. 1

(57) Abstract: A smart card with raster effect on a surface has a card base, the card base comprises a front-side PVC substrate layer (1), a front-side PVC protective film layer (2), an intermediate INLAY layer (3), a reverse-side PVC substrate layer (4), a reverse-side screen printing ink layer (5), a reverse-side offset printing pattern layer (6) and a reverse-side PVC protective film layer (7) from top to bottom, especially in that the front-side PVC transparent substrate layer (1) has a raster processing layer on a front side, and a front-side offset printing pattern layer (9), a front-side screen printing white ink layer (10) and a front-side screen printing low-temperature lamination adhesive layer (11) are provided between a reverse-side of the front-side PVC transparent substrate layer (1) and the front-side PVC protective film layer (2), the front-side screen printing low-temperature lamination adhesive layer (11) being attached to the front-side PVC protective film layer (2). The smart card is made by laminating twice which ensures the raster layer and the card body to be closely bonded with each other without affecting the raster effect with the bonding strength meeting the high-level standards.

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TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

— *with international search report (Art. 21(3))*

SMART CARD WITH RASTER EFFECT ON SURFACE AND PRODUCTION METHOD THEREOF

TECHNICAL FIELD

The present invention belongs to the technical field of smart card production and processing, in particular to a smart card with raster effect on a surface and a production method thereof.

BACKGROUND OF THE INVENTION

Raster is a technology that combines digital technology with traditional printing technology to show different special effects on a special film. Raster has visual effects of stereoscopic effect, zooming, shifting, flipping, depth of field and the like, can display a vivid stereoscopic world on a plane, and has a strong pattern expression effect. At present, the common raster products on the market include raster painting, raster cover and other products, the materials for printing raster effect are generally PET, PP, PVC, TPU, etc., but there is no smart card with raster effect, because the existing production process cannot complete the production of raster smart cards, for three specific reasons as follows:

1. the mainstream material for manufacturing smart cards is PVC, and PVC materials have a low Vicat softening temperature, generally between 60°C and 90°C, and in order to make the PVC layers bond well together, the lamination temperature must be higher than 130°C;

2. the intermediate INLAY layer of the smart card is made of a PVC material to facilitate antenna winding; and the combination of the intermediate INLAY layer with a PVC printed layer (non-raster surface) must meet to be higher than the lamination temperature (130°C), and the processing temperature of the raster surface layer cannot be higher than the Vicat temperature of the PVC material (60°C to 90°C), otherwise the raster stripe will be melted and the printed picture and text cannot show the raster effect;

3. if the raster surface material uses a material with a relatively high Vicat temperature, such as PET or PP, it has a structural asymmetry not only with the intermediate INLAY layer of a PVC material but also with the PVC printed layer on the other side, thereby causing more serious warping problems, and the surface cannot be processed in other subsequent procedures (such as hot stamping, flat stamping, thermal transfer, etc.).

Therefore, the development of a smart card with raster effect on a surface to meet the customers' demand for traditional card innovation has become an urgent problem in the industry.

SUMMARY OF THE INVENTION

The object of the present invention is to solve the problem that the raster technology currently cannot be applied to the production of smart cards and there is no smart card with raster effect in the market, and provide a smart card with raster effect on a surface and a production method thereof.

A smart card with raster effect on a surface of the present invention, the smart card having a card base, the card base comprising a front-side PVC transparent substrate layer, a front-side PVC protective film layer, an intermediate INLAY layer, a reverse-side PVC substrate layer, a reverse-side screen printing ink layer, a reverse-side offset printing pattern layer, and a reverse-side PVC protective film layer from top to bottom, especially in that the front-side PVC transparent substrate layer has a raster processing layer on a front side, and a front-side offset printing pattern layer, a front-side screen printing white ink layer and a front-side screen printing low-temperature lamination adhesive layer are provided between a reverse side of the front-side PVC transparent substrate layer and the front-side PVC protective film layer, the front-side screen printing low-temperature lamination adhesive layer being bonded with the front-side PVC protective film layer.

In the present invention, the card base of the smart card is further provided on a front side or a reverse side with a concave cavity for accommodating an IC chip, with an IC chip being packaged in the concave cavity, the IC chip being connected to the intermediate INLAY layer.

A method for producing a smart card with raster effect on a surface of the present invention comprises the steps of:

(1) taking a large sheet of reverse-side PVC substrate, respectively printing a screen printing ink layer and an offset printing pattern layer on a front side of the reverse-side PVC substrate according to the requirements of designed pictures and texts, and performing large sheet inspection after the printing;

(2) taking a large sheet of front-side PVC transparent substrate, respectively printing an offset printing pattern layer and a screen printing white cover ink layer on a reverse side of the large sheet of front-side PVC transparent substrate according to the requirements of designed

pictures and texts, performing raster processing on a front side of the large sheet of front-side PVC transparent substrate after the printing, screen-printing a low-temperature lamination adhesive layer on the screen printing ink layer after the raster processing, and performing large sheet inspection after the screen-printing;

(3) sequentially stacking the reverse-side PVC protective film layer, the large sheet of reverse-side PVC substrate layer, the intermediate INLAY layer and the front-side PVC protective film layer, performing alignment and spot welding, and performing first lamination after the spot welding, the first lamination comprising two stages of hot pressing and cold pressing, with hot pressing parameters of: a temperature of 135°C to 145°C, a pressure of 120 to 140 Bar, and a pressing time of 15 to 20 minutes, and with cold pressing parameters of: a cold pressing temperature of 20°C, a pressure of 130 to 150 Bar, a pressing time of 13 to 17 minutes, and a lamination thickness controlled at 0.520 to 0.530 mm; and obtaining a large sheet of intermediate after the lamination; and

(4) performing alignment and spot welding for the large sheet of intermediate and the large sheet of front-side PVC substrate prepared in step (2), and performing second lamination after the spot welding, the second lamination comprising two stages of hot pressing and cold pressing, with hot pressing parameters of: a temperature of 60°C to 90°C, a pressure of 80 to 100 Bar, and a pressing time of 10 to 20 minutes, and with cold pressing parameters of: a cold pressing temperature of 20°C, a pressure of 90 to 120 Bar, a pressing time of 10 to 20 minutes, and a lamination thickness controlled at 0.76 to 0.84 mm; and after the lamination, performing mechanical correction of flatness, punching, and single card inspection, which is finished if the inspection is qualified, the front-side PVC protective film layer of the large sheet of intermediate being bonded with the low-temperature lamination adhesive layer of the large sheet of front-side PVC substrate.

In the present invention, the large sheet of front-side PVC transparent substrate has a raster processing depth of 0.03 to 0.08 mm and a number of published and printed lines of the raster pattern $\geqslant$ 300 LPI.

In the present invention, the low-temperature lamination adhesive is preferably a MSK-GC305A water-based adhesive produced by Zhongshan Moore Packaging Materials Co., Ltd., the screen printing mesh number is 77 to 100 T, and infrared heat curing and drying is performed after the printing, with a drying temperature of 40°C to 60°C and a drying time of 20 to 40

minutes. The MSK-GC305A water-based adhesive has main components of polyurethane emulsion, acrylic emulsion, water and auxiliary agent.

In the present invention, the low-temperature lamination adhesive may further use DSK765A and DSK765B lamination intermediate oils produced by Huizhou Desikun Industrial Co., Ltd., which are used after mixing according to the ratio of DSK765A : DSK765B = 100 : 5 by weight and uniformly dispersing, the screen printing mesh number is 100 to 140 T, and after the printing, infrared heat curing and drying is performed, with a drying temperature of 50°C to 60°C and a drying time of 3 to 5 minutes. The DSK765A and DSK765B lamination intermediate oils have main components of synthetic resins, alkyd resins, mixed solvents and auxiliary agents.

Of course, the low-temperature lamination adhesive described in the present invention is not limited to the two types described above, and may also use a low-temperature lamination adhesive which is produced by any other manufacturer and meets the requirements of the lamination procedure of PVC raster substrates at a lamination temperature of 60°C to 90°C.

In the present invention, the large sheet of front-side PVC transparent substrate has a thickness of 0.10 to 0.30 mm, the front-side PVC protective film has a thickness of 0.02 to 0.08 mm, the intermediate INLAY layer has a thickness of 0.10 to 0.40 mm, and the large sheet of reverse-side PVC substrate has a thickness of 0.10 to 0.30 mm; and the reverse-side PVC protective film has a thickness of 0.02 to 0.10 mm. The thickness of the large sheet of front-side PVC transparent substrate, front-side PVC protective film, the intermediate INLAY layer, the large sheet of reverse-side PVC substrate or the reverse-side PVC protective film layer as described above as required includes but not limited to the above range, and the above thickness ranges do not impose any limitation on the smart card of the present invention, and as long as it is a smart card with raster effect on a surface manufactured according to the structure and principle of the claims of the present invention, it is considered to be fall within the scope of protection of the claims of the present invention.

In the present invention, the thickness of the large sheet of front-side PVC transparent substrate is preferably 0.25 mm, the thickness of the front-side PVC protective film is preferably 0.025 mm, the thickness of the intermediate INLAY layer is preferably 0.17 mm, and the thickness of the large sheet of reverse-side PVC substrate is preferably 0.25 mm; and the thickness of the reverse-side PVC protective film is preferably 0.08 mm.

Compared with the prior art, the present invention has the advantages as follows:

1. a smart card with raster effect on a surface is provided, so that a printed pattern on a card face of the smart card has a stereoscopic depth or dynamic change effect, and the surface image is vivid and dynamic; and

2. a method for producing a smart card with raster effect on a surface is provided, and by laminating twice, the raster layer and the card body can be closely bonded with each other without affecting the raster effect, with the bonding strength meeting the relevant ISO standards.

The product of the present invention introduces the raster technology into the traditional card manufacturing process, meets the requirements of the combination of the transparent PVC raster substrate and the intermediate INLAY layer, combines reasonable process designs to complete the production of the raster smart card, so that the smart card presents a stereoscopic, dynamic pattern effect, and can be widely used in (but not limited to) the fields of finance, transportation, ETC, medical treatment, campus, micro-payment and the like.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a structural schematic diagram of a smart card according to Embodiment 1 of the present invention;

Fig. 2 is a structural schematic diagram of a smart card according to Embodiment 2 of the present invention; and

Fig. 3 is a flow chart of the production process of the smart card according to Embodiment 2 of the present invention.

In the figures: 1 - Front-side PVC transparent substrate layer, 2 - Front-side PVC protective film layer, 3 - Intermediate INLAY layer, 4 - Reverse-side PVC substrate layer, 5 - Reverse-side screen printing ink layer, 6 - Reverse-side offset printing pattern layer, 7 - Reverse-side PVC protective film layer, 8 - Raster processing layer, 9 - Front-side offset printing pattern layer, 10 - Front-side screen printing white ink layer, 11 - Front-side screen printing low-temperature lamination adhesive layer, 12 - IC chip, 13 - Concave cavity.

DETAILED DESCRIPTION

Embodiment 1

A smart card with raster effect on a surface of this embodiment has a card base, the card base comprising a front-side PVC transparent substrate layer 1, a front-side PVC protective film layer 2, an intermediate INLAY layer 3, a reverse-side PVC substrate layer 4, a reverse-side

screen printing ink layer 5, a reverse-side offset printing pattern layer 6, and a reverse-side PVC protective film layer 7 from top to bottom, especially in that the front-side PVC transparent substrate layer 1 has a raster processing layer 8 on a front side, and a front-side offset printing pattern layer 9, a front-side screen printing white ink layer 10 and a front-side screen printing low-temperature lamination adhesive layer 11 are provided between a reverse side of the front-side PVC transparent substrate layer 1 and the front-side PVC protective film layer 2, the front-side screen printing low-temperature lamination adhesive layer 11 being bonded with the front-side PVC protective film layer 2.

A method for producing a smart card with raster effect on a surface of this embodiment comprises the steps of:

(1) taking a large sheet of reverse-side PVC substrate, respectively printing a reverse-side screen printing ink layer 6 and a reverse-side offset printing pattern layer 5 on a front side of the reverse-side PVC substrate according to the requirements of designed pictures and texts, and performing large sheet inspection after the printing;

(2) taking a large sheet of front-side PVC transparent substrate, respectively printing a front-side offset printing pattern layer 9 and a front-side screen printing white ink layer 10 on a reverse side of the large sheet of front-side PVC transparent substrate according to the requirements of designed pictures and texts, performing raster processing on a front side of the large sheet of front-side PVC transparent substrate after the printing, screen-printing a front-side low-temperature lamination adhesive layer 11 on the screen printing ink layer after the raster processing, and performing large sheet inspection after the screen-printing;

(3) sequentially stacking the reverse-side PVC protective film layer 7, the large sheet of reverse-side PVC substrate layer 4, the intermediate INLAY layer 3 and the front-side PVC protective film layer 2, performing alignment and spot welding, and performing first lamination after the spot welding, the first lamination comprising two stages of hot pressing and cold pressing, with hot pressing parameters of: a temperature of 140°C, a pressure of 130 Bar, and a pressing time of 15 minutes, and with cold pressing parameters of: a cold pressing temperature of 20°C, a pressure of 140 Bar, a pressing time of 15 minutes, and a lamination thickness controlled at 0.520 to 0.530 mm; and obtaining a large sheet of intermediate after the lamination; and

(4) performing alignment and spot welding for the large sheet of intermediate and the large sheet of front-side PVC substrate layer 1 prepared in step (2), and performing second

lamination after the spot welding, the second lamination comprising two stages of hot pressing and cold pressing, with hot pressing parameters of: a temperature of 75°C, a pressure of 90 Bar, and a pressing time of 15 minutes, and with cold pressing parameters of: a temperature of 20°C, a pressure of 120 Bar, a pressing time of 15 minutes, and a lamination thickness controlled at 0.76 mm; after the lamination, performing mechanical correction of flatness, punching, and single card inspection, which is finished if the inspection is qualified, the front-side PVC protective film layer of the large sheet of intermediate being bonded with the low-temperature lamination adhesive layer of the large sheet of front-side PVC substrate.

The large sheet of front-side PVC transparent substrate has a raster processing depth of 0.05 mm and a number of published and printed lines of the raster pattern of 500 LPI.

The low-temperature lamination adhesive is a MSK-GC305A water-based adhesive produced by Zhongshan Moore Packaging Materials Co., Ltd., the screen printing mesh number is 85 T, and infrared heat curing and drying is performed after the printing, with a drying temperature of 50°C and a drying time of 28 minutes.

The large sheet of front-side PVC transparent substrate has a thickness of 0.25 mm, the front-side PVC protective film has a thickness of 0.025 mm, the intermediate INLAY layer has a thickness of 0.17 mm, and the large sheet of reverse-side PVC substrate has a thickness of 0.25 mm; and the reverse-side PVC protective film has a thickness of 0.08 mm.

According to the pilot production verification, the parameters in this embodiment are the optimal production parameters.

Embodiment 2

A smart card with raster effect on a surface of this embodiment has a card base, the card base comprising a front-side PVC transparent substrate layer 1, a front-side PVC protective film layer 2, an intermediate INLAY layer 3, a reverse-side PVC substrate layer 4, a reverse-side screen printing ink layer 5, a reverse-side offset printing pattern layer 6, and a reverse-side PVC protective film layer 7 from top to bottom, especially in that the front-side PVC transparent substrate layer 1 has a raster processing layer 8 on a front side, and a front-side offset printing pattern layer 9, a front-side screen printing white ink layer 10 and a front-side screen printing low-temperature lamination adhesive layer 11 are provided between a reverse side of the front-side PVC transparent substrate layer 1 and the front-side PVC protective film layer 2, the front-side screen printing low-temperature lamination adhesive layer 11 being bonded with the front-

side PVC protective film layer 2; and the card base of the smart card is further provided on a front side with a concave cavity 13 for accommodating an IC chip 12, with an IC chip being packaged in the concave cavity, the IC chip 12 being connected to the intermediate INLAY layer 3.

A method for producing a smart card with raster effect on a surface of this embodiment comprises the steps of:

(1) taking a large sheet of reverse-side PVC substrate, respectively printing a screen printing ink layer and an offset printing pattern layer on a front side of the reverse-side PVC substrate according to the requirements of designed pictures and texts, and performing large sheet inspection after the printing;

(2) taking a large sheet of front-side PVC transparent substrate, respectively printing an offset printing pattern layer and a screen printing white cover ink layer on a reverse side of the large sheet of front-side PVC transparent substrate according to the requirements of designed pictures and texts, performing raster processing on a front side of the large sheet of front-side PVC transparent substrate after the printing, screen-printing a low-temperature lamination adhesive layer on the screen printing ink layer after the raster processing, and performing large sheet inspection after the screen-printing;

(3) sequentially stacking the reverse-side PVC protective film layer, the large sheet of reverse-side PVC substrate layer, the intermediate INLAY layer and the front-side PVC protective film layer, performing alignment and spot welding, and performing first lamination after the spot welding, the first lamination comprising two stages of hot pressing and cold pressing, with hot pressing parameters of: a temperature of 135°C, a pressure of 140 Bar, and a pressing time of 20 minutes, and with cold pressing parameters of: a cold pressing temperature of 20°C, a pressure of 130 Bar, a pressing time of 17 minutes, and a lamination thickness controlled at 0.520 to 0.530 mm; and obtaining a large sheet of intermediate after the lamination; and

(4) performing alignment and spot welding for the large sheet of intermediate and the large sheet of front-side PVC substrate prepared in step (2), and performing second lamination after the spot welding, the second lamination comprising two stages of hot pressing and cold pressing, with hot pressing parameters of: a temperature of 70°C, a pressure of 100 Bar, and a pressing time of 20 minutes, and with cold pressing parameters of: a temperature of 20°C, a pressure of 120 Bar, a pressing time of 10 minutes, and a lamination thickness controlled at 0.82

mm; after the lamination, performing mechanical correction of flatness, punching, and single card inspection, which is finished if the inspection is qualified, the front-side PVC protective film layer of the large sheet of intermediate being bonded with the low-temperature lamination adhesive layer of the large sheet of front-side PVC substrate.

The large sheet of front-side PVC transparent substrate has a raster processing depth of 0.04 mm and a number of published and printed lines of the raster pattern of 300 LPI.

The low-temperature lamination adhesive uses DSK765A and DSK765B lamination intermediate oils produced by Huizhou Desikun Industrial Co., Ltd., which are used after mixing according to the ratio of DSK765A : DSK765B = 100 : 5 by weight and uniformly dispersing, the screen printing mesh number is 120 T, and after the printing, infrared heat curing and drying is performed, with a drying temperature of 55°C and a drying time of 4 minutes.

The large sheet of front-side PVC transparent substrate has a thickness of 0.15 mm, the front-side PVC protective film has a thickness of 0.06 mm, the intermediate INLAY layer has a thickness of 0.37 mm, and the large sheet of reverse-side PVC substrate has a thickness of 0.15 mm; and the reverse-side PVC protective film has a thickness of 0.08 mm.

Embodiment 3

A smart card with raster effect on a surface of this embodiment has the same structure as that in Embodiment 2, and the production method thereof comprises the steps of:

(1) taking a large sheet of reverse-side PVC substrate, respectively printing a screen printing ink layer and an offset printing pattern layer on a front side of the reverse-side PVC substrate according to the requirements of designed pictures and texts, and performing large sheet inspection after the printing;

(2) taking a large sheet of front-side PVC transparent substrate, respectively printing an offset printing pattern layer and a screen printing white cover ink layer on a reverse side of the large sheet of front-side PVC transparent substrate according to the requirements of designed pictures and texts, performing raster processing on a front side of the large sheet of front-side PVC transparent substrate after the printing, screen-printing a low-temperature lamination adhesive layer on the screen printing ink layer after the raster processing, and performing large sheet inspection after the screen-printing;

(3) sequentially stacking the reverse-side PVC protective film layer, the large sheet of reverse-side PVC substrate layer, the intermediate INLAY layer and the front-side PVC

protective film layer, performing alignment and spot welding, and performing first lamination after the spot welding, the first lamination comprising two stages of hot pressing and cold pressing, with hot pressing parameters of: a temperature of 145°C, a pressure of 120 Bar, and a pressing time of 15 minutes, and with cold pressing parameters of: a cold pressing temperature of 20°C, a pressure of 150 Bar, a pressing time of 13 minutes, and a lamination thickness controlled at 0.520 to 0.530 mm; and obtaining a large sheet of intermediate after the lamination; and

(4) performing alignment and spot welding for the large sheet of intermediate and the large sheet of front-side PVC substrate prepared in step (2), and performing second lamination after the spot welding, the second lamination comprising two stages of hot pressing and cold pressing, with hot pressing parameters of: a temperature of 80°C, a pressure of 80 Bar, and a pressing time of 10 minutes, and with cold pressing parameters of: a temperature of 20°C, a pressure of 90 Bar, a pressing time of 20 minutes, and a lamination thickness controlled at 0.80 mm; after the lamination, performing mechanical correction of flatness, punching, and single card inspection, which is finished if the inspection is qualified, the front-side PVC protective film layer of the large sheet of intermediate being bonded with the low-temperature lamination adhesive layer of the large sheet of front-side PVC substrate.

The large sheet of front-side PVC transparent substrate has a raster processing depth of 0.08 mm and a number of published and printed lines of the raster pattern of 500 LPI.

The low-temperature lamination adhesive uses DSK765A and DSK765B lamination intermediate oils produced by Huizhou Desikun Industrial Co., Ltd., which are used after mixing according to the ratio of DSK765A : DSK765B = 100 : 5 by weight and uniformly dispersing, the screen printing mesh number is 140 T, and after the printing, infrared heat curing and drying is performed, with a drying temperature of 50°C and a drying time of 5 minutes.

The large sheet of front-side PVC transparent substrate has a thickness of 0.30 mm, the front-side PVC protective film has a thickness of 0.02 mm, the intermediate INLAY layer has a thickness of 0.10 mm, and the large sheet of reverse-side PVC substrate has a thickness of 0.30 mm; and the reverse-side PVC protective film has a thickness of 0.08 mm.

Embodiment 4

A smart card with raster effect on a surface of this embodiment has the same structure as that in Embodiment 2, and the production method thereof comprises the steps of:

(1) taking a large sheet of reverse-side PVC substrate, respectively printing a screen

printing ink layer and an offset printing pattern layer on a front side of the reverse-side PVC substrate according to the requirements of designed pictures and texts, and performing large sheet inspection after the printing;

(2) taking a large sheet of front-side PVC transparent substrate, respectively printing an offset printing pattern layer and a screen printing white cover ink layer on a reverse side of the large sheet of front-side PVC transparent substrate according to the requirements of designed pictures and texts, performing raster processing on a front side of the large sheet of front-side PVC transparent substrate after the printing, screen-printing a low-temperature lamination adhesive layer on the screen printing ink layer after the raster processing, and performing large sheet inspection after the screen printing;

(3) sequentially stacking the reverse-side PVC protective film layer, the large sheet of reverse-side PVC substrate layer, the intermediate INLAY layer and the front-side PVC protective film layer, performing alignment and spot welding, and performing first lamination after the spot welding, the first lamination comprising two stages of hot pressing and cold pressing, with hot pressing parameters of: a temperature of 138°C, a pressure of 135 Bar, and a pressing time of 17 minutes, and with cold pressing parameters of: a cold pressing temperature of 20°C, a pressure of 145 Bar, a pressing time of 15 minutes, and a lamination thickness controlled at 0.520 to 0.530 mm; and obtaining a large sheet of intermediate after the lamination; and

(4) performing alignment and spot welding for the large sheet of intermediate and the large sheet of front-side PVC substrate prepared in step (2), and performing second lamination after the spot welding, the second lamination comprising two stages of hot pressing and cold pressing, with hot pressing parameters of: a temperature of 90°C, a pressure of 85 Bar, and a pressing time of 12 minutes, and with cold pressing parameters of: a temperature of 20°C, a pressure of 110 Bar, a pressing time of 12 minutes, and a lamination thickness controlled at 0.80 mm; after the lamination, performing mechanical correction of flatness, punching, and single card inspection, which is finished if the inspection is qualified, the front-side PVC protective film layer of the large sheet of intermediate being bonded with the low-temperature lamination adhesive layer of the large sheet of front-side PVC substrate.

The large sheet of front-side PVC transparent substrate has a raster processing depth of 0.06 mm and a number of published and printed lines of the raster pattern of 600 LPI.

The low-temperature lamination adhesive uses DSK765A and DSK765B lamination

intermediate oils produced by Huizhou Desikun Industrial Co., Ltd., which are used after mixing according to the ratio of DSK765A : DSK765B = 100 : 5 by weight and uniformly dispersing, the screen printing mesh number is 100 T, and after the printing, infrared heat curing and drying is performed, with a drying temperature of 60°C and a drying time of 3 minutes.

The large sheet of front-side PVC transparent substrate has a thickness of 0.27 mm, the front-side PVC protective film has a thickness of 0.08 mm, the intermediate INLAY layer has a thickness of 0.33 mm, and the large sheet of reverse-side PVC substrate has a thickness of 0.10 mm; and the reverse-side PVC protective film has a thickness of 0.02 mm.

Embodiment 5

A smart card with raster effect on a surface of this embodiment has the same structure as that in Embodiment 1, and the production method thereof comprises the steps of:

(1) taking a large sheet of reverse-side PVC substrate, respectively printing a screen printing ink layer and an offset printing pattern layer on a front side of the reverse-side PVC substrate according to the requirements of designed pictures and texts, and performing large sheet inspection after the printing;

(2) taking a large sheet of front-side PVC transparent substrate, respectively printing an offset printing pattern layer and a screen printing white cover ink layer on a reverse side of the large sheet of front-side PVC transparent substrate according to the requirements of designed pictures and texts, performing raster processing on a front side of the large sheet of front-side PVC transparent substrate after the printing, screen-printing a low-temperature lamination adhesive layer on the screen printing ink layer after the raster processing, and performing large sheet inspection after the screen printing;

(3) sequentially stacking the reverse-side PVC protective film layer, the large sheet of reverse-side PVC substrate layer, the intermediate INLAY layer and the front-side PVC protective film layer, performing alignment and spot welding, and performing first lamination after the spot welding, the first lamination comprising two stages of hot pressing and cold pressing, with hot pressing parameters of: a temperature of 142°C, a pressure of 125 Bar, and a pressing time of 17 minutes, and with cold pressing parameters of: a cold pressing temperature of 20°C, a pressure of 135 Bar, a pressing time of 14 minutes, and a lamination thickness controlled at 0.520 to 0.530 mm; and obtaining a large sheet of intermediate after the lamination; and

(4) performing alignment and spot welding for the large sheet of intermediate and the

large sheet of front-side PVC substrate prepared in step (2), and performing second lamination after the spot welding, the second lamination comprising two stages of hot pressing and cold pressing, with hot pressing parameters of: a temperature of 60°C, a pressure of 95 Bar, and a pressing time of 20 minutes, and with cold pressing parameters of: a temperature of 20°C, a pressure of 115 Bar, a pressing time of 17 minutes, and a lamination thickness controlled at 0.82 mm; after the lamination, performing mechanical correction of flatness, punching, and single card inspection, which is finished if the inspection is qualified, the front-side PVC protective film layer of the large sheet of intermediate being bonded with the low-temperature lamination adhesive layer of the large sheet of front-side PVC substrate.

The large sheet of front-side PVC transparent substrate has a raster processing depth of 0.03 mm and a number of published and printed lines of the raster pattern of 400 LPI.

The low-temperature lamination adhesive is a MSK-GC305A water-based adhesive produced by Zhongshan Moore Packaging Materials Co., Ltd., the screen printing mesh number is 100 T, and infrared heat curing and drying is performed after the printing, with a drying temperature of 60°C and a drying time of 20 minutes.

The large sheet of front-side PVC transparent substrate has a thickness of 0.10 mm, the front-side PVC protective film has a thickness of 0.02 mm, the intermediate INLAY layer has a thickness of 0.40 mm, and the large sheet of reverse-side PVC substrate has a thickness of 0.20 mm; and the reverse-side PVC protective film has a thickness of 0.10 mm.

The above embodiments are merely illustrative of specific embodiments of the claims of the present invention, and do not limit the present invention in any way, and smart cards with raster effect on a surface produced by anyone according to the smart card structure and the principle of the production method according to the claims of the present invention are all be considered to be within the scope of protection of the claims of the present invention.

CLAIMS

What Is Claimed Is:

1. A smart card with raster effect on a surface, the smart card having a card base, the card base comprising a front-side PVC transparent substrate layer, a front-side PVC protective film layer, an intermediate INLAY layer, a reverse-side PVC substrate layer, a reverse-side screen printing ink layer, a reverse-side offset printing pattern layer, and a reverse-side PVC protective film layer from top to bottom, characterized in that the front-side PVC transparent substrate layer has a raster processing layer on a front side, and a front-side offset printing pattern layer, a front-side screen printing white ink layer and a front-side screen printing low-temperature lamination adhesive layer are provided between a reverse side of the front-side PVC transparent substrate layer and the front-side PVC protective film layer, the front-side screen printing low-temperature lamination adhesive layer being bonded with the front-side PVC protective film layer.

2. The smart card with raster effect on a surface according to claim 1, characterized in that the card base of the smart card is further provided on a front side or a reverse side with a concave cavity for accommodating an IC chip, with an IC chip being packaged in the concave cavity, the IC chip being connected to the intermediate INLAY layer.

3. A method for producing the smart card with raster effect on a surface according to claim 1 or 2, the method comprising the steps of:

(1) taking a large sheet of reverse-side PVC substrate, respectively printing a screen printing ink layer and an offset printing pattern layer on a front side of the reverse-side PVC substrate according to the requirements of designed pictures and texts, and performing large sheet inspection after the printing;

(2) taking a large sheet of front-side PVC transparent substrate, respectively printing an offset printing pattern layer and a screen printing white cover ink layer on a reverse side of the large sheet of front-side PVC transparent substrate according to the requirements of designed pictures and texts, performing raster processing on a front side of the large sheet of front-side PVC transparent substrate after the printing, screen-printing a low-temperature lamination

adhesive layer on the screen printing ink layer after the raster processing, and performing large sheet inspection after the screen-printing;

(3) sequentially stacking the reverse-side PVC protective film layer, the large sheet of reverse-side PVC substrate layer, the intermediate INLAY layer and the front-side PVC protective film layer, performing alignment and spot welding, and performing first lamination after the spot welding, the first lamination comprising two stages of hot pressing and cold pressing, with hot pressing parameters of: a temperature of 135°C to 145°C, a pressure of 120 to 140 Bar, and a pressing time of 15 to 20 minutes, and with cold pressing parameters of: a cold pressing temperature of 20°C, a pressure of 130 to 150 Bar, a pressing time of 13 to 17 minutes, and a lamination thickness controlled at 0.520 to 0.530 mm; and obtaining a large sheet of intermediate after the lamination; and

(4) performing alignment and spot welding for the large sheet of intermediate and the large sheet of front-side PVC substrate prepared in step (2), and performing second lamination after the spot welding, the second lamination comprising two stages of hot pressing and cold pressing, with hot pressing parameters of: a temperature of 60°C to 90°C, a pressure of 80 to 100 Bar, and a pressing time of 10 to 20 minutes, and with cold pressing parameters of: a cold pressing temperature of 20°C, a pressure of 90 to 120 Bar, a pressing time of 10 to 20 minutes, and a lamination thickness controlled at 0.76 to 0.84 mm; and after the lamination, performing mechanical correction of flatness, punching, and single card inspection, which is finished if the inspection is qualified, the front-side PVC protective film layer of the large sheet of intermediate being bonded with the low-temperature lamination adhesive layer of the large sheet of front-side PVC substrate.

4. The method for producing the smart card with raster effect on a surface according to claim 3, characterized in that the large sheet of front-side PVC transparent substrate has a raster processing depth of 0.03 to 0.08 mm and a number of published and printed lines of the raster pattern ≥ 300 LPI.

5. The method for producing the smart card with raster effect on a surface according to claim 3, characterized in that the low-temperature lamination adhesive is a MSK-GC305A water-based adhesive produced by Zhongshan Moore Packaging Materials Co., Ltd., the screen

printing mesh number is 77 to 100 T, and infrared heat curing and drying is performed after the printing, with a drying temperature of 40°C to 60°C and a drying time of 20 to 40 minutes.

6. The method for producing the smart card with raster effect on a surface according to claim 3, characterized in that the low-temperature lamination adhesive uses DSK765A and DSK765B lamination intermediate oils produced by Huizhou Desikun Industrial Co., Ltd., which are used after mixing according to the ratio of DSK765A : DSK765B = 100 : 5 by weight and uniformly dispersing, the screen printing mesh number is 100 to 140 T, and after the printing, infrared heat curing and drying is performed, with a drying temperature of 50°C to 60°C and a drying time of 3 to 5 minutes.

7. The method for producing the smart card with raster effect on a surface according to claim 3 or 4, characterized in that the large sheet of front-side PVC transparent substrate has a thickness of 0.10 to 0.30 mm, the front-side PVC protective film has a thickness of 0.02 to 0.08 mm, the intermediate INLAY layer has a thickness of 0.10 to 0.40 mm, and the large sheet of reverse-side PVC substrate has a thickness of 0.10 to 0.30 mm; and the reverse-side PVC protective film has a thickness of 0.02 to 0.10 mm.

8. The method for producing the smart card with raster effect on a surface according to claim 7, characterized in that the large sheet of front-side PVC transparent substrate has a thickness of 0.25 mm, the front-side PVC protective film has a thickness of 0.025 mm, the intermediate INLAY layer has a thickness of 0.17 mm, and the large sheet of reverse-side PVC substrate has a thickness of 0.25 mm; and the reverse-side PVC protective film has a thickness of 0.08 mm.

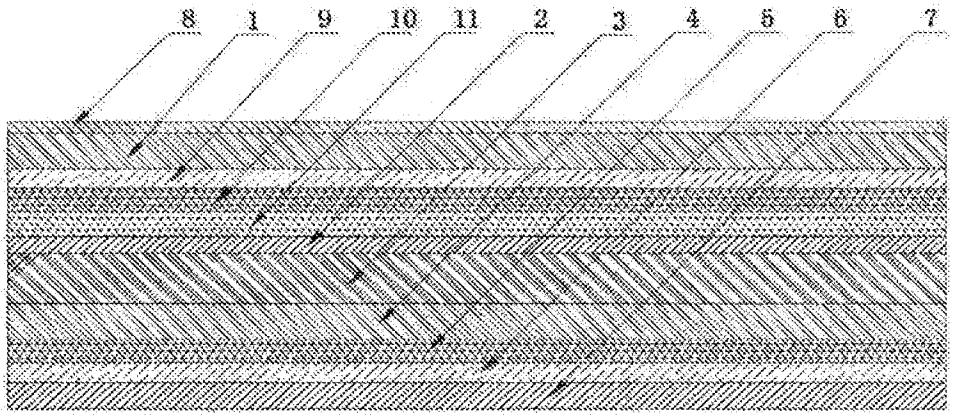

Fig. 1

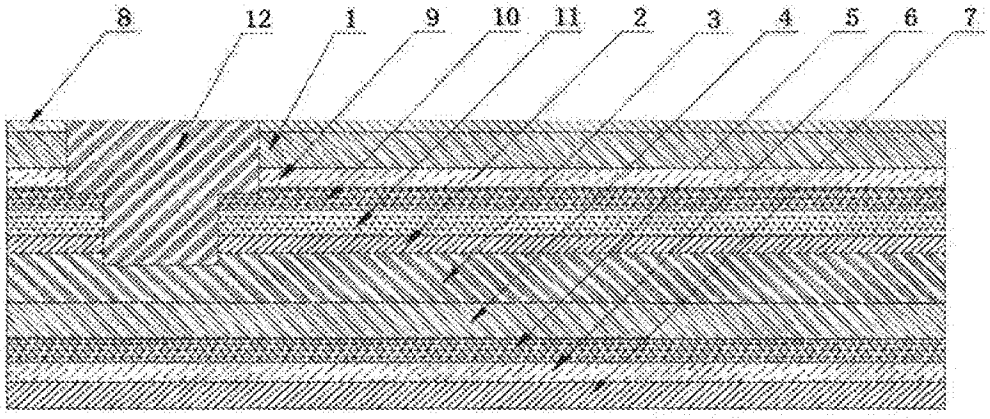

Fig. 2

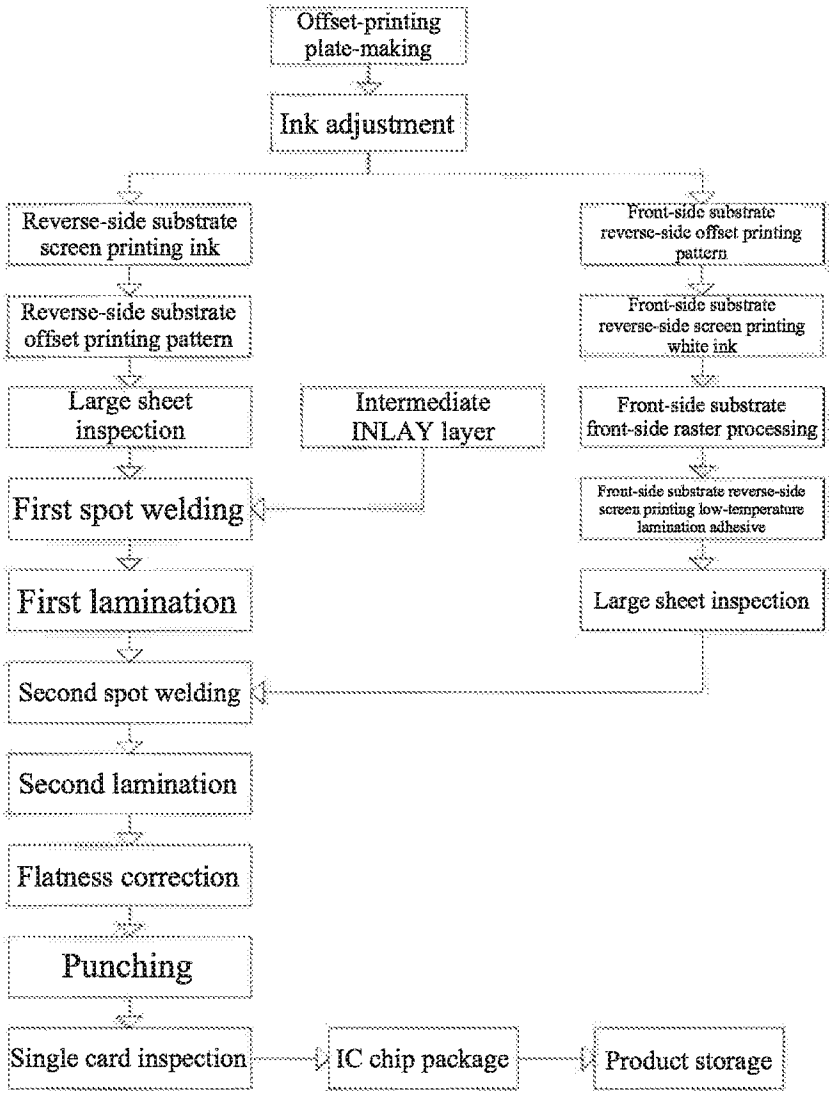
Offset-printing plate-making
Ink adjustment
Reverse-side substrate screen printing ink
Reverse-side substrate offset printing pattern
Large sheet inspection
Intermediate INLAY layer
First spot welding
First lamination
Second spot welding
Second lamination
Flatness correction
Punching
Single card inspection
IC chip package
Product storage
Front-side substrate reverse-side offset printing pattern
Front-side substrate reverse-side screen printing white ink
Front-side substrate front-side raster processing
Front-side substrate reverse-side screen printing low-temperature lamination adhesive
Large sheet inspection

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2018/116564

A. CLASSIFICATION OF SUBJECT MATTER

B32B 27/30(2006.01)i; B32B 27/06(2006.01)i; B32B 33/00(2006.01)i; B32B 38/14(2006.01)i; B32B 37/10(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)

B32B27; B32B33; B32B38; B32B37

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

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

CNABS,CPRSABS,CNTXT,DWPI,SIPOABS: raster,grating,inlay,intermediate,middle,card,laminate,press+,stamp+,two, second,twice

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 102147875 A (BEIJING ZATCARD TECHNOLOGY CO., LTD. ET AL.) 10 August 2011 (2011-08-10) description, paragraphs 1, 8-61, figs. 1-2	1-2
Y	CN 102077221 A (GIESECKE & DEVRIENT GMBH) 25 May 2011 (2011-05-25) description paragraphs 1, 5-32, figs. 1-2	1-2
PX	CN 207565093 U (GIESECKE & DEVRIENT CHINA INFORMATION TECH. CO., LTD.) 03 July 2018 (2018-07-03) the whole document	1-8
PX	CN 107672266 A (GIESECKE & DEVRIENT CHINA INFORMATION TECH. CO., LTD.) 09 February 2018 (2018-02-09) the whole document	1-8
A	DE 102011050746 A1 (HOLOGRAM IND. RES. GMBH) 06 December 2012 (2012-12-06) the whole document	1-8
A	US 2013/0309447 A1 (ZIEMKUS, THOMAS) 21 November 2013 (2013-11-21) the whole document	1-8

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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
07 January 2019	**28 January 2019**

Name and mailing address of the ISA/CN	Authorized officer
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Facsimile No. **(86-10)62019451**	Telephone No. **86-10-53962825**

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2018/116564

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CN	102147875	A	10 August 2011	None			
CN	102077221	A	25 May 2011	CN	201222263	Y	15 April 2009
				EP	2297677	B1	11 March 2015
				US	8397996	B2	19 March 2013
				US	2011101106	A1	05 May 2011
				WO	2010000462	A1	07 January 2010
				ES	2533271	T3	08 April 2015
				EP	2297677	A1	23 March 2011
CN	207565093	U	03 July 2018	None			
CN	107672266	A	09 February 2018	None			
DE	102011050746	A1	06 December 2012	US	9477203	B2	25 October 2016
				WO	2012164011	A1	06 December 2012
				US	2014111837	A1	24 April 2014
				EP	2714400	B1	15 July 2015
				EP	2714400	A1	09 April 2014
US	2013/0309447	A1	21 November 2013	None			