(410) on a substrate (420), said device (430) consisting of a bar dipole magnet, wherein the platelet-shaped magnetic or magnetizable pigment particles are exposed to the magnetic field (magnetic field lines shown as lines with arrows pointing from the North Pole to the South Pole) of the magnetic-field generating device (430) in one area wherein the magnetic field is substantially homogeneous (shown as a dotted rectangle A) and wherein the substrate (420) carrying the coating layer (410) is provided in said area A with the angle α .

Fig. 4A2 schematically illustrates a suitable magnetic-field generating device (430) for mono-axially orienting platelet-shaped magnetic or magnetizable pigment particles in a coating layer (410) on a substrate (420), said device (430) consisting of two bar dipole magnets (M1, M2) having a same magnetic direction and an iron yoke (Y), wherein the platelet-shaped magnetic or magnetizable pigment particles are exposed to the magnetic field (magnetic field lines shown as lines with arrows pointing from the North Pole to the South Pole) of the magnetic field of the bar dipole magnet (430) in one area wherein the magnetic field is substantially homogeneous (shown as a dotted rectangle A) and wherein the substrate (420) carrying the coating layer (410) is provided in said area A at the specific angle α.

Fig. 4B1 schematically illustrates (left) a suitable magnetic-field generating device (430) and a cross-section (right) of said device (430) for bi-axially orienting at least a part of platelet-shaped magnetic or magnetizable pigment particles in a coating layer (410) on a substrate (420), said device (430) consisting of a linear arrangement of four dipole magnets (M1-M4) that are positioned in a staggered fashion or in zigzag formation, wherein the platelet-shaped magnetic or magnetizable pigment particles are exposed to the magnetic field (magnetic field lines shown as lines with arrows pointing from the North Pole to the South Pole) of magnetic-field generating device (430) in one area wherein the magnetic field is substantially homogeneous (shown as dotted rectangles A and A') and wherein the substrate (420) carrying the coating layer (410) is provided in said area A (or alternatively in area A') with the angle α.

Fig. 4B2 schematically illustrates (left) a suitable magnetic-field generating device (430) and a cross-section (right) of said device (430) for bi-axially orienting at least a part of platelet-shaped magnetic or magnetizable pigment particles in a coating layer (410) on a substrate (420), said device (430) consisting of two dipole magnets (M1, M2) having an opposite magnetic direction, wherein the platelet-shaped magnetic or magnetizable pigment particles are exposed to the magnetic field (magnetic field lines shown as lines with arrows pointing from the North Pole to the South Pole) of the magnetic-field generating device (430) in one area wherein the magnetic field is substantially homogeneous (shown as dotted rectangles A and A') and wherein the substrate (420) carrying the coating layer (410) is provided in said area A (or alternatively in said area A') with the angle α .

Fig. 4B3 schematically illustrates (left) a suitable magnetic-field generating device (430) and a cross-section (right) of said device (430) for bi-axially orienting at least a part of platelet-shaped magnetic or magnetizable pigment particles in a coating layer (410) on a substrate (420), said device (430) consisting of two dipole magnets (M1, M2) having a same magnetic direction, wherein the platelet-shaped magnetic or magnetizable pigment particles are exposed to the magnetic field (magnetic field lines shown as lines with arrows pointing from the North Pole to the South Pole) of the magnetic-field generating device (430) in one area wherein the magnetic field is substantially

homogeneous (shown as a dotted rectangle A) and wherein the substrate (420) carrying the coating layer (410) is provided in said area A with the angle α .

Fig. 4B4 schematically illustrates (left) a suitable magnetic-field generating device (430) and a top view (right) of said device (430) for bi-axially orienting at least a part of platelet-shaped magnetic or magnetizable pigment particles in a coating layer (410) on a substrate (420), said device (430) consisting of a Halbach array comprising five dipole magnets (M1-M5), wherein the platelet-shaped magnetic or magnetizable pigment particles are exposed to the magnetic field (magnetic field lines shown as lines with arrows pointing from the North Pole to the South Pole) of the magnetic-field generating device (430) in one area wherein the magnetic field is substantially homogeneous (shown as a dotted parallelepiped A) and wherein the substrate (420) carrying the coating layer (410) is provided in said area A with the angle α .

Fig. 4B5 schematically illustrates a cross-section of a suitable magnetic-field generating device (430) for bi-axially orienting at least a part of platelet-shaped magnetic or magnetizable pigment particles in a coating layer (410) on a substrate (420), said device (430) consisting of Halbach cylinder assembly comprising four structures, each one comprising a magnet bar (M1-M4) surrounded by a magnet-wire coil (not shown), wherein the platelet-shaped magnetic or magnetizable pigment particles are exposed to the magnetic field (magnetic field lines shown as lines with arrows pointing from the North Pole to the South Pole) of the magnetic-field generating device (430) in one area wherein the magnetic field is substantially homogeneous (shown as a dotted rectangle A) and wherein the substrate (420) carrying the coating layer (410) is provided in said area A with the angle α .

Fig. 4B6 schematically illustrates (left) a suitable magnetic-field generating device (430) and a top view (right) of said device (430) for bi-axially orienting at least a part of platelet-shaped magnetic or magnetizable pigment particles in a coating layer (410) on a substrate (420), said device (430) consisting of an assembly of eight bar dipole magnets (M1-M8), said assembly comprising a first set comprising a first bar dipole magnet (M4) and two second bar dipole magnets(M1, M6), a second set comprising a first bar dipole magnet (M5) and two second bar dipole magnets (M3; M8) and a first pair of third bar dipole magnets (M2, M7), wherein the platelet-shaped magnetic or magnetizable pigment particles are exposed to the magnetic field (magnetic field lines shown as lines with arrows pointing from the North Pole to the South Pole) of the magnetic-field generating device (430) in one area wherein the magnetic field is substantially homogeneous (shown as a dotted rectangle A) and wherein the substrate (420) carrying the coating layer (410) is provided in said area A at the specific angle α .

Fig. 5A schematically illustrate an oblique view (Fig. 5A1) and a cross-section (Fig. 5A2-3) of a suitable magnetic-field-generating device (530) for bi-axially orienting platelet-shaped magnetic or magnetizable pigment particles comprised in a coating layer (510) on a substrate (520) and a curing device (540). The magnetic-field-generating device (530) comprise nine bar dipole magnets (M1-M9) with alternating North-South magnetic directions and arranged in a row, wherein the platelet-shaped magnetic or magnetizable pigment particles are exposed to the magnetic field (for illustration purpose, magnets M3-M9 have been shown in Fig. 5A2, magnetic field lines shown as lines with arrows pointing from the North Pole to the South Pole) of the magnetic field of the magnetic-field generating device (530) in one area wherein the magnetic field is substantially homogeneous (shown as a dotted parallelepiped A) and

wherein the substrate (520) carrying the coating layer (510) is provided in said area A with the angle α . Fig 5A3 illustrates a process wherein the at least partially curing step with the curing device (540) is carried out partially simultaneously with the magnetic orientation step.

Fig. 6AB schematically illustrate front views of a magnetic-field-generating device (630) for mono-axially orienting platelet-shaped magnetic or magnetizable pigment particles comprised in a coating layer (610) on a substrate (620) and a curing device (640). The magnetic-field-generating device (630) comprise two bar dipole magnets (M1, M2) and two pole pieces (P1, P2) arranged as a rectangular assembly, wherein the platelet-shaped magnetic or magnetizable pigment particles are exposed to the magnetic field (magnetic field lines shown as lines with arrows pointing from the North Pole to the South Pole) of the magnetic field of the magnetic-field generating device (630) in one area wherein the magnetic field is substantially homogeneous (shown as a dotted rectangle A) and wherein the substrate (620) carrying the coating layer (610) is provided in said area A with the angle α . Fig 6B1 illustrate a process wherein the at least partially curing step is carried out partially simultaneously with the magnetic orientation step and Fig. 6B2 illustrates a process wherein the at least partially curing step is carried out subsequently to the magnetic orientation step.

Fig. 7A show photographic images of OELs, said OELs being obtained by using the method and device shown in Fig. 5.

Fig. 7B illustrates curves of the brightness values of the OELs comprising bi-axially oriented pigment particles shown in Fig. 7A and having different elevation angles γ, wherein the OELs have been printed on a transparent PET substrate disposed on a black substrate. The y-axis represents the brightness of the OEL in arbitrary units as calculated on 100 x 100 pixels areas of OEL's pictures, the x-axis representing the observation angles θ.

Fig. 8 show photographic images of OELs comprising bi-axially oriented pigment particles and similar to Fig. 3D, said OELs being obtained by using the method and device shown in Fig. 5.

Fig. 9A-B illustrates curves of brightness values of two OELs comprising mono-axially oriented pigment particles with an elevation angle γ of about 20°, wherein the OELs have been printed on a transparent PET substrate disposed on a black substrate (Fig. 9A) or on a white substrate (Fig. 9B). The y-axis represents the brightness of the OEL in arbitrary units as calculated on 100 x 100 pixels areas of OEL's pictures, the x-axis representing the observation angles θ..

Fig. 10 schematically illustrates an apparatus for taking the photographic images shown in Fig. 7A and 8 at different observation angles θ, the apparatus comprising an integration sphere (IS), an illumination source (L), a camera (C) and a movable holder (H) for the samples (S), the camera (C) and the movable holder (H) being fixed on a plate (P), so as to vary the observation angle θ of the sample.

[022] The magnetic field lines (shown as lines with arrows pointing from the North Pole to the South Pole) of the magnetic-field generating device (x30) shown in the figures for illustration purpose have been obtained by simulation, said magnetic field simulations have been performed with the software Vizimag 3.19.

DETAILED DESCRIPTION

Definitions

magnetic properties. For example, suitable interference coated pigment particles comprise a core made of a magnetic material such as those described hereabove, said core being coated with one or more layers made of one or more metal oxides, or they have a structure consisting of a core made of synthetic or natural micas, layered silicates (e.g. talc, kaolin and sericite), glasses (e.g. borosilicates), silicon dioxides (SiO_2), aluminum oxides (Al_2O_3), titanium oxides (TiO_2), graphites and mixtures of two or more thereof. Furthermore, one or more additional layers such as coloring layers may be present.

[066] The platelet-shaped, magnetic or magnetizable pigment particles described herein preferably have a size d50 between about 2 μm and about 50 μm (as measured by direct optical granulometry).

[067] The platelet-shaped magnetic or magnetizable pigment particles described herein may be surface treated so as to protect them against any deterioration that may occur in the coating composition and coating layer and/or to facilitate their incorporation in said coating composition and coating layer; typically corrosion inhibitor materials and/or wetting agents may be used.

[068] According to one embodiment shown for example in Fig. 3A, the OELs described herein comprise a single at least partially cured coating layer (310) with magnetically oriented platelet-shaped magnetic or magnetizable pigment particles incorporated therein, wherein substantially all the platelet-shaped magnetic or magnetizable pigment particles have substantially the same elevation angle γ.

[069] According to one embodiment shown for example in Fig. 3B-E, the OELs described herein comprise two zones comprising the platelet-shaped magnetic or magnetizable pigment particles, wherein substantially all the platelet-shaped magnetic or magnetizable pigment particles in the one zone have substantially the same elevation angle γ and substantially all the platelet-shaped magnetic or magnetizable pigment particles in another zone have substantially the same additional elevation angle γ', wherein the elevation angle γ is larger than 0° and smaller than 30° ($0° < \gamma < 30°$) or larger than 150° and smaller than 180° ($150° < \gamma < 180°$), preferably larger than or equal to about 5° and smaller than 30° ($5° \leq \gamma < 30°$) or larger than 150° and smaller than or equal to about 175° ($150° < \gamma \leq 175°$), more preferably, in the range from about 5° to about 25° ($5° \leq \gamma \leq 25°$) or from about 155° to about 175° ($155° \leq \gamma \leq 175°$) and wherein the additional elevation angle γ' is larger than 0° and smaller than 30° ($0° < \gamma' < 30°$) or larger than 150° and smaller than 180° ($150° < \gamma' < 180°$), preferably larger than or equal to about 5° and smaller than 30° ($5° \leq \gamma' < 30°$) or larger than 150° and smaller than or equal to about 175° ($150° < \gamma' \leq 175°$), more preferably, in the range from about 5° to about 25° ($5° \leq \gamma' \leq 25°$) or from about 155° to about 175° ($155° \leq \gamma' \leq 175°$), said elevation angle γ and additional elevation angle γ ' being different from each other (preferably they differ of at least 10°) and/or being not coplanar.

[070] According to one embodiment for OELs comprising platelet-shaped magnetic or magnetizable pigment particles having the elevation angle γ and the additional elevation angle γ', being different, the additional elevation angle γ' has the following value: $\gamma' = 180 - \gamma$, such as for example, should γ be 20°, then γ' is 160° (in other words, the magnetic orientation patterns of the two zones are substantially symmetric).

[071] According to one embodiment shown for example in Fig. 3B, the OELs described herein comprise a single at least partially cured coating layer (310) comprising the platelet-shaped magnetic or magnetizable pigment particles in one or more first zones (310-a) and the platelet-shaped magnetic or

magnetizable pigment particles to the magnetic field of the magnetic-field generating device (x30) described herein in one or more areas (shown in the figures as dotted rectangles A and A') wherein the magnetic field is substantially homogeneous (i.e. a magnetic field which has a substantially constant magnitude and direction over the entire area(s) of interest (for mono-axial orientation); or a magnetic field which is substantially confined to a plane (for bi-axial orientation), wherein the substrate (x20) carrying the coating layer (x10) is provided in said one or more areas with an angle α formed by the coating layer (x10) and a tangent to magnetic field lines of the magnetic field of the magnetic-field generating device (x30) within the one or more areas wherein the magnetic field is substantially homogeneous. The angle α is larger than 0° and smaller than 30° ($0° < \alpha < 30°$) or larger than 150° and smaller than 180° ($150° < \alpha < 180°$), preferably larger than or equal to about 5° and smaller than 30° ($5° \leq \alpha < 30°$) or larger than 150° and smaller than or equal to about 175° ($150° < \alpha \leq 175°$), more preferably in the range from about 5° to about 25° ($5° \leq \alpha \leq 25°$) or from about 155° to about 175° ($155° \leq \alpha \leq 175°$).

[087] The step b) described herein is carried out to so as to mono-axially or bi-axially orient at least a part of the platelet-shaped magnetic or magnetizable pigment particles described herein. In contrast to a mono-axial orientation wherein magnetic or magnetizable pigment particles are orientated in such a way that only their main axis is constrained by the magnetic field (Fig. 2B), carrying out a bi-axial orientation means that the platelet-shaped magnetic or magnetizable pigment particles are made to orientate in such a way that their two main axes X and Y are constrained (Fig. 2C). That is, each platelet-shaped magnetic or magnetizable pigment particle can be considered to have a major axis in the plane of the pigment particle and an orthogonal minor axis in the plane of the pigment particle. The axes X and Y of the platelet-shaped magnetic or magnetizable pigment particles are each caused to orient according to the magnetic field. Effectively, this results in neighboring platelet-shaped magnetic pigment particles that are close to each other in space to be substantially parallel to each other. Put another way, a bi-axial orientation aligns the planes of the platelet-shaped magnetic or magnetizable pigment particles so that the planes of said pigment particles are oriented to be substantially parallel relative to the planes of neighboring (in all directions) platelet-shaped magnetic or magnetizable pigment particles.

[088] According to one embodiment, the step b) is carried out to so as to mono-axially orient at least a part of the platelet-shaped magnetic or magnetizable pigment particles described herein. Suitable magnetic-field generating devices for mono-axially orienting the platelet-shaped magnetic or magnetizable pigment particles described herein are not limited.

[089] According to one embodiment shown in Fig. 4A1, a suitable magnetic-field generating device (430) for mono-axially orienting at least a part of the platelet-shaped magnetic or magnetizable pigment particles consists of a bar dipole magnet. As shown in Fig. 4A1, the platelet-shaped magnetic or magnetizable pigment particles in the coating layer (410) on the substrate (420) are exposed to the magnetic field (magnetic field lines shown as lines with arrows pointing from the North Pole to the South Pole) of the magnetic field of the magnetic-field generating device (430) described herein in one or more areas (shown as a dotted rectangle A) wherein the magnetic field is substantially homogeneous and wherein the magnetic field lines are substantially parallel to each other in said one or more areas and

substantially parallel to each other in said one or more areas and wherein the substrate (420) carrying the coating layer (410) is provided in said one or more areas with the angle α described herein.

[097] According to one embodiment shown in 4B5 and Fig. 12A of WO 2016/083259 A1, a suitable magnetic-field generating device (430) for bi-axially orienting at least a part of the platelet-shaped magnetic or magnetizable pigment particles consists of a Halbach cylinder assembly comprising four structures, each one comprising a magnet bar (M1-M4) surrounded by a magnet-wire coil (not shown). As shown in Fig. 4B5, the platelet-shaped magnetic or magnetizable pigment particles in the coating layer (410) on the substrate (420) are exposed to the magnetic field (magnetic field lines shown as lines with arrows pointing from the North Pole to the South Pole) of the magnetic fields of the magnetic-field generating device (430) in one or more areas (shown as a dotted rectangle A) wherein the magnetic field is substantially homogeneous and wherein the magnetic field lines are substantially parallel to each other in said one or more areas and wherein the substrate (420) carrying the coating layer (410) is provided in said one or more areas with the angle α described herein.

[098] According to one embodiment shown in 4B6 and Fig. 2A of the co-pending application EP 20176506.2, a suitable magnetic-field generating device (430) for bi-axially orienting at least a part of the platelet-shaped magnetic or magnetizable pigment particles consists of an assembly of eight bar dipole magnets (M1-M8), said assembly comprising a first set comprising a first bar dipole magnet (M4) and two second bar dipole magnets (M1, M6), a second set comprising a first bar dipole magnet (M5) and two second bar dipole magnets (M3; M8) and a first pair of third bar dipole magnets (M2, M7). As shown in Fig. 4B6, the platelet-shaped magnetic or magnetizable pigment particles in the coating layer (410) on the substrate (420) are exposed to the magnetic field (magnetic field lines shown as lines with arrows pointing from the North Pole to the South Pole) of the magnetic fields of the magnetic-field generating device (430) in one or more areas (shown as a dotted rectangle A) wherein the magnetic field is substantially homogeneous and wherein the magnetic field lines are substantially parallel to each other in said one or more areas and wherein the substrate (420) carrying the coating layer (410) is provided in said one or more areas with the angle α described herein.

[099] According to one embodiment shown in Fig. 5A1-3 and used in the Examples hereafter, a suitable magnetic-field generating device (530) for bi-axially so as orient at least a part of the platelet-shaped magnetic or magnetizable pigment particles consists of an assembly comprising nine bar dipole magnets (M1-M9) with alternating North-South magnetic directions and arranged in a row. As shown in Fig. 5A2, the platelet-shaped magnetic or magnetizable pigment particles in the coating layer (510) on the substrate (520) are exposed to the magnetic field (magnetic field lines shown as lines with arrows pointing from the North Pole to the South Pole) of the magnetic fields of the magnetic-field generating device (530) in one or more areas (shown as a dotted parallelepiped A) wherein the magnetic field is substantially homogeneous and wherein the magnetic field lines are substantially parallel to each other in said one or more areas and wherein the substrate (520) carrying the coating layer (510) is provided in said one or more areas with the angle α described herein.

[0100] As known by the man skilled in the art, if the substrate (x20) carrying the coating layer (x10) is static or concomitantly moves with the magnetic-field generating devices (i.e. moves at the same speed

Magnetic-field-generating device for mono-axial orientation (Fig. 6)

[0122] A magnetic field generating device (630) was used to mono-axially orient the pigment particles. The magnetic field generating device (630) comprised two bar dipole magnets (M1, M2) and two pole pieces (P1, P2).

[0123] Each of the two bar dipole magnets (M1, M2) had the following dimensions: 40 mm (L1) x 40 mm (L2) x 10 mm (L3). The two bar dipole magnets (M1, M2) were made of NdFeB N42.

[0124] The two bar dipole magnets (M1, M2) were at a distance (d1) of about 40 mm from each other. The magnetic axis of each of the two bar dipole magnets (M1, M2) was substantially parallel to the length (L1) of said magnets, the magnetic direction of said two bar dipole magnets (M1, M2) pointing in the same direction.

[0125] Each of the two pole pieces (P1, P2) had the following dimensions: 60 mm (L4) x 40 mm (L5) x 3 mm (L6). The two pole pieces (P1, P2) were made of iron (ARMCO®).

[0126] The two bar dipole magnets (M1, M2) and the two pole pieces (P1, P2) were disposed such as to form a rectangular cuboid with a centered rectangular cuboid void, said void consisting of the area A wherein the magnetic field was substantially homogeneous and wherein the magnetic field lines were substantially parallel to each other, such that the distance (d2) between the two pole pieces (P1, P2) was about 40 mm, i.e. the distance (d2) between the two pole pieces (P1, P2) was the length (L1) of the two bar dipole magnets (M1, M2).

E1-E5 and C1-C3 (Fig. 3A, Fig. 5, Fig. 7)

[0127] For each sample, the UV-Vis curable screen printing ink of Table 1 was applied onto on a piece of PET (BG71 Colour Laser Printer & Copier OHP Film from Folex 100 micrometers thick, 45 mm x 30 mm) (520) so as to form a coating layer (40 mm x 25 mm) (510), wherein said application step was carried out with a laboratory screen printing device using a 90T screen so as to form a coating layer (510) having a thickness of about 20 µm.

[0128] While the coating layer (510) was still in a wet and not yet at least partially cured state, the substrate (520) was placed on top of the center of a supporting plate (300 mm x 40 mm x 1 mm) made of high density polyethylene (HDPE). The supporting plate carrying the substrate (520) and the coating layer (510) were moved at a speed of about 10 cm/sec beside the magnetic-field generating device (530) (as illustrated in Fig. 5) at a distance (d5) of about 20 mm between the magnetic-field-generating device (530) surface facing the substrate (520) and the nearest edge of the coating layer (510), and a height between said nearest coating layer (510) edge and the bottom surface of the magnetic magnetic-field generating device (530) being half the length (½ L1) of the bar dipole magnets (M1-M9). The supporting plate carrying the substrate (520) and the coating layer (510) was concomitantly moved while adopting an angle α, formed by the coating layer (510) and a tangent to the magnetic field lines of the magnetic field of the magnetic-field-generating device (530) within the area A wherein the magnetic field was homogeneous, said angle α having a value of about 1° (E1), 5° (E2), 10° (E3), 20° (E4), 25° (E5), 30° (C1), 40° (C2) and 50° (C3).

[0129] The coating layers (510) were independently at least partially cured by a curing unit (540) (UV LED lamp (FireFly 395 nm, 4W/cm^2, from Phoseon) disposed above the substrate path at a distance (d4) of about 15 mm for the center of the length (L1) of the bar dipole magnet (M1-M9), beside the space

between the eighth and ninth dipole magnets (M8 and M9) and beside the ninth bar dipole magnet (M9) at a distance (d3) of about 10 mm, as illustrated in Fig. 5A1-3.

E6 (Fig. 3D, Fig. 5, Fig. 8)

[0130] The UV-Vis curable screen printing ink of Table 1 was applied onto on a piece of PET (BG71 Colour Laser Printer & Copier OHP Film from Folex 100 micrometers thick, 45 mm x 30 mm) (520) so as to form a first coating layer (510) having the shape of "A" (6 mm) (510), wherein said application step was carried out with a laboratory screen printing device using a 90T screen so as to form a coating layer (510) having a thickness of about 20 µm.

[0131] While the coating layer (510) was still in a wet and not yet at least partially cured state, the substrate (520) was placed on top of the center of a supporting plate (300 mm x 40 mm x 1 mm) made of high density polyethylene (HDPE). The supporting plate carrying the substrate (520) and the coating layer (510) was moved at a speed of about 10 cm/sec beside the magnetic-field generating device (530) (as illustrated in Fig. 5) at a distance (d5) of about 20 mm between the magnetic-field-generating device (530) surface facing the substrate (520) and the nearest edge of the coating layer (510), and a height between said nearest coating layer (510) edge and the bottom surface of the magnetic magnetic-field generating device (530) being half the length (½ L1) of the bar dipole magnets (M1-M9). The supporting plate carrying the substrate (520) and the coating layer (510) were concomitantly moved while adopting an angle α, formed by the coating layer (510) and a tangent to the magnetic field lines of the magnetic field of the magnetic-field-generating device (530) within the area A wherein the magnetic field was homogeneous, having a value of about 20°.

[0132] The first coating layer (510) was at least partially cured by the curing unit (540) under the same conditions/position positions as for E1-E5 and C1-C3.

[0133] For each sample, the UV-Vis curable screen printing ink of Table 1 was applied on top of the already applied coating layer (510) so as to form a second coating layer (511) having the shape of "T" (6 mm), wherein said application step was carried out with a laboratory screen printing device using a 90T screen so as to form a coating layer (511) having a thickness of about 20 µm.

[0134] While the second coating layer (511) was still in a wet and not yet at least partially cured state, the substrate (520) was exposed to the magnetic field of the magnetic-field-generating device (530) under the same conditions as for the first coating layer (510) except that the angle α' was about 160°.

[0135] The second coating layer (511) was at least partially cured by the curing unit (540) under the same conditions/position positions as for E1-E5 and C1-C3.

E7-E8 (Fig. 3A, Fig. 6, Fig. 9)

[0136] The UV-Vis curable screen printing ink of Table 1 was applied onto on a piece of PET (BG71 Colour Laser Printer & Copier OHP Film from Folex 100 micrometers thick, 45 mm x 30 mm) (620) so as to form a coating layer (40 mm x 25 mm) (610), wherein said application step was carried out with a laboratory screen printing device using a 90T screen so as to form a coating layer (610) having a thickness of about 20 µm.

[0137] While the coating layer (610) was still in a wet and not yet at least partially cured state, the substrate (620) was placed on top of the center of a supporting plate (60 mm x 40 mm x 1 mm) made of high density polyethylene (HDPE).

[0138] The supporting plate carrying the substrate (620) and the coating layer (610) were disposed in the center of the void of the magnetic assembly (630) as illustrated in Fig. 6 while adopting angle α, formed by the coating layer (610) and a tangent to magnetic field lines of the magnetic-field-generating device (630) within the area A wherein the magnetic field was homogeneous, having a value of about 20°.

[0139] For sample E7, after about 1 second, the coating layer (610) was at least partially cured by a curing unit (640) (UV LED lamp (FireFly 395 nm, 4W/cm^2, from Phoseon) as illustrated in Fig. 6B1.

[0140] For sample E8, subsequently to the exposure to the magnetic field, the supporting plate carrying the substrate (620) and the coating layer (610) were moved at a distance (d_i) of about 1 cm away from the magnetic assembly (630), the coating layer (610) was cured upon exposure during about 0.5 second to a UV-LED-lamp (640) from Phoseon (Type FireFlex 50 x 75 mm, 395 nm, 8W/cm^2), as illustrated in Fig. 6B2.

Correlation between the angles α during the orientation step and the elevation angles γ of the pigment particles in the coating layer (x10)

[0141] The correlation between the angles α during the method described hereabove and the elevation angles γ was assessed by measuring said elevation angles γ by using the conoscopic scatterometer measurements according to the method disclosed in WO 2019/038371 A1 and by measuring the elevation angles of a selection of five adjacent pigment particles on a SEM picture (ZEISS EVO HD15, using standard method of sample preparation by embedding into an epoxy matrix (Technicol 9461) with the following dimensions: 10 mm x 10 mm x30 mm) a cross-section of the coating layer (x10). Results are provided in Table 2.

Table 2

	Angle α	**Expected elevation angle γ**	**Elevation angle γ measured by a conoscopic scatterometer**	**Elevation angle γ as measured on SEM pictures**
E1	1°	1°	NA[1]	NA[2]
E2	5°	5°	NA[1]	NA[2]
E3	10°	10°	11°	10°
E4	20°	20°	20°	19°
E5	25°	25°	NA[1]	NA[1]
C1	30°	30°	29°	NA[3]
C2	40°	40°	NA[3]	NA[1]

[1] not measured

[2] the elevation angle was too small to be measured with sufficient accuracy with SEM images

[3] the elevation angle is too big to be measured by conoscopic scatterometer (total field of view is limited to 40° and the scatterometer does not allow to use 100% of the field)

[0142] The conoscopic scatterometer measurements have been performed by using a conoscopic scatterometer as described in WO 2019/038371 A1, Fig. 4A (obtained from Eckhartd Optics LLC, 5430