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Claims

1. A method for creating a hidden pattern on a substrate, which is invisible when viewed at a first angle relative to the surface of the substrate, and visible when viewed from a second angle relative to the surface of the substrate, the method comprising the following steps:

a) providing a substrate, wherein the substrate comprises at least one external surface comprising a salifiable alkaline or alkaline earth compound,

wherein the salifiable alkaline or alkaline earth compound is an alkaline or alkaline earth hydroxide, an alkaline or alkaline earth bicarbonate, an alkaline or alkaline earth carbonate, or a mixture thereof,

b) providing a liquid treatment composition comprising at least one acid, and

c) applying the liquid treatment composition onto the at least one external surface in form of a preselected pattern by inkjet printing to form a hidden pattern,

wherein the liquid treatment composition is applied in form of drops having a volume of less than or equal to 1000 pl, and

wherein the drop spacing is less than or equal to 1000 µm.

2. The method of claim 1, wherein the at least one external surface of step a) is in form of a laminate or a coating layer comprising the salifiable alkaline or alkaline earth compound.

3. The method of any one of the preceding claims, wherein the substrate is selected from the group consisting of paper, cardboard, containerboard, plastic, non-wovens, cellophane, textile, wood, metal, glass, mica plate, marble, calcite, nitrocellulose, natural stone, composite stone, brick, concrete, and laminates or composites thereof, preferably paper, cardboard, containerboard, or plastic.

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4. The method of any one of the preceding claims, wherein the at least one external surface and the substrate of step a) are made from the same material.

5. The method of any one of the preceding claims, wherein the salifiable alkaline or alkaline earth compound is an alkaline or alkaline earth carbonate being preferably selected from lithium carbonate, sodium carbonate, potassium carbonate, magnesium carbonate, calcium magnesium carbonate, calcium carbonate, or mixtures thereof, more preferably the salifiable alkaline or alkaline earth compound is calcium carbonate, and most preferably the salifiable alkaline or alkaline earth compound is a ground calcium carbonate, a precipitated calcium carbonate and/or a surface-treated calcium carbonate.

6. The method of any one of the preceding claims, wherein the at least one acid is selected from the group consisting of hydrochloric acid, sulphuric acid, sulphurous acid, phosphoric acid, citric acid, oxalic acid, acetic acid, formic acid, sulphamic acid, tartaric acid, phytic acid, boric acid, succinic acid, suberic acid, benzoic acid, adipic acid, pimelic acid, azelaic acid, sebaic acid, isocitric acid, aconitic acid, propane-1,2,3-tricarboxylic acid, trimesic acid, glycolic acid, lactic acid, mandelic acid, acidic organosulfur compounds, acidic organophosphorus compounds, and mixtures thereof, preferably the at least one acid is selected from the group consisting of hydrochloric acid, sulphuric acid, sulphurous acid, phosphoric acid, oxalic acid, boric acid, suberic acid, succinic acid, sulphamic acid, tartaric acid, and mixtures thereof, more preferably the at least one acid is selected from the group consisting of sulphuric acid, phosphoric acid, boric acid, suberic acid, sulphamic acid, tartaric acid, and mixtures thereof, and most preferably the at least one acid is phosphoric acid and/or sulphuric acid.

7. The method of any one of the preceding claims, wherein the liquid treatment composition further comprises a fluorescent dye, a phosphorescent dye, an ultraviolet absorbing dye, a near infrared absorbing dye, a thermochromic dye, a halochromic dye, metal ions, transition metal ions, magnetic particles, or a mixture thereof.

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8. The method of any one of the preceding claims, wherein the liquid treatment composition comprises the acid in an amount from 0.1 to 100 wt.-%, based on the total weight of the liquid treatment composition, preferably in an amount from 1 to 80 wt.-%, more preferably in an amount from 3 to 60 wt.-%, and most preferably in an amount from 10 to 50 wt.-%.

9. The method of any one of the preceding claims, wherein the preselected pattern is an one-dimensional bar code, a two-dimensional bar code, a three-dimensional bar code, a security mark, a number, a letter, an alphanumeric symbol, a logo, an image, a shape or a design.

10. The method of any one of the preceding claims, wherein the drops have a volume from 500 pl to 1 fl, preferably from 100 pl to 10 fl, more preferably from 50 pl to 100 fl, and most preferably from 10 pl to 1 pl.

11. The method of any one of the preceding claims, wherein the drop spacing is from 10 nm to 500 µm, preferably from 100 nm to 300 µm, more preferably from 1 µm to 200 µm, and most preferably from 5 µm to 100 µm.

12. A substrate comprising a hidden pattern, which is invisible when viewed at a first angle relative to the surface of the substrate, and visible when viewed from a second angle relative to the surface of the substrate, obtainable by a method according to any one of claims 1 to 11, wherein the hidden pattern comprises an acid salt of the salifiable alkaline or alkaline earth compound.

13. The substrate of claim 12, wherein the hidden pattern differs from the at least one external surface in surface roughness, gloss, light absorption, electromagnetic radiation reflection, fluorescence, phosphorescence, magnetic property, electric conductivity, whiteness and/or brightness.

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14. The substrate of claim 12 or 13, wherein the hidden pattern comprises a security feature and/or a decorative feature, preferably an one-dimensional bar code, a two-dimensional bar code, a three-dimensional bar code, a security mark, a number, a letter, an alphanumeric symbol, a logo, an image, a shape or a design.

15. A product comprising a substrate according to any one of claims 12 to 14, wherein the product is a branded product, a security document, a non-secure document, or a decorative product, preferably the product is a perfume, a drug, a tobacco product, an alcoholic drug, a bottle, a garment, a packaging, a container, a sporting good, a toy, a game, a mobile phone, a CD, a DVD, a blue ray disk, a machine, a tool, a car part, a sticker, a label, a tag, a poster, a passport, a driving licence, a bank card, a credit card, a bond, a ticket, a tax stamp, a banknote, a certificate, a brand authentication tag, a business card, a greeting card, or a wall paper.

16. Use of a substrate according to any one of claims 12 to 14 in security applications, in overt security elements, in covert security elements, in brand protection, in microlettering, in micro imaging, in decorative applications, in artistic applications, in visual applications, or in packaging applications.