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54 **Foam plastic sheet material and method of making it.**

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Foam plastics sheet material and method of making it

This invention relates to foam plastics sheet materials, for example, foamed wallcoverings having decorative effects based mainly on comparative colour intensity. Such effects can be achieved by the necessary number of printing operations, possibly with simultaneous mechanical embossing, but this tends to increase cost and the practical range of variation becomes limited.

The invention aims to provide a new way of producing, in foam wallcovering and the like, decorative effects based on colour intensity. The invention utilises migratory pigment techniques.

Such techniques are themselves well known. US—A—3 953 564 for example discloses the application of inks to the back side of a porous layer and allowed to penetrate the layer so that a sharply defined design is produced which extends from the back of the layer up to or towards the face of the layer. The process described in US—A—3 953 564 does not provide any way of controlling colour intensity other than that present in the initial design. To obtain colour intensity effects using the process of US—A—3 953 564 a number of printing operations are required. To obtain such effects in register a careful mechanical embossing step is additionally required.

The present invention uses a migratory pigment technique without the need for supplementary printing operations and mechanical embossing and provides an easy way of controlling colour intensity, the control being correlated and registered with relief decorative effects.

The invention provides a process for the production of a foam plastics sheet material having a decorative finish, such as a wallcovering material or the like, said process comprising:

(a) applying, to at least parts of the surface of a web, a first coating composition being an ink or lacquer and containing an organic migratory pigment;

(b) applying, over at least some of the parts of said web to which said first composition has been applied, a second coating composition which includes a thermoplastic polymer dispersed in a plasticiser and a heat decomposable blowing agent so that said second coating composition is foamable on heating; and

(c) heating said web and coating compositions to cause said second composition to foam and to cause said organic pigment to migrate into the foamed second coating; characterised in that said pigment is soluble in said plasticiser and the pigment migration is such that at least two different colourations are exposed on the overall surface of the material which are not reproductions of the first coat.

The invention also provides foam plastics

sheet material having a decorative finish provided by pigmentation such as wallcovering materials and the like comprising a web having thereon a first coat consisting of an ink or lacquer and an organic migratory pigment and thereon a foam coat, which includes a polymer thermoplastic dispersed in a plasticiser, characterised in that the pigmentation is derived from an organic pigment which is soluble in said plasticiser and which has migrated from the first coat into the foamed coat so that the overall surface of the material exposes at least two different colourations which are not reproductions of the first coat.

The first, or base, coat and the foam coat may be partial or overall so long as a part of the foam coat overlaps the base coat to give a migration path.

The two colourations may differ in intensity or differ in spectral position.

The foam coat may have plural thicknesses so that the amount of pigment migrating to the surface varies according to the thickness.

The base coating composition may be printed on to selected areas of the web and then the foamable composition may be applied as an overall coating. Alternatively, if the foamable composition is applied only to some of the areas to which the base coating composition has been applied (whether or not the base coating composition had been applied overall), the foam areas above the base coat will be depicted in a colouration different from that of those areas where the base coating composition, but not the foamable composition, had been applied. Both the base coating composition and the foamable composition may be applied as overall coatings with the foamable composition varying in thickness, such as by applying a foamable composition of varying thickness or by using a chemical embossing technique or coating on to a pre-embossed web. The valleys regions of the foamed material will then exhibit a deeper colouration than the peaks.

The amount of migratory pigment, in the areas to which the base coating composition is applied, is preferably in the range 0.1 to 5 g/m². By using in the base coating composition one or more non-migratory pigments, further decorative effects can be achieved if the foamable composition is not applied as a coating overall. A colour change can be derived also by having mixed pigments only one of which migrates.

The web may be any sheet or film material or may be a textile web. Particularly suitable webs include paper, board, wood, plastics film or sheet, and woven or non-woven textiles made of natural or synthetic fibrous materials. The web may be given a coating, over some or all of its surface, of a material containing a polymeric binder prior to application of the base coating composition.

In the case of a paper web, an overall ground coat may be applied. In some cases, particularly where the base coating composition is to be applied overall, the ground coat may form that application by incorporation of the migratory pigment into the ground coat.

The base coating composition preferably contains a polymeric binder. The binder may be thermoplastic or thermosetting and may be a synthetic or a natural polymeric material. Examples of binders include the thermoplastic polymeric materials listed hereinafter in relation to the foamable composition, thermosetting polymers such as polyurethanes, phenol formaldehyde, urea formaldehyde, or melamine formaldehyde resins, synthetic rubbers, natural polymer materials such as rubber, starch, gums and rosins.

The base coating composition may be applied in liquid form and dried or fused or may be applied as a powdered or particulate migratory pigment to an adhesive layer on the web. The base coating composition may be an ink or lacquer (which terms includes a plastisol) containing the migratory pigment.

Examples of suitable thermoplastic polymeric materials that may be used as binder in the base coating composition and in the foamable composition include polymers or copolymers of at least one ethylenically unsaturated monomeric material selected from olefins, for example, ethylene, propylene, butene, isobutene; vinyl chloride; vinyl esters, for example vinyl acetate; vinylidene chloride; vinyl ethers; acrylonitrile; esters of acrylic or methacrylic acids, for example methyl acrylate, ethyl acrylate, butyl acrylate, and methyl methacrylate; acrylic or methacrylic acids; styrene; butadiene; and isobutylene.

Other polymers that may be used include thermoplastic cellulosic polymers such as cellulose acetate and cellulose nitrate. Mixtures of polymers may be employed.

Preferred thermoplastic polymeric materials include homopolymers of vinyl chloride and copolymers of vinyl chloride with comonomers such as vinyl acetate, vinyl ethers, vinylidene chloride and olefins; copolymers of esters of acrylic or methacrylic acids; and cellulose nitrate. Vinyl chloride homo and copolymers are particularly preferred.

When the foam composition is a vinyl chloride polymer plastisol, suitable organic pigments for the base coating composition are those that are soluble in the plasticiser employed. Examples of such pigments include C.I. Pigment Red 5, 7 and 112; C.I. Pigment Yellow 1 and 3; C.I. Pigment Orange 5; C.I. Pigment Violet 2; and C.I. Pigment Green 7. The C.I. Pigment numbers refer to the classified group of pigments as set out in the "Society of Dyers and Colorists, Colour Index" second edition and supplement 1963.

The base coating composition may contain

the same or different polymeric material to that contained in the foamable composition.

Additives that modify the decomposition temperature of the blowing agent may be incorporated into the composition.

The base coating composition may itself contain a heat decomposable blowing agent.

The foamable composition is preferably applied at a rate of 40 to 1200 g of binder material in the foamable composition per square metre of substrate.

The foamable composition preferably contains 0.5 to 15%, particularly 1 to 10%, by weight of blowing agent, based on the weight of the binder material in the composition. By the term binder material we mean the non-volatile components of the coating composition, that, on heating, coalesce to form an integrated film. In computing the quantity of binder material, inorganic non-film forming ingredients such as fillers and pigments are excluded.

A printed pattern may be applied, if desired, by known printing techniques, to the substrate bearing the layer of the foamable composition. Additionally, or alternatively, a wear layer of transparent polymeric composition, e.g. an unpigmented vinyl plastisol, may be applied. Where, after application of the foamable composition, the substrate is printed, whether with an ink containing a compound that modifies the decomposition temperature of the blowing agent or simply with a decorative ink, the wear layer, if used, should be applied after application of the ink. The coating compositions may contain other conventional ingredients, e.g. pigments, dyes, fillers, extenders, plasticisers, stabilisers, and viscosity modifiers.

After application of the foamable composition, and after application of any printing and or wear layers thereto, the coated web is heated to cause foaming. Where the base coating composition contains a heat decomposable blowing agent, it should not be foamed prior to application of the foamable composition unless the base coating composition is of such a nature that, on decomposition of the blowing agent, a residual foamed coating is obtained. This is largely a matter of the proportion of the binder material relative to the proportion of other ingredients, such as pigments, in the base coating composition. Thus if the proportion of binder is such that the coating of the base coating composition is merely a layer of blowing agent, migratory pigment, and any other solid ingredients adherent to the web, rather than a continuous matrix of the binder encapsulating the solid ingredients, upon heating to decompose the blowing agent, the gas evolved will be lost to the atmosphere and little or no foaming will occur. In such cases it is necessary that the blowing agent in the base coating composition is not decomposed until after application of the foamable composition.

The invention will now be described further with reference to the accompanying drawings and examples.

Brief Description of Drawings

Fig. 1 is a sectional view of material according to the present invention;

Fig. 2 is a plan diagrammatic view of the material shown in Fig. 1;

Fig. 3 is a sectional view of another material according to the present invention in the course of manufacture;

Fig. 4 is the material of Fig. 3 at the end of manufacture; and

Fig. 5 is a plan diagrammatic view of the material of Fig. 4.

Description of Preferred Embodiments

In Fig. 1 a base paper 10 has applied to it a pattern in the form of spaced parallel lines 11 of pigmented ink (exaggerated in the depth dimension). This was dried and then partially coated with a plastisol at two thicknesses 12a, 12b and the plastisol was foamed.

The lines 11 which were not covered with foam (indicated in Fig. 2 by close cross-hatching) presented their strong original colour. The lines 11 below foam thickness 12a migrated through the foam to reach the surface (indicated by open cross-hatching) to present the pigment colour 11a reduced in intensity. At the foam thickness 12b, pigment migration had taken place but the surface of the material had not been reached, level 13 only being reached.

In Fig. 3, an embossed paper base 20 has been given an overall coating 21 of pigmented ink (exaggerated in the depth dimension). This overall coating 21 was then itself coated overall with a foamable plastisol composition 22, the composition being at various depths by reason of the embossing of base 20. The plastisol composition 22 was then heated to cause the plastisol to foam and take up various depths and the pigment in the ink to migrate. Pigment migrates intensely to level 30 (as indicated by the close hatched box); it migrates weakly to the level 31 (as indicated by the open hatched box); and migration stops at level 33 and hence level 32 of the foam is unpigmented.

Three examples of the invention will now be given. In these examples all parts and percentages are by weight.

Example 1

(This example can be related to Figs. 1 and 2 of the drawings).

A brown ink was made up to the following formulation:

		<u>Parts</u>
	Styrene/acrylic polymer emulsion	13.0
5	Polyvinyl alcohol soln.	26.0
	Water	70.0
	Wetting agent	0.25
10	0.92 Ammonia	0.2
	Clay	100.0
15	C.I. Pigment Orange 5	10.0
	Red Oxide	7.5
	Black	0.5

A white grounded wallpaper base paper of substance 120 gm⁻² was printed flexographically with the ink in a simple design consisting of lines and dots.

The printed paper was dried and then screen printed with a PVC plastisol of the following formulation in a series of broad stripes of thickness 0.1 mm.

		<u>Parts</u>	
30	Vinyl chloride homopolymer	100	Binder material
35	Dicaprylphthalate (plasticiser)	55.5	
	Epoxidised oil (stabiliser)	3	
40	Viscosity depressant	3	
	Titanium dioxide	21	
45	Cadmium/zinc octoate (activator)	4	
	Azodicarbonamide (blowing agent)	5.5	

The plastisol print was gelled at 150°C for 20 secs. and then a second plastisol of the same formulation overprinted onto the gelled print in the form of a few narrow stripes.

The wallcovering was then heated at 200°C for 60 secs. to expand the vinyl print.

The single layer of plastisol expanded to a thickness of 0.6 mm and showed the original flexo print design in orange where the orange pigment alone had migrated into the foam layer

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on heating. This contrasted with the original dark brown print design in the valleys between the plastisol print.

The double thickness of plastisol print expanded to a thickness of 1.3 mm and showed no migration of the pigment, remaining completely white.

Example 2

(This example can be related to Figs. 3, 4 and 5 of the drawings)

A 150 gm⁻² wallpaper base paper was given an all over air knife coating of an orange ground coat of the following formulation:

	Parts
Styrene acrylic polymer emulsion (50% solids)	18.0
Wetting agent	0.12
Clay	50.0
0.92 Ammonia	0.5
Cellulose thickener (1% soln.)	3.0
Defoamer	0.06
Water	42.5
C.I. Pigment Orange 5	6.0

The coating was dried at 120°C to give a dry weight of 25 gm⁻² and then the coated paper mechanically embossed with an overall design having many different depths of emboss.

The embossed paper was then given an all over coating of foamable plastisol of formulation as in example 1 by means of a knife over roller coater.

Total plastisol coat weight was 150 gm⁻² but the coat thickness varied depending on the depth of emboss in the paper.

The coating was then foamed by heating at 200°C for 75 secs.

The resulting product showed the emboss in the paper in reverse relief and had the appearance of being valley inked.

Where only a thin layer of PVC had been coated the orange pigment had migrated through to the surface but in the high relief areas where the thickness of foam was greater than 1.0 mm the foamed PVC remained white. In between the extremes the orange colouration varied in strength as the foam thickness varied.

Example 3

A printing ink was made up to the following formulation:

	Parts
Styrene/acrylic polymer emulsion (50% solids)	8
Aqueous polyvinyl alcohol solution (12½%)	8
C.I. Pigment Violet 2	5
Water	97
p,p-oxybis (benzene-sulphonylhydrazide)	12
Carboxy methyl cellulose	1

The pigment (C.I. Pigment Violet 2) is soluble in dicaprylphthalate.

A wallpaper base paper of substance 90 g/m² was screen printed with the above ink to a floral design. The combined weight of blowing agent and pigment applied was 4.7 g/m² to the printed areas.

The printed paper was dried and then coated with a PVC plastisol having the formulations as given in Example 1.

The plastisol was applied as an overall coating of thickness 0.25 mm (corresponding to a polymer weight of 162 g/m²) and then the coated paper was heated in an oven for 60 secs. at 200°C to effect foaming.

The resultant product displayed the floral design in a fine blister texture which was pale pink in colour, while the parts of the foam that were not above the printed pattern exhibited a smooth white coloured surface.

Claims

1. A process for the production of a foam plastics sheet material having a decorative finish, such as a wallcovering material or the like, said process comprising:

(a) applying, to at least parts of the surface of a web, a first coating composition being an ink or lacquer and containing an organic migratory pigment;

(b) applying, over at least some of the parts of said web to which said first coating composition has been applied, a second coating composition which includes a thermoplastic polymer dispersed in a plasticiser and a heat decomposable blowing agent so that said second coating composition is foamable on heating; and

(c) heating said web and coating compositions to cause said second composition to foam and to cause said organic pigment to migrate into the foamed second coating characterised in

that said pigment is soluble in said plasticiser and the pigment migration is such that at least two different colourations are exposed on the overall surface of the material which are not reproductions of the first coat.

2. A process according to claim 1 in which said second coating composition has at least two thicknesses and the pigment has migrated to the surface of the shallower thickness but not to the surface of the deeper thickness.

3. A process according to claim 1 or 2 in which the first coating composition contains a thermoplastic or thermosetting polymeric binder.

4. A process according to any one of claims 1, 2 or 3 in which the first coating composition is applied at a rate to give a pigment application of from 0.1 to 5 g/m² and the second coating composition is applied at a rate of from 40 to 1200 g/m².

5. A process according to any one of claims 1 to 4 in which the web is embossed before application of the second coating composition.

6. A process according to any one of claims 1 to 5 in which the first coating composition includes a heat decomposable blowing agent which causes foaming of that composition.

7. Foam plastics sheet material having a decorative finish provided by pigmentation such as wallcovering materials and the like comprising a web having thereon a first coat consisting of an ink or lacquer and an organic migratory pigment and thereon a foam coat, which includes a thermoplastic polymer dispersed in a plasticiser, characterised in that the pigmentation is derived from an organic pigment which is soluble in said plasticiser and which has migrated from the first coat into the foamed coat so that the overall surface of the material exposes at least two different colourations which are not reproductions of the first coat.

Patentansprüche

1. Verfahren zur Herstellung von Schaumstoff-Plattenmaterial mit dekorativer Oberflächenbeschaffenheit, wie beispielsweise Wandbekleidungsmaterial o.dgl., mit folgenden Verfahrensschritten:

- (a) Auf mindestens einen Teil der Oberfläche einer Gewebbahn wird ein erstes Beschichtungsmaterial aufgebracht, das eine Tinte oder ein Lack ist und ein organisches Wanderpigment enthält;
- (b) über mindestens einigen der Teile der Gewebbahn, auf die das erste Beschichtungsmaterial aufgebracht worden ist, wird ein zweites Beschichtungsmaterial aufgebracht, das ein in einem Weichmacher dispergiertes thermoplastisches Polymer sowie ein warmzersetzbares Treibmittel enthält, so daß das zweite Beschichtungsmaterial bei Erwärmung verschäumbar ist, und

(c) die Gewebbahn und die Beschichtungsmaterialien werden erhitzt, um das zweite Material zu verschäumen und das organische Pigment zu veranlassen, in die zweite verschäumte Beschichtung zu wandern,

dadurch gekennzeichnet, daß das Pigment in Weichmacher löslich ist und die Pigmentwanderung so ist, daß zumindest zwei unterschiedliche Färbungen auf der Gesamtoberfläche des Materials frei werden, die kein Reproduktionen der ersten Beschichtung sind.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß das zweite Beschichtungsmaterial mindestens zwei Dickenabmessungen hat und das Pigment zur Oberfläche der niedrigeren Dickenabmessung, jedoch nicht zur Oberfläche der höheren Dickenabmessung, gewandert ist.

3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß das erste Beschichtungsmaterial ein thermoplastisches oder duroplastisches polymers Bindemittel enthält.

4. Verfahren nach einem der Ansprüche 1, 2 oder 3, dadurch gekennzeichnet, daß das erste Beschichtungsmaterial in einer solchen Rate aufgebracht wird, daß sich ein Pigmentauftrag von 0,1 bis 5 g/m² ergibt, und daß das zweite Beschichtungsmaterial mit einer Rate von 40 bis 1200 g/m² aufgebracht wird.

5. Verfahren nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß die Gewebbahn vor dem Aufbringen des zweiten Beschichtungsmaterials geprägt wird.

6. Verfahren nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß das erste Beschichtungsmaterial ein warmzersetzbares Treibmittel enthält, welches ein Verschäumen dieses Materials hervorruft.

7. Schaumstoff-Plattenmaterial mit dekorativer Oberflächenbeschaffenheit, vorgesehen durch Pigmentierung, beispielsweise Wandbekleidungsmaterial u.dgl., mit einer Gewebbahn, auf der eine erste Beschichtung aus Tinte oder Lack und einem organischen Wanderpigment und darauf eine Schaumschicht vorgesehen sind, die ein in einem Weichmacher dispergiertes thermoplastisches Polymer enthält, dadurch gekennzeichnet, daß die Pigmentierung auf einem organischen Pigment beruht, welches in Weichmacher löslich ist und aus der ersten Beschichtung in die Schaumschicht gewandert ist, so daß die Gesamtoberfläche des Materials mindestens zwei unterschiedliche Färbungen freigibt, die keine Reproduktionen der ersten Beschichtung sind.

Revendications

1. Procédé de production d'un matériau en feuille de matière plastique expansée à apprêt décoratif, tel un matériau de recouvrement de mur ou analogue, procédé selon lequel:

- a) on applique, sur au moins des parties de la surface d'une bande, une première composition de revêtement, encre ou laque, contenant un pigment organique migrant,
- b) on applique sur au moins certains des parties de ladite bande sur laquelle a été appliquée la première composition de revêtement, une seconde composition de revêtement qui comprend un polymère thermoplastique dispersé dans un plastifiant et un agent gonflant décomposable à la chaleur, de sorte que ladite seconde composition de revêtement peut s'expanser par chauffage; et
- c) on chauffe ladite bande et les compositions de revêtement pour provoquer l'expansion de ladite seconde composition et la migration du pigment organique dans la seconde composition expansée,

caractérisé par le fait que ledit pigment est soluble dans ledit plastifiant et la migration du pigment est telle qu'au moins deux colorations différentes sont exposées sur toute la surface du matériau, qui ne sont pas des reproductions du premier revêtement.

2. Procédé selon la revendication 1, dans lequel la seconde composition de revêtement a au moins deux épaisseurs et le pigment a migré à la surface de l'épaisseur la plus faible, mais non à la surface de l'épaisseur la plus forte.

3. Procédé selon l'une des revendications 1 ou 2, dans lequel la première composition de revêtement contient un liant polymère thermoplastique ou thermodurcissable.

4. Procédé selon l'une des revendications 1, 2 ou 3, dans lequel la première composition de revêtement est appliquée à un degré tel qu'on obtienne une application de pigment allant de 0,1 à 5 g/m² et la seconde composition de revêtement est appliquée à raison de 40 à 1200 g/m².

5. Procédé selon l'une des revendications 1 à 4, dans lequel la bande est gaufrée avant application de la seconde composition de revêtement.

6. Procédé selon l'une des revendications 1 à 5, dans lequel la première composition de revêtement comprend un agent gonflant décomposable à la chaleur qui provoque l'expansion de cette composition.

7. Matériau en feuille de matière plastique expansée à apprêt décoratif produit par pigmentation, tel que des matériaux de recouvrement de murs et analogue, comprenant une bande sur laquelle est une première couche, constituée d'une encre ou vernis et d'un pigment organique migrant, et sur celle-ci une couche expansée qui comprend un polymère thermoplastique dispersé dans un plastifiant, caractérisé par le fait que la pigmentation est dérivée d'un pigment organique qui est soluble dans ledit plastifiant et qui a migré de la première couche dans la couche expansée de sorte que toute la surface du matériau expose au moins deux colorations différentes qui ne sont pas des reproductions de la première couche.

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