

DESCRIPTION

TITLE OF THE INVENTION: COATING METHOD

TECHNICAL FIELD

[0001]

The invention relates to a novel coating method.

BACKGROUND ART

[0002]

Coating materials containing dispersed particles of two or more colors can form colorful coating films when applied by a single coating process. In recent years, such coating materials have been favorably used on building walls and other structures because they can provide a finish with a design of a pattern in which dots of two or more colors are scattered.

[0003]

Recently, a design of a large pattern having parts of different colors each clearly visible even from a slight distance, such as that observed in the design of natural stone, has come into favor.

[0004]

On the other hand, coating materials are generally applied using spray type devices such as spray guns (see, for example, Patent Documents 1 and 2). In view of material loss and other factors, however, spray type devices are now being

replaced by roller type devices.

[0005]

The coating materials are also being adapted to roller type devices. Unfortunately, when a roller type device is used to make a finish with a design of a large pattern, the coating material can fail to be successfully transferred from the roller to the base material, so that problems such as a failure to obtain the desired large pattern and an uneven finish can easily occur. It is not easy even for experienced people to make a finish with a design of a large pattern.

[0006]

Against such problems, for example, Patent Document 3 discloses a technique in which after coating is performed using a porous roller, the surface of the coating is stretched using a special trowel so that a finish with a design of a large pattern is obtained. Unfortunately, this technique, which requires the finishing process using the trowel in addition to the roller coating, is not considered to be a simple method.

PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0007]

Patent Document 1: JP-A-2007-175650

Patent Document 2: JP-A-2013-049017

Patent Document 3: JP-A-2006-326494

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0008]

An increase in the number of steps in a coating process can increase construction cost or prolong construction period. Therefore, making a coating process short is one of important problems. Under such circumstances, there has been a demand for a simple technique capable of making a finish with a design of a large pattern even by roller coating.

MEANS FOR SOLVING THE PROBLEMS

[0009]

As a result of intensive studies to solve such problems, the inventors have accomplished the invention based on the finding that the use of a special roller makes it possible to easily make a finish with a design of a large pattern by roller coating.

[0010]

Specifically, the invention has the following features.

1. A coating method using a roller, the method including applying a coating material to a substrate using a roller, wherein the roller is a porous roller with a surface having a plurality of separate depressions, and the coating material contains particles with a size of 0.2 cm or more.

2. The coating method according to item 1, wherein the depressions on the surface of the porous roller have a total area that is from 20% to 80% of the entire surface of the roller.

3. The coating method according to item 1 or 2, wherein the depressions have a size of 0.3 cm to 3 cm.

4. The coating method according to any one of items 1 to 3, wherein the depressions have a depth of 1 mm to less than 15 mm.

5. The coating method according to any one of items 1 to 4, wherein the porous roller has a thickness of 1 mm to less than 15 mm.

EFFECT OF THE INVENTION

[0011]

The coating method of the invention makes it possible to easily make a finish with a design of a large pattern by roller coating.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a view of an example of a roller for use in the invention;

Fig. 2 is an enlarged view of the surface of a porous layer shown in Fig. 1;

Fig. 3 is an enlarged view of the cross-section of a porous

layer having open and closed pores; and

Fig. 4 is an enlarged view of the cross-section of a porous layer having interconnected pores.

DESCRIPTION OF REFERENCE SIGNS

[0013]

X: Depression

Y: Pore

Y1: Open pore (porous layer surface)

Y2: Closed pore

Y3: Interconnected pore

a: Depression size

b: Distance between depressions

1: Core

2: Reinforcing member

3: Handle shaft

4: Porous layer

5: Handle

MODE FOR CARRYING OUT THE INVENTION

[0014]

Hereinafter, modes for carrying out the invention will be described in detail.

[0015]

The invention is directed to a coating method using a

roller, in which the roller is a porous roller with a surface having a plurality of separate depressions. In the coating method, a coating material containing particles with a size of 0.2 cm or more is applied to a substrate using such a roller, so that a finish with a design of a large pattern can be easily achieved.

[0016]

In this regard, the term "large" refers to a size that allows a shape to be visually recognized, specifically, a size of 0.2 cm or more. The term "large pattern" refers to a pattern with large dots, in other words, a pattern with dots recognizable even from a slight distance.

[0017]

<Porous roller>

As shown in Fig. 1, the porous roller used in the invention includes, for example, a tubular core and a porous layer provided on the outer surface of the tubular core. The tubular core is so hollow that a handle with a shaft can be attached thereto. The shaft of the handle is inserted into the hollow so that the roller becomes ready to be used.

[0018]

The tubular core may be, for example, but not limited to, a plastic, wooden, or metallic core. To improve the intimate contact between the handle shaft and the core, for example, a reinforcing member made of plastic, rubber, glass, metal, or

fibers may be provided between the handle shaft and the core.

[0019]

The porous roller according to the invention has a plurality of separate depressions on its surface (the surface of the porous layer constituting the porous roller). The term "separate depressions" refers to depressions that are so arranged that the adjacent depressions are isolated from each other with the porous material of the porous layer. When the porous roller with such features is used, particles enter the depressions, and the coating material component also adheres to the pores described below, so that the coating material can be applied to the entire surface of the substrate. As a result, the transfer of the three-dimensional pattern from the depressions is less likely to occur, and the use of the coating material allows the transfer of a large pattern onto the surface of the substrate.

[0020]

When the surface of the porous roller is viewed, the shape of any one of the depressions may be, for example, but not limited to, circular, triangular, quadrangular, hexagonal, or polygonal.

[0021]

When the surface of the porous roller is viewed, the size of any one of the depressions is preferably from 0.3 cm to 3 cm, more preferably from 0.5 cm to 2.0 cm, even more preferably

from 0.7 cm to 1.5 cm, most preferably from 0.9 cm to 1.2 cm. The depressions with such a size make it easy to transfer the coating material onto the substrate while maintaining the size and shape of the particles with a size of 0.2 cm or more in the coating material. The size of each depression may be calculated by multiplying the maximum distance from the center of gravity to the edge of each shape by 2. For example, the size of the depression with a circular shape may be its diameter, the size of the depression with a regular triangle shape may be calculated from $L \cos 30^\circ \times 4/3$, wherein L is the length of its one side, the size of the depression with a regular square shape may be the length of its diagonal, and the size of the depression with a regular hexagon shape may be the diameter of its circumscribed circle.

[0022]

In this regard, the shape and size of the depression refer to the shape and size on the surface of the porous roller.

[0023]

The size of the plurality of such depressions on the surface of the porous layer is preferably at least 1.5 times (more preferably at least twice) larger than the size of the pores described below.

[0024]

The total area of the depressions (the sum total of the areas of the depressions) on the surface of the porous roller

is preferably from 20% to 80%, more preferably from 25% to 70%, even more preferably from 30% to 60%, most preferably from 35% to 50% of the entire surface area of the roller (the area of the outer surface of the roller). When the percentage of the total area of the depressions in the surface of the roller falls within the above range, a finish with a large pattern can be easily and efficiently achieved by the coating method.

[0025]

The percentage (%) of the total area of the depressions in the surface of the porous roller can be calculated by dividing the total area of the depressions by the area of the surface of the roller (the width of the roller x the circumference of the roller surface). For example, when the depressions are circular and of the same size, the percentage can be calculated from (the area of the circle x the number of the circles)/(the area of the roller surface). If the depressions have random shapes, a development view of the roller surface may be drawn, from which the total area of the depressions may be determined.

[0026]

The depressions preferably have a depth of 1 mm to less than 15 mm, more preferably 2 mm to 13 mm, even more preferably 3 mm to 10 mm, most preferably 4 mm to 7 mm. The depressions may have any shape in the depth direction. For example, when the depressions have a circular surface shape, they preferably have a shape uniform in the depth direction, such as a

cylindrical shape, or preferably have a shape decreasing in size in the depth direction, such as a conical shape or a truncated cone shape. In this regard, the depth of the depression refers to the distance from the surface of the porous roller to the deepest part of the depression, which is most distant from the surface.

[0027]

The porous roller used in the invention has a plurality of depressions with the features described above. The depressions may be arranged randomly or regularly. In the invention, the depressions are preferably arranged regularly. When the surface of the porous roller is viewed, the shapes of the regularly arranged depressions may be, for example, alternately arranged large and small circles, alternately arranged circles and triangles, or regularly arranged circles A, B, and C with the distance between the circles A and B being different from that between the circles B and C.

[0028]

Particularly in the invention, the depressions are preferably arranged regularly with equal sizes and/or shapes. Such depressions are preferably arranged at equal intervals.

[0029]

As shown in Fig. 2, the ratio (b/a) of the distance (b) between the adjacent depressions to the size (a) of the depressions of the porous roller used in the invention is

preferably from 1.1 to less than 2 (more preferably from 1.2 to 1.9, even more preferably from 1.3 to 1.8). The depressions arranged regularly with such a distance make it easy to simply obtain a more favorable large pattern without causing unevenness in large pattern. In this regard, the distance (b) between the adjacent depressions refers to the distance between the centers of gravity of the respective shapes of depressions.

[0030]

The porous layer having a plurality of depressions may be produced by any appropriate method, such as a method of applying heat to some parts of a porous layer with no depression so that the parts can be melted to form depressions with the desired size and shape, a method of cutting away some parts of a porous layer with no depression with a cutter or a drill, or a molding method using a certain mold. The depressions may be formed in a porous layer before or after the porous layer is attached to the tubular core. The porous roller having a plurality of such depressions is attached to a handle shaft so that the roller becomes ready to be used.

[0031]

The porous layer as a component of the porous roller according to the invention has a large number of pores on the surface of the layer and/or in the interior of the layer. The pores may be closed pores formed separately from one another or interconnected pores formed by interconnection of pores (see

Figs. 3 and 4).

[0032]

The porous roller used in the invention is preferably, for example, a roller having a spongy porous layer. Although the porous layer may be of any type, such as a porous layer having interconnected pores or a porous layer having closed pores, a porous layer having closed pores is preferred in the invention (see Figs. 3 and 4). As shown in Fig. 3, the roller having a porous layer containing closed pores preferably has a structure including open pores on its surface and closed pores in its interior, in which the coating material component can adhere to the open pores on the surface so that the coating material can be prevented from entering the inner closed pores too much and thus easily transferred onto the substrate. The roller with such a structure also has high strength and can be used for a long period of time without being protected or reinforced with a mesh-shaped net or the like. The roller with such a structure also allows the use of coating materials with viscosities in a wide range.

[0033]

The pore size of the porous layer with such features is preferably, but not limited to, $2/3$ or less (or preferably $1/2$ or less) of the size of the depressions, more preferably 10 mm or less, even more preferably from 0.5 mm to 8 mm, further more preferably from 1 mm to 5 mm, most preferably from 1.5 mm to

4 mm. The pore size may be calculated by multiplying the maximum distance from the center of gravity to the edge of each pore by 2. The pore size may also be determined, for example, with respect to the open pores on the surface or in the cross-section. The pore size should be the average of values calculated for ten sites.

[0034]

Examples of the material for the porous layer include, but are not limited to, acrylic resin, urethane resin, ester resin, ethylene resin, and other resins, which may be formed into a spongy porous structure.

[0035]

In contrast to the porous roller used in the invention, a fiber roller such as a wool roller or a synthetic fiber roller can crush the particles or cause unevenness, which can make it impossible to obtain a large pattern or easily cause an uneven finish. In addition, a rubber or plastic roller (pattern roller) can make the three-dimensional pattern of depressions prominent, so that an uneven large pattern can appear. In addition, even though having a porous layer, a roller with no depression can fail to sufficiently transfer the coating material, crush the particles, or cause unevenness, which can make it impossible to obtain a large pattern or easily cause an uneven finish.

[0036]

The thickness of the porous roller (the porous layer) is preferably from 1 mm to less than 15 mm, more preferably from 2 mm to 13 mm, even more preferably from 3 mm to 9 mm, most preferably from 4 mm to 7 mm. The porous roller with such a thickness allows the coating material to be applied efficiently and provides superior workability. The roller with too large a thickness can produce a prominent three-dimensional pattern or an unclear large pattern and can provide an uneven appearance to the pattern. The thickness of the porous roller is the value obtained by measuring the thickness of the depression-free part of the cross-section of the porous layer.

[0037]

The width (length) of the porous layer is preferably, but not limited to, about 80 mm to about 250 mm. The diameter of the porous roller (the diameter of the cylinder containing the porous layer) is preferably from about 15 mm to about 100 mm.

[0038]

<Coating material>

The coating material used in the invention is characterized by containing particles with a size of 0.2 μm or more (preferably 0.5 μm to 3 μm). The coating material is used to form a large pattern having dots with a size of 0.2 μm or more on the surface of the substrate. The size of the particles refers to the maximum diameter determined by gently and stably placing the particles on a horizontal surface and observing them

from above. In this regard, the maximum diameter can be calculated by multiplying the maximum distance from the center of gravity to the edge of the shape by 2. The particle size can be measured with an optical microscope or other means.

[0039]

The coating material preferably contains a binder together with the particles with a size of 0.2 μm or more. The binder is a component for bonding the particles. The binder may include, for example, acrylic resin, acrylic-silicone resin, silicone resin, epoxy resin, urethane resin, fluororesin, ethylene resin, vinyl acetate resin, polyester resin, alkyd resin, or vinyl chloride resin.

[0040]

In addition, the coating material may also contain an additive such as a pigment, a curing agent, a solvent, a dispersant, a viscosity modifier, a film forming aid, a thickener, an antifoaming agent, a leveling agent, an anti-settling agent, an anti-sagging agent, a plasticizer, a preservative, an antifungal agent, an anti-algae agent, an antibacterial agent, a moistening agent, a dryness modifier, a dehydrating agent, a matting agent, an anti-freezing agent, an ultraviolet absorber, an antioxidant, or a light stabilizer. The coating material may be of any type, such as a water-based type or a solvent-based type.

[0041]

The particles with a size of 0.2 cm or more used in the invention may be of any form, such as gel particles or solid particles, in the coating material. The particles with a size of 0.2 cm or more are a component for forming dots with a size of 0.2 cm or more so that a large pattern can be obtained when the coating material is applied to the substrate. The coating material may also contain particles with a size of less than 0.2 cm.

[0042]

When the particles in the coating material are gel particles, the particles preferably contain a colorant and a resin as their components.

[0043]

Examples of the colorant include titanium oxide, zinc oxide, yellow iron oxide, ochre, titan yellow, carbon black, graphite, chrome green, cobalt green, ultramarine blue, Prussian blue, cobalt blue, cobalt violet, molybdate orange, red oxide, permanent red, brilliant carmine, lake red, anthraquinone red, perylene red, fast yellow, permanent yellow, isoindolinone yellow, quinophthalone yellow, phthalocyanine green, phthalocyanine blue, quinacridone violet, and other color pigments.

[0044]

Examples of the resin include acrylic resin, acrylic-silicone resin, silicone resin, epoxy resin, urethane

resin, fluororesin, ethylene resin, vinyl acetate resin, polyester resin, alkyd resin, and vinyl chloride resin.

[0045]

When the particles in the coating material are solid particles, the particles may include, for example, crushed natural stone, a pottery powder, a ceramic powder, rubber particles, metal particles, silica sand, feldspar, silica, white marble, mica, or glass beads as a component. The surface of these materials may also be colored. The particles to be used may also be solid resin particles produced by solidifying the gel of a particle component in advance.

[0046]

The particles may also contain any other additive as a component.

[0047]

The mixing ratio of the particles to the binder in the coating material according to the invention is preferably 50 to 3,000 parts by weight of the particles (more preferably 100 to 2,000 parts by weight of the particles) to 100 parts by weight of the solids in the binder.

[0048]

For example, the gel particles may be used preferably in an amount of 50 parts by weight to 500 parts by weight, more preferably in an amount of 100 parts by weight to 400 parts by weight, based on 100 parts by weight of the solids in the binder.

[0049]

The solid particles may also be used preferably in an amount of 100 parts by weight to 3,000 parts by weight, more preferably in an amount of 300 parts by weight to 2,000 parts by weight, based on 100 parts by weight of the solids in the binder.

[0050]

<Coating method>

The coating method of the invention can be mainly used for the coating of buildings, civil engineering structures, and other structures. Examples of the substrate, on which the coating method may be performed, include plaster boards, plywoods, concrete, mortar, bricks, ceramic tiles, fiber reinforced cement boards, cement calcium silicate boards, slag cement perlite boards, ALC boards, siding boards, extrusion-molded boards, steel sheets and plates, and plastic sheets and plates. The surface of these substrates may have undergone a certain surface treatment (such as a sealer treatment, a surfacer treatment, a filler treatment, or a putty treatment), or a coating film may have already been formed on the surface of these substrates.

[0051]

The method of the invention includes applying the coating material to the substrate using the roller, which is impregnated with the coating material. Specifically, the method of the

invention includes rolling the roller on the substrate to transfer the coating material onto the substrate. Even when the coating material is special one containing particles with a size of 0.2 cm or more, the use of the roller according to the invention makes it possible to uniformly transfer the particles in a continuous manner. Particularly when the coating material used contains gel particles, the use of the roller according to the invention makes it possible to easily transfer the gel particles by a small number of times of application without crushing the gel particles.

[0052]

In the invention, the amount of application of the coating material may be selected as appropriate. Preferably, the coating material is applied in an amount of about 0.2 to about 5 kg/m², more preferably in an amount of about 0.3 to about 3 kg/m². For example, when the gel particles are used, the amount of application of the coating material is preferably from about 0.2 to about 1.2 kg/m², more preferably from about 0.3 to about 1 kg/m². When the solid particles are used, the amount of application of the coating material is preferably from about 0.5 to about 5 kg/m², more preferably from about 0.8 to about 4 kg/m².

[0053]

In the coating method, the viscosity of the coating material may be controlled as appropriate. Preferably, the

viscosity of the coating material should be controlled in the range of about 1 Pa·s to about 50 Pa·s. In this regard, the viscosity is the value measured using a BH-type viscometer at a rotation speed of 20 rpm, a temperature of 23°C, and a relative humidity of 50%RH.

[0054]

The coating material may also be cured by any known method such as a method of curing by heating, a method of curing without heating, or a method of adding a catalyst or other materials to allow a curing reaction to proceed. In the method of curing by heating, curing is preferably performed at 40°C to 200°C, more preferably at 50°C to 120°C. In the method of curing without heating (room temperature curing), curing is preferably performed at 0°C to 40°C, more preferably at 5°C to 35°C.

EXAMPLES

[0055]

Hereinafter, in order to clarify the advantageous effects of the invention, the invention will be described with reference to examples and comparative examples.

[0056]

Coating materials 1 to 6 each containing dispersed particles of the specified type in an acrylic resin emulsion were prepared by mixing the raw materials according to the formulation shown in Table 1 below. In Table 1, all values are

parts by weight.

[0057]

[Table 1]

Coating material	1	2	3	4	5	6
Acrylic resin emulsion 1	200	200	200	200	200	200
Particles 1	100					
Particles 2	100				100	
Particles 3		100			100	
Particles 4		100		100		
Particles 5			100	100		
Particles 6			100			
Particles 7						100
Particles 8						100
Acrylic resin emulsion 1	Acrylic resin emulsion with a solids content of 50% by weight					
Particles 1	Gel particles with a size of 0.8 cm containing acrylic resin emulsion (solids content 50% by weight) and titanium oxide (white pigment)					
Particles 2	Gel particles with a size of 1.0 cm containing acrylic resin emulsion (solids content 50% by weight) and black iron oxide (black pigment)					
Particles 3	Gel particles with a size of 0.3 cm containing acrylic resin emulsion (solids content 50% by weight) and titanium oxide (white pigment)					
Particles 4	Gel particles with a size of 0.7 cm containing acrylic resin emulsion (solids content 50% by weight) and black iron oxide (black pigment)					
Particles 5	Gel particles with a size of 1.2 cm containing acrylic resin emulsion (solids content 50% by weight) and titanium oxide (white pigment)					
Particles 6	Gel particles with a size of 1.5 cm containing acrylic resin emulsion (solids content 50% by weight) and black iron oxide (black pigment)					
Particles 7	Gel particles with a size of 0.5 mm containing acrylic resin emulsion (solids content 50% by weight) and titanium oxide (white pigment)					
Particles 8	Gel particles with a size of 0.2 mm containing acrylic resin emulsion (solids content 50% by weight) and black iron oxide (black pigment)					

[0058]

Next, rollers 1 to 29 shown in Table 2 were prepared.

Rollers 1 to 26 are 120 mm wide and each have depressions equal

in size and shape. Roller 27 is a porous roller with no depression. Roller 28 is a rubber-made pattern roller having no depressions or pores but having a concave-convex pattern on its surface. Roller 29 is a wool fiber roller with a fiber length (thickness) of 8 mm having no depressions or pores.

[0059]

[Table 2]

Porous roller		Thickness (mm)	Pore size (mm)	Pore form	Depression shape	Depression size (mm)	Depression depth (mm)	Total number of depressions	Total area (%) of depressions
	Material								
1	Urethane resin	5	2	Closed pores with surface open pores	Circular/ cylindrical	10	5	198	79.3%
2	Urethane resin	5	2	Closed pores with surface open pores	Circular/ cylindrical	10	5	160	64.1%
3	Urethane resin	5	2	Closed pores with surface open pores	Circular/ cylindrical	10	5	96	38.5%
4	Urethane resin	5	2	Closed pores with surface open pores	Circular/ cylindrical	10	5	70	28.0%
5	Urethane resin	5	2	Closed pores with surface open pores	Circular/ cylindrical	10	5	60	24.0%
6	Urethane resin	5	4	Closed pores with surface open pores	Circular/ cylindrical	10	5	96	38.5%
7	Urethane resin	5	1.5	Closed pores with surface open pores	Circular/ cylindrical	10	5	96	38.5%
8	Urethane resin	5	2	Closed pores with surface open pores	Circular/ cylindrical	11	5	96	46.5%
9	Urethane resin	5	2	Closed pores with surface open pores	Circular/ cylindrical	13	5	96	65.0%
10	Urethane resin	5	2	Closed pores with surface open pores	Circular/ cylindrical	16	5	70	71.8%
11	Urethane resin	5	3	Closed pores with surface open pores	Circular/ cylindrical	9	5	96	31.2%
12	Urethane resin	5	3	Closed pores with surface open pores	Circular/ cylindrical	9	5	70	22.7%
13	Urethane resin	5	3	Closed pores with surface open pores	Circular/ cylindrical	9	5	48	15.6%
14	Urethane resin	5	2	Closed pores with surface open pores	Circular/ cylindrical	8	5	96	24.6%
15	Urethane resin	5	2	Closed pores with surface open pores	Circular/ cylindrical	6	5	96	13.8%

16	Urethane resin	4	2	Closed pores with surface open pores	Circular/cylindrical	10	4	96	40.0%
17	Urethane resin	6	2	Closed pores with surface open pores	Circular/cylindrical	10	6	112	43.2%
18	Urethane resin	8	2	Closed pores with surface open pores	Circular/cylindrical	10	8	60	21.6%
19	Urethane resin	12	2	Closed pores with surface open pores	Circular/cylindrical	10	12	144	45.5%
20	Urethane resin	15	2	Closed pores with surface open pores	Circular/cylindrical	10	12	160	46.3%
21	Urethane resin	5	3	Closed pores with surface open pores	Circular/cylindrical	10	2	70	28.0%
22	Urethane resin	5	3	Closed pores with surface open pores	Circular/cylindrical	10	5	96	38.5%
23	Urethane resin	5	3	Interconnected pores	Circular/cylindrical	10	5	70	28.0%
24	Ethylene resin	5	3	Closed pores with surface open pores	Circular/cylindrical	10	5	96	38.5%
25	Urethane resin	5	2	Closed pores with surface open pores	Square/square prism	10	5	128	32.7%
26	Urethane resin	5	2	Closed pores with surface open pores	Elliptical/elliptical prism	10	5	128	34.2%
27	Urethane resin	5	2	Closed pores with surface open pores	Absent	-	-	-	-
28	Rubber-made pattern roller	5	-	-	-	-	With 3 mm concave-convex pattern	-	-
29	Wool roller	8	-	-	-	-	-	-	-

[0060]

(Evaluation experiments)

(Evaluation of workability)

An acrylic resin primer was applied in an amount of 0.2 kg/m² to a 90 cm x 90 cm slate board (substrate) and then dried for 2 hours. Subsequently, using the combination shown in Table 3, the coating material shown in Table 1 was applied in an amount of 0.7 kg/m² with the roller shown in Table 2 while the workability of the application was evaluated. The evaluation was rated on one of the five scales: A, B, C, D, and Z shown below. Table 3 shows the results.

A: The coating material in an amount of 0.7 kg/m² was easily and successfully applied to the entire surface of the substrate by at most two reciprocations of the roller.

B: The coating material in an amount of 0.7 kg/m² was successfully applied to the entire surface of the substrate by three reciprocations of the roller.

C: The coating material in an amount of 0.7 kg/m² was successfully applied to the entire surface of the substrate by four reciprocations of the roller.

D: The coating material in an amount of 0.7 kg/m² was successfully applied to the entire surface of the substrate by five to nine reciprocations of the roller.

Z: The coating material in an amount of 0.7 kg/m² was not able to be applied even by ten reciprocations of the roller.

[0061]

(Evaluation of finish)

After the coating material (0.7 kg/m^2) was applied for the evaluation of the workability, each resulting sample was dried for 24 hours and then visually evaluated for surface finish. The evaluation was rated on one of the six scales: A, B, C, D, E, and Z shown below. Table 3 shows the results.

A: A good large pattern design was observed over the entire surface.

B: A good large pattern design was observed over almost the entire surface.

C: A large pattern design was observed over most of the surface although an uneven pattern was observed at a part of the surface.

D: A large pattern design was observed over most of the surface although some particles were observed to be crushed.

E: A large pattern design was observed over most of the surface although a three-dimensional pattern was observed at a part of the surface.

Z: No large pattern design was observed.

[0062]

[Table 3]

	Example																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Coating material	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Roller	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Workability evaluation	C	B	A	B	C	A	A	A	B	C	B	C	D	C	D	A	A
Finish evaluation	C	B	A	B	C	A	A	A	B	C	A	C	C	C	C	A	A
	Example													Comparative Example			
	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4
Coating material	1	1	1	1	1	1	1	1	1	2	3	4	5	1	1	1	6
Roller	18	19	20	21	22	23	24	25	26	8	8	8	8	27	28	29	3
Workability evaluation	D	C	D	C	A	C	A	B	B	A	A	A	A	Z	Z	Z	A
Finish evaluation	C	E	E	D	A	D	A	A	A	A	A	A	A	Z	Z	Z	Z

[0063]

The evaluation results in Table 3 show that in the examples using the specified roller and the specified coating material, a large pattern design is successfully obtained with a practically acceptable level of workability and finish. On the other hand, good workability and good finish are not simultaneously achieved in the comparative examples where the roller or the coating material used is not of the specified type.

CLAIMS

1. A coating method using a roller, the method comprising applying a coating material to a substrate using a roller, wherein

the roller is a porous roller with a surface having a plurality of separate depressions, and

the coating material contains particles with a size of 0.2 cm or more.

2. The coating method according to claim 1, wherein the depressions on the surface of the porous roller have a total area that is from 20% to 80% of an entire surface of the roller.

3. The coating method according to claim 1 or 2, wherein the depressions have a size of 0.3 cm to 3 cm.

4. The coating method according to any one of claims 1 to 3, wherein the depressions have a depth of 1 mm to less than 15 mm.

5. The coating method according to any one of claims 1 to 4, wherein the porous roller has a thickness of 1 mm to less than 15 mm.