

ENVIRONMENT-FRIENDLY PROJECTION TRANSMISSION SCREEN AND PREPARATION METHOD THEREOF

FIELD OF THE INVENTION

The present invention relates to an environment-friendly projection transmission screen and preparation method thereof, in particular to a new material in the field of environmental protection. The environment-friendly projection transmission screen and preparation method thereof are mainly applied in advertising outdoors, interior and exterior decoration and exhibitions.

BACKGROUND OF THE INVENTION

At present, projection systems are widely applied in business presentations, multimedia conference rooms, classrooms, stadiums and other occasions. The projection modes used are mainly front projection and rear projection. Accordingly, projection screens can also be divided into front projection screens (reflection-type) and rear projection screens (transmission-type). The front projection means that the installation position of a projector and audiences are on the same side of the projection screen, and light emitted by the projector is projected to the projection screen to form an image on the projection screen and then reflected to human eyes. Similarly, the rear projection means that the installation position of a projector and audiences are on opposite sides of the projection screen respectively, and light emitted by the projector is directed to the projection screen from one side of the projection screen and enters audiences' eyes through the projection screen. The front projection screen is not limited by size, but a good viewing effect can be obtained provided that ambient light is controlled, and the picture contrast ratio seriously declines in an environment with good ambient light and illumination. The rear projection screen has a high sense of wholeness in pictures with beautiful colors and realistic images, and does not need ambient light control. The rear projection screen applies to environments with good ambient light and illumination. However, the rear projection screen is not as good as the front projection screen in size, and needs enough back space to ensure the projection distance. Moreover, no double-sided high-definition screen for both front and rear projection modes is available now.

An example of light of an illuminating beam projector is disclosed in the South Korean authorized utility model No.20-0273709. The art relates to attachment of a microparticle sticker formed by a plurality of microparticles to a transparent glass screen board by using a binder. However, only a reflection-type beam projector can be used due to the non-transparency of the screen board, and no image can be viewed from outside due to the use of a transmission-type beam projector.

An example of a projection screen which allows viewing images from outside is disclosed in the South Korean patent No.10-0988415. The projection screen can be rolled into a scroll and coated with a binder. However, the projection screen has the disadvantage that the binder may be adhered to undesired parts in the case of being rolled into a scroll.

A high-definition projection paint composition and preparation method thereof is disclosed in a Chinese patent application No.201810142893.1. The high-definition projection paint composition comprises 1~10 wt% of silica microparticles, 1~10 wt% of tin dioxide microparticles, 30~60 wt% of the binder, 1~2 wt% of the leveling agent, 1~2 wt% of the defoaming agent and residual solvents. The patent application mainly solves the problems of nanoparticle dispersion and the like with organic solvents, but has the problem of environmental pollution.

SUMMARY OF THE INVENTION

The present invention aims to provide an environment-friendly projection transmission screen, characterized in that it comprises a substrate and an aqueous polymer emulsion coating material formed on a single side surface

of the substrate.

The environment-friendly projection transmission screen in the first aspect of the present invention is characterized in that the aqueous polymer emulsion coating material is obtained by directly applying an aqueous polymer emulsion composition to a single side surface of the substrate before drying at normal pressure and temperature.

5 The environment-friendly projection transmission screen in the first aspect of the present invention is characterized in that the aqueous polymer emulsion coating material comprises the aqueous polymer emulsion composition, inorganic nanoparticles and additives.

The environment-friendly projection transmission screen in the first aspect of the present invention is characterized in that the substrate is in the shape of plane, arc or semicircle.

10 The application of the environment-friendly projection transmission screen in the first aspect of the present invention is characterized in that the environment-friendly projection transmission screen is formed by using glass windows of chain businesses such as chain supermarkets, pharmacies, cosmetics stores, office buildings or shops along streets as glass substrates and directly applying the transmission paint composition to the glass substrates.

The second aspect of the present invention provides a preparation method of the environment-friendly projection transmission screen, characterized in that it comprises the following steps: a substrate pretreatment step, an applying step and a forming step.

15 The preparation method of the environment-friendly projection transmission screen in the second aspect of the present invention is characterized in that the applying step comprises a spray coating step or a roller coating step.

The preparation method of the environment-friendly projection transmission screen in the second aspect of the present invention is characterized in that the forming step is carried out at normal temperature and pressure.

20 The preparation method of the environment-friendly projection transmission screen in the second aspect of the present invention is characterized in that the included angle between the substrate and the ground is any angle selected between 0° and 90° in the applying step.

25 The preparation method of the environment-friendly projection transmission screen in the second aspect of the present invention is characterized in that the environment-friendly projection transmission screen is formed by using glass windows of chain businesses such as chain supermarkets, pharmacies, cosmetics stores, office buildings or shops along streets as glass substrates and directly applying the transmission paint composition to the glass substrates.

The environment-friendly projection transmission screen in the second aspect of the present invention is applied in advertising outdoors, interior and exterior decoration and exhibitions.

30 The application in the second aspect of the present invention is characterized in that the application in advertising outdoors refers to forming the environment-friendly projection transmission screen by directly applying environment-friendly projection transmission paint to glass windows of chain businesses such as chain supermarkets, pharmacies, cosmetics stores, office buildings or shops along streets as glass substrates.

In the present invention, a high-definition screen is simply formed by spray coating for use in all transmission-type beam projectors and reflection-type beam projectors. No additional screen cloth is required in the present invention, and projection may be carried out in any place in a very easy way. With the high-definition paint of the present invention, a high-definition projection screen can be formed in any place quickly by simple

operation. Moreover, the size of the projection screen is not affected by other factors, and is only determined by the size of the transparent sheet.

The screen uses a coating material for preparation of projection screens with the advantages of low cost, environmental protection and easy construction. The coating material can be applied and dried at normal temperature and pressure by conventional spray coating, roller coating and other methods. The coating material does not contain organic solvents and has no pollution to the environment. The coating material is fast in drying at normal temperature and pressure and facilitates construction. Therefore, the coating material can be fabricated on site so that the cost of the project screen is further reduced. The coating material is characterized in that the coating of the coating material of the coating composition does not require professional training for professionals, and the coating material is directly applied to the required clean substrate at normal temperature and pressure by the simple method of spray coating or roller coating, dried and filmed naturally.

With the coating composition used by the present invention, a high-definition environment-friendly projection film can be formed by field coating on any suitable substrate in any place without additional provision of screen cloth, making it very easy to project. The coating composition used for the screen can form a projection film on transparent substrates such as glass for rear projection imaging with a viewing angle up to 170° and high resistance to ambient light. Compared with the prior art, the art of the present invention has the following advantages: the construction is easy; the size of the projection screen is not affected by other factors, and is only determined by the size of the transparent substrate; the formed environment-friendly projection screen is affected by ambient light to a small extent, and pictures with beautiful colors and realistic images can be formed even under bright light; and clear images can be seen on both sides of the screen. Since rear projection imaging is used, the projector can be completely hidden without a shadow of the presenter, and the projector light produce no glare effect. As the substrate is still in the original state when unused, the original function of the substrate is not affected.

The coating composition of the present invention can also be applied to the existing white curtain or wall to form a high-definition environment-friendly projection film, which can form a clear picture even in bright light and overcome the disadvantage of the existing white curtain that needs to be used in the dark. The environment-friendly projection screen of the present invention can be used in outdoor advertising, interior and exterior decoration, exhibitions, office work and the like.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The technical scheme in the embodiments of the present invention is described in detail below. Obviously, the described embodiments are only part of the embodiments of the present invention, not all of them. Based on the embodiments in the present invention, all other embodiments acquired by persons of ordinary skill in the art without doing creative work are within the scope of protection of the present invention.

It should be noted that the term "comprise", "contain" or any other variant thereof herein is intended to cover non-exclusive inclusions so that a process, method, object or equipment that comprises a series of elements comprises not only those elements, but also other elements that are not explicitly listed, or also comprises elements inherent in such process, method, object or equipment.

According to the environment-friendly projection transmission screen of the present invention, the aqueous polymer emulsion coating material is obtained by applying an aqueous polymer emulsion composition to a single surface of the substrate and drying at normal temperature and pressure, wherein the aqueous polymer emulsion coating material comprises aqueous polymer emulsion composition, inorganic nanoparticles and additives.

For the environment-friendly projection transmission screen of the present invention, the substrate can be in

any shape such as plane, arc or semicircle, and the high-definition screen can be formed as long as a uniform coating can be formed by means of spray coating or roller coating and the like.

The preparation method of the environment-friendly projection transmission screen of the present invention can be formed and obtained using the substrate pretreatment step, applying step and forming step through a simple method. The forming step is carried out at normal temperature and pressure.

5 According to the preparation method of the environment-friendly projection transmission screen of the present invention, the included angle between the substrate and the ground is any angle selected between 0° and 90° in the applying step. The environment-friendly projection transmission screen is formed by using glass windows of chain businesses such as chain supermarkets, pharmacies, cosmetics stores, office buildings or shops along streets as glass substrates and directly applying the transmission paint composition to the glass substrates.

10 The environment-friendly projection transmission screen of the present invention is suitable for applications in advertising outdoors, interior and exterior decoration and exhibitions.

As an embodiment, the coating material of the present invention contains binder as the raw material of the coating material. As an example of such binder, the binder contains one of acrylic emulsion, vinyl acetate emulsion, polyvinyl butyral, vinyl acetate, polyurethane and organic-inorganic mixed binder, or consists of one or more of their mixtures.

15 Except for inclusion of the silica microparticles and binder, the coating material applied to the coating layer as the double screen of the present invention may also contain a leveling agent for homogenizing painting surfaces and a defoaming agent for inhibiting bubble formation in the painting process.

20 The overall composition of the coating material with leveling agent and defoaming agent can contain 1~10 wt% of silica microparticles, 1~10 wt% of tin dioxide microparticles, 30~60 wt% of binder, 1~2 wt% of leveling agent, 1~2 wt% of defoaming agent and residual solvents. In the present invention, the solvent for a semitransparent coating material consists of water or alcohol.

Moreover, metal microparticles can also be added into the raw material as the coating material in the foregoing composition.

The metal microparticles reduce the transmission of ultraviolet or infrared rays. The metal microparticles not only protect people indoors against ultraviolet rays, but also provide better image quality than that of the beam projector 3 for the screened coating layer 2 through the reflection property peculiar to metals.

25 And due to the heat insulation effect of the metal microparticles, the energy efficiency can be further improved in the case that the coating material with added metal microparticles is applied to buildings and external boundaries glass and the like.

30 As an example of the metal microparticles, the metal microparticles can be used by mixing more than one kind of titanium oxide, zinc oxide, indium oxide, tin oxide, antimony tin oxide, indium tin oxide and the like with the size of 10~500nm and molybdenum oxide (MoO_3), tantalum oxide (Ta_2O_5), tungsten oxide (WO_3), vanadium pentoxide (V_2O_5), niobium oxide (Nb_2O_5) and the like with the size of about 10~500nm.

Preferably, 50~150 parts (by weight) of these metal micro particles are added relative to 100 parts (by weight) of silica microparticles.

If the glare becomes serious in the case that the amount of usage is more than that above, the effect of protection against ultraviolet rays cannot be fully obtained in the case of a small amount of usage.

As the second embodiment, the coating material of the present invention can also be an aqueous polymer

emulsion composition. The aqueous polymer emulsion composition contains aqueous polymer emulsion, inorganic nanoparticles and additives.

Preferably, the aqueous polymer emulsion comprises aqueous polyurethane emulsion, aqueous polyacrylate emulsion, EVA emulsion or two or more aqueous polymer emulsions.

Preferably, the inorganic nanoparticles are selected from one or more mixtures of nano-silica, nano-tin dioxide, nano-zinc dioxide, nano-titanium dioxide, nano-alumina and nano-zirconia, and the nanoparticle mixture has the mass content of 1-10% in the composition. Its content affects the transmittance of the screen without projection, but does not affect its projection imaging. The mass content of the nanoparticle mixture should not be higher than 10%, especially when used in the case that the glass windows of chain businesses such as chain supermarkets, pharmacies, cosmetics stores, office buildings or shops along streets are used as glass substrates, without affecting the appearance even when used as the high-definition screen.

A color-matching nano-filler can also be contained in the environment-friendly projection transmission screen. Preferably, the color-matching nano-filler is a mixture of one or more than two selected from nano-copper dioxide, nano-ferric oxide, nano-manganese dioxide and nano-carbon black, with a mass content of 0.01-2% in the composition.

In the present invention, the additive consists of defoaming agent, dispersing agent and film forming agent, and has the mass content of 1-10% in the composition.

An aqueous polymer emulsion composite coating material for preparation of environment-friendly projection screens of the present invention. The aqueous polymer emulsion composition coating material of the present invention is suitable for preparing a dual-purpose projection screen for rear and front applications on a transparent substrate, especially suitable for meeting the requirement of transforming transparent glass windows or display boards of existing buildings into front and rear projection screens. The present invention relates to a screen coating material which has the characteristics of high light resisting capability, simple construction, low cost and environmental protection.

According to the double-sided projection screen of the present invention, the aqueous polymer emulsion composition is applied to the substrate to form the projection film which is used with the projector to form images.

In the present invention, the aqueous polymer emulsion is a carrier material which can be commercially available aqueous polyurethane emulsion, aqueous polyacrylate emulsion, EVA emulsion or two or more aqueous polymer emulsions and the like, with a solid content preferably ranging from 25 to 45% and with a content of 65-85% in the composition.

The substrates comprise transparent substrates, opaque substrates, transparent glass windows of the existing buildings, or display boards and the like. The construction described in the present invention is simple and environment-friendly, and has the characteristics that the aqueous polymer emulsion composition coating material is applied without professional training for professionals, applied to the required clean substrate at normal temperature and pressure by the simple method of spray coating or roller coating, dried and filmed naturally, without generating an organic solvent odor in the process of drying.

A display screen of about 1.6 square meters can be prepared from 100ml coating material of the present invention without being affected by weathers, construction environments and the like.

The aqueous polymer emulsion composite coating material of the present invention is suitable in interior and exterior decoration, exhibitions, and outdoor advertising screens of the existing buildings, available for site operation, with simple construction, short drying time, cost and time saving and high resistance to ambient light so

that clear pictures are visible even under strong light condition in the daytime.

The aqueous polymer emulsion composition for preparation of projection screens is used in the present invention, which has the advantages of low cost, environmental protection and easy construction, available for coating and drying at normal temperature and pressure by the conventional spray coating, roller coating and other modes, without organic solvent and without pollution to the environment, with high drying speed at normal temperature and pressure, making construction easy, and therefore, the aqueous polymer emulsion composition can be made on site so that the cost of the projection screen is further reduced. The aqueous polymer emulsion composition is characterized in that the coating of the aqueous polymer emulsion composition coating material does not require professional training for professionals, the coating material is directly applied to the required clean substrate at normal temperature and pressure by the simple method of spray coating or roller coating, dried and filmed naturally.

A high-definition environment-friendly projection film can be formed by applying the aqueous polymer emulsion composition used in the present invention to any suitable substrate on site in any place without additional provision of the screen cloth, and projection may be carried out in a very easy way. The aqueous polymer emulsion composition used for the screen can form a projection film on transparent substrates such as glass for rear projection imaging, with a viewing angle of 170° and high resistance to ambient light. Compared with the prior art, the art of the present invention has the following advantages: the construction is easy; the size of the projection screen is not affected by other factors, and is only determined by the size of the transparent substrate; the formed environment-friendly projection screen is affected by ambient light to a small extent, and pictures with beautiful colors and realistic images can be formed even under bright light; and clear images can be seen on both sides of the screen. Since rear projection imaging is used, the projector can be completely hidden without a shadow of the presenter, and the projector light produce no glare effect. As the substrate is still in the original state when unused, the original function of the substrate is not affected.

The aqueous polymer emulsion composition of the present invention can also be applied to the existing white curtain or wall to form a high-definition environment-friendly projection film which can form a clear picture even in bright light and overcome the disadvantage of the existing white curtain which needs to be used in the dark. The environment-friendly projection screen of the present invention can be used in the fields of outdoor advertising, interior and exterior decoration, exhibitions, office work and the like.

Embodiments

Embodiment 1

Add 8 parts (by weight) of silicon dioxide into 100 parts (by weight) of aqueous polyurethane; mix 2 parts (by weight) of nano-tin dioxide with 2 parts (by weight) of water, with a solid content of 45%. Then the aqueous polymer composition 1 of embodiment 1 is obtained after dispersion for 60 minutes by ultrasonic waves. Put the aqueous polymer composition 1 into a spray gun, apply the aqueous polymer composition 1 to the pretreated glass substrate for spray coating in a direction perpendicular to the ground, dry naturally and obtain a grey-white coating film with the surface drying time of 10~15. The glass coated with the aqueous polymer 1 can be used as a projection screen with a viewing angle of 170° , and both sides of the coating can be imaged. The rear projection effect is excellent with the coating used toward the projector.

Embodiment 2

Add 14 parts (by weight) of silicon dioxide into 100 parts (by weight) of aqueous polyurethane; add 7 parts (by weight) of nano-titanium dioxide; mix in 2 parts (by weight) of water, with a solid content of 63%. Then transmission paint composition 2 of embodiment 2 is obtained after dispersion for 60 minutes by ultrasonic waves;

put the transmission paint composition 2 into a spray gun, apply the transmission paint composition 2 to the pretreated glass substrate for spray coating in a direction perpendicular to the ground, dry naturally and obtain a grey-white coating film with the surface drying time of 10~15. The glass coated with the aqueous polymer 1 can be used as a projection screen with a viewing angle of 170, and both sides of the coating can be imaged. The rear projection effect is excellent with the coating used toward the projector.

Embodiment 3

Add 8 parts (by weight) of silicon dioxide, 2 parts (by weight) of nano-tin dioxide and 0.05 part of copper dioxide into 100 parts (by weight) of aqueous polyurethane, mix in 2 parts (by weight) of water, with a solid content of 47%. Then transmission paint composition 3 of embodiment 3 is obtained after dispersion for 60 minutes by ultrasonic waves; put the transmission paint composition 3 into a spray gun, apply the transmission paint composition 3 to the pretreated glass substrate for spray coating in a direction perpendicular to the ground, dry naturally and obtain a grey-white coating film with the surface drying time of 10~15. The glass coated with the aqueous polymer 1 can be used as a projection screen with a viewing angle of 170, and both sides of the coating can be imaged. The rear projection effect is excellent with the coating used toward the projector.

Embodiment 4

Add 14 parts (by weight) of silicon dioxide and 7 parts (by weight) of nano-tin dioxide into a mixture of 100 parts (by weight) of aqueous acrylate and aqueous polyurethane (3:7); mix in 2 parts (by weight) of water with a solid content of 63. Then transmission paint composition 4 of embodiment 4 is obtained after dispersion for 60 minutes by ultrasonic waves; put the transmission paint composition 4 into a spray gun, apply the transmission paint composition 4 to the pretreated glass substrate for spray coating in a direction perpendicular to the ground, dry naturally and obtain a grey-white coating film with the surface drying time of 10~15. The glass coated with the aqueous polymer 1 can be used as a projection screen with a viewing angle of 170, and both sides of the coating can be imaged. The rear projection effect is excellent with the coating used toward the projector.

The above-mentioned embodiments only express several modes of carrying out the invention, which are described specifically in more detail but cannot be understood as restrictions on the scope of the invention patent for that reason. It should be noted that for persons of ordinary skill in the art, a number of modifications and improvements can also be made without departing from the concept of the present invention, all of which are within the scope of protection of the present invention. Therefore, the scope of protection of the invention patent shall be subject to the claims appended hereto.

CLAIMS

1. An environment-friendly projection transmission screen, characterized in that it comprises a substrate and an aqueous polymer emulsion coating material formed on a single side surface of the substrate.
- 5 2. The environment-friendly projection transmission screen according to claim 1, characterized in that the aqueous polymer emulsion coating material is obtained by directly applying an aqueous polymer emulsion composition to a single side surface of the substrate before drying at normal pressure and temperature.
3. The environment-friendly projection transmission screen according to claim 1, characterized in that the aqueous polymer emulsion coating material comprises the aqueous polymer emulsion composition, inorganic nanoparticles and additives.
- 10 4. The environment-friendly projection transmission screen according to claim 1, characterized in that the substrate is in the shape of plane, arc or semicircle.
5. The application of the environment-friendly projection transmission screen according to claim 1, characterized in that the environment-friendly projection transmission screen is formed by using glass windows of chain businesses such as chain supermarkets, pharmacies, cosmetics stores, office buildings or shops along streets as glass substrates and directly applying the transmission paint composition to the glass substrates.
- 15 6. A preparation method of the environment-friendly projection transmission screen, characterized in that it comprises the following steps: a substrate pretreatment step, an applying step and a forming step.
7. The preparation method of the environment-friendly projection transmission screen according to claim 6, characterized in that the applying step comprises a spray coating step or a roller coating step.
8. The preparation method of the environment-friendly projection transmission screen according to claim 6, characterized in that the forming step is carried out at normal temperature and pressure.
- 20 9. The preparation method of the environment-friendly projection transmission screen according to claim 6, characterized in that the included angle between the substrate and the ground is any angle selected between 0° and 90° in the applying step.
10. The preparation method of the environment-friendly projection transmission screen according to claim 9, characterized in that the environment-friendly projection transmission screen is formed by using glass windows of chain businesses such as chain supermarkets, pharmacies, cosmetics stores, office buildings or shops along streets as glass substrates and directly applying the transmission paint composition to the glass substrates.
- 25 11. The application of the environment-friendly projection transmission screen according to any of claims 6-10 in advertising outdoors, interior and exterior decoration and exhibitions.
12. The application according to claim 11, characterized in that the application in advertising outdoors refers to forming the environment-friendly projection transmission screen by directly applying environment-friendly projection transmission paint to glass windows of chain businesses such as chain supermarkets, pharmacies, cosmetics stores, office buildings or shops along streets as glass substrates.
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