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(54) **Luminous display and a manufacturing method thereof**

(57) Disclosed is a luminous display used for decoration. The display includes a front surface member and a rear surface member. Included between the front and rear surface members are transparent, middle and lower electrode plates provided between the front and rear surface members, a luminous phosphor layer disposed between the transparent and middle electrode plates, a UV coating layer provided adjacent to the front surface

member, an upper dampproofing layer disposed between the UV coating layer and the transparent electrode plate, a lower dampproofing layer provided adjacent to the rear surface layer, an ionized layer provided between the lower and middle electrode plates, and a sealing frame placed around the luminous display, over the edges of the front and rear surface members and to seal all the layers therebetween.

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Description

The present invention relates to a luminous display, and more particularly, to a luminous display which is used for decoration by being installed on an interior or exterior wall of a building and a manufacturing method thereof.

Generally, luminous displays utilizing electrodes connected to a luminous phosphor layer to radiate light are used in a variety of electronic and electric goods. The displays show information for the user to view. An example is the display used in public telephones which indicates the amount of money inserted in the phone and the amount remaining. Such luminous displays enable users to view the display at night or in dark places.

In the above luminous displays, as an electrode plate made of IN_2O_3 or SnQ is used on both sides of the luminous paint layer, a large amount of electrical power is used because of the high level of electrical resistivity, manufacturing of the display with dimensions larger than 10cm x 3cm is difficult, and manufacturing of the devices is costly.

Further, in the conventional luminous display, as a result of the size limitation and the high resistance value of the electrode plates, the degree to which illumination can be adjusted and colour varied is limited. Accordingly, it is not possible to use the illuminating device for decoration purposes.

Conventional luminous displays used for decoration include incandescent lights, fluorescent lights, and neon signs. However such devices are not energy efficient, are expensive to install, and generate an excessive amount of heat. As a result, it is not practical to the displays for decoration in the home.

The present invention has been made in an effort to solve the above problems.

It is an object of the present invention to provide a luminous display used for decoration and a manufacturing method thereof which, though using a luminous phosphor layer, can be manufactured to large sizes, and is able to attain a high degree of illumination and allow the use of a variety of colours such that both commercial and home use is feasible.

To achieve the above object, the present invention provides a luminous display used for decoration including a front surface member and a rear surface member. There are included between the front and rear surface members, transparent, middle and lower electrode plates provided between the front and rear surface members, a luminous phosphor layer disposed between the transparent and middle electrode plate, a UV coating layer provided adjacent to the front surface member, an upper dampproofing layer disposed between the UV coating layer and the transparent electrode plate, a lower dampproofing layer provided adjacent to the rear surface layer, an ionized layer provided between the lower and middle electrode plates, and a sealing frame placed around the luminous display, over the edges of the front

and rear surface members and to seal all the layers therebetween.

According to a feature of the present invention, filters are mounted to the upper dampproofing layer, disposed between the UV coating layer and the transparent electrode plate, to realize the display of a variety of colours.

A method for making a luminous display, comprising the steps of : disposing a lower electrode plate and a middle electrode plate on a lower dampproofing layer disposed on a rear surface member, an ionized layer being disposed between the electrode plates; spraying a mixture made of 67 % cyano ethyl celluloid solution and 33% luminous dust on the lower surface of a transparent electrode plate which is made from a mixture of 55 % IN_2O_3 , 42% SnO_2 , and 3% hardening agent at the thickness of 1000Å; heat-treating the transparent electrode plate at 500°C - 600°C to form a luminous phosphor layer between the transparent electrode plate and the middle electrode plate; depositing a dampproofing layer, a UV coating layer, and a front surface member on the transparent electrode plate; and sealing the luminous display and all the layers using a frame placed around the edges of the luminous display.

The middle and lower electrode plates are made by depositing a copper sulfide (Cu_2SO_4) solvent on an aluminium plate, drying the same, then heat treating the plates between 380°C - 430°C such that the lower and middle electrode plates have a high degree of electrical conductivity.

Further, the luminous dust includes 55% TiO_2 , 30% zinc oxide (ZnO) and 15% zinc sulfide (ZnSO_4) and the particles of said luminous dust are sized at 0.5-1µm such that direct current is used in the luminous display.

The luminous dust may be sized at 5-20µm such that alternating current is used in the luminous display.

By way of example, a specific embodiment of the invention will now be shown with reference to the accompanying figures, in which :-

Figure 1 is a perspective view of a luminous display according to a preferred embodiment of the present invention; and

Figure 2 is a partial sectional perspective view of the luminous display shown in Figure 1.

Reference will now be made in detail to the present preferred embodiment of the invention, an example of which is illustrated in the accompanying drawings.

In the drawings, reference numeral 1 denotes a luminous display according to a preferred embodiment of the present invention. A transparent electrode plate 7, middle, and lower electrode plates 8, and 88 and a luminous phosphor layer 9 are provided between a front surface member 2 and a rear surface member 3 of the luminous display.

A dampproofing layer 5 is interposed between the

rear surface member 3 and the lower electrode plate 88, and an ionized layer 6 is interposed between the lower electrode plate 88 and the middle electrode plate 8. The middle and lower electrode plates 8 and 88 are made by depositing a copper sulfide (Cu_2SO_4) solvent on an aluminium plate, then after drying, heat treating the plates between 380°C - 430°C such that the lower and middle electrode plates 8 and 88 have a high degree of electrical conductivity.

A mixture made of 67% cyano ethyl celluloid solution and 33% luminous dust is sprayed on a lower surface of the transparent electrode plate 7, then the same undergoes a heat-treatment process at 500°C - 600°C . As a result, the luminous phosphor layer 9 is formed between the transparent electrode plate 7 and the middle electrode plate 8.

Further, the transparent electrode plate 7 is made from a mixture of 55% In_2O_3 , 42% SnO_2 , and 3% hardening agent which is sprayed then hardened at a thickness of $1000\text{\AA}$ such that electrical resistance is minimized.

A dampproofing layer 4 is provided on top of the transparent electrode plate 7, and a UV coating layer 2a is provided on top of the dampproofing layer 4. The front surface member 2 is placed on top of the UV coating layer 2a. A sealing frame 10 is placed around the luminous display 1 over the edges of the front and rear surface members 2 and 3 to seal all the layers therebetween. Electrical power is supplied to the luminous display 1 by an electrical wire 11 and a plug 12 which are connected to the electrode plate 7, 8 and 88. With the supply of electrical power, light is emitted from the luminous phosphor layer 9 which passes through the transparent electrode plate 7, the dampproofing layer 4, and the UV coating layer 2a to be radiated out the front surface member 2.

In the luminous display 1 structured as in the above, it is preferable to add a compound to allow different levels of illumination to be controlled and colours to be varied. Such an addition allows both direct and alternating current to be used, and the control of the level of illumination from 40Lit to 800Lit.

Namely, the luminous phosphor layer 9 is formed by spraying a compound comprised of 67 % cyano ethyl celluloid solution and 33 % luminous dust on the lower surface of the transparent electrode plate 7, then heat treating the compound at 500°C - 600°C .

The above luminous dust includes 55% TiO_2 , 30% zinc oxide (ZnO), and 15 % zinc sulfide (ZnSO_4). If the size of the luminous dust particles is set at $0.5\text{-}1\mu\text{m}$ and the particles amassed, direct current can be used in the luminous display 1. However, when the size of the dust particles is set at $5\text{-}20\mu\text{m}$ and the particles separated, alternating can be used in the luminous display 1.

When wanting to display colours from the luminous phosphor layer 9, copper (Cu), chrome (Cr), aluminium (Al), manganese (Mn) and other such elements are added at different ratios to zinc sulfide (ZnS). If the 0.04%

Cu and 0.005 % Cr are added to ZnS a red colour can be displayed, if 0.08 % Cu and 0.02% Al are added to ZnS a green colour can be displayed, and adding 0.05% Cu and 1.3% Mn to ZnS allows a pink colour to be displayed. It is also possible to realize the display of a variety of colours by mounting colour filters to the damp-proofing layer 4.

With regard to illumination, if the ratio of Mn to Cu is fixed to 1.5/1, by maintaining maximal density ratio of Mn at 0.5mol%, and that of Cu at 0.3mol%, a degree of illumination of 2400cd/m^2 can be attained. Here, it is preferable that a thickness of the luminous phosphor layer 9 is within a range of $5000\text{-}6000\text{\AA}$ with a $\pm 3\%$ deviation.

The transparent electrode plate 7 is formed on the luminous phosphor layer 9 from a mixture of 55% In_2O_3 , 42% SnO_2 , and 3% hardening agent at a thickness of $1000\text{\AA}$. Accordingly, the resistance value of the transparent electrode plate 7 is minimized to $10^{-5}\Omega$ such that only a small amount of electricity is consumed.

Further, the middle and lower electrode plates 8 and 88 are made by depositing a copper sulfide (Cu_2SO_4) solvent on an aluminium plate, drying the solvent, and heat treating the plates between 380° - 430°C . As a result, the lower and middle electrode plates 8 and 88 have a high degree of electrical conductivity, allowing the overall size of the luminous display 1 to be substantially enlarged without the lower and middle electrode plates 8 and 88 warping, while preventing the generation of a potential difference and a reduction in illumination.

In the above, by providing the dampproofing layer 4, the UV coating layer 2a, and the front surface member 2 on top of the transparent electrode plate 7, and the dampproofing layer 5 and the rear surface member 5 under the lower electrode plate 88, then placing the sealing frame 10 around all the edges of the luminous display 1, interference from external light is prevented by the UV coating layer 2a such that the desired colour can be displayed.

In the luminous display of the present invention structured as in the above, the electricity usage is kept to a minimum by utilizing only 0.5W - 5W per 1 m^2 . Also, the display allows both direct and alternating current of 6V - 220V to be used, the size of the display can be greatly increased and the shape altered in a variety of ways, and can realize an assortment of colours and levels of illumination enabling the display to be used for commercial purposes as well as in the home.

While this invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

The reader's attention is directed to all papers and

documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

Claims

1. A luminous display, comprising :

a front surface member;
a rear surface member;
transparent, middle, and lower electrode plates provided between the front and rear surface members;
a luminous phosphor layer disposed between the transparent and middle electrode plates;
a UV coating layer provided adjacent to the front surface member;
an upper dampproofing layer disposed between the UV coating layer and the transparent electrode plates;
a lower dampproofing layer provided adjacent to the rear surface layer;
an ionized layer provided between the lower and middle electrode plates; and
a sealing frame placed around the luminous display, over the edges of the front and rear surface members and to seal all the layers there-between.

2. The luminous display of claim 1, wherein filters are mounted to the upper dampproofing layer, disposed between the UV coating layer and the transparent electrode plate, to realize the display of a variety of colours.

3. A method for making a luminous display, comprising the steps of :

disposing a lower electrode plate and a middle electrode plate on a lower dampproofing layer disposed on a rear surface member, an ionized layer being disposed between the electrode plates;
spraying a mixture made of 67% cyano ethyl celluloid solution and 33 % luminous dust on the lower surface of a transparent electrode plate which is made from a mixture of 55% IN_2O_3 , 42% SnO_2 and 3% hardening agent at the thickness of 1000Å;
heat-treating the transparent electrode plate at 500°C - 600°C to form a luminous phosphor layer between the transparent electrode plate and the middle delectrode plate;
depositing a dampproofing layer, a UV coating layer, and a front surface member on the transparent electrode plate; and
sealing the luminous display and all the layers using a frame placed around the edges of the luminous display.

4. The method of claim 3, wherein the middle and lower electrode plates are made by depositing a copper sulfide (Cu_2SO_4) solvent on an aluminium plate, drying the same, then heat treating the plates between 380°C - 430°C such that the lower and middle electrode plates have a high degree of electrical conductivity.

5. The method of claim 3, wherein said luminous dust includes 55 % TiO_2 , 30% zinc oxide (ZnO), and 15 % zinc sulfide (ZnSO_4) and the particles of said luminous dust are sized at 0.5-1µm such that direct current is used in the luminous display.

6. The luminous display of claim 3 wherein said luminous dust includes 55% TiO_2 , 30% zinc oxide (ZnO), and 15% zinc sulfide (ZnSO_4) and the particles of said luminous dust are sized at 5-20µm such that alternating current is used in the luminous display.

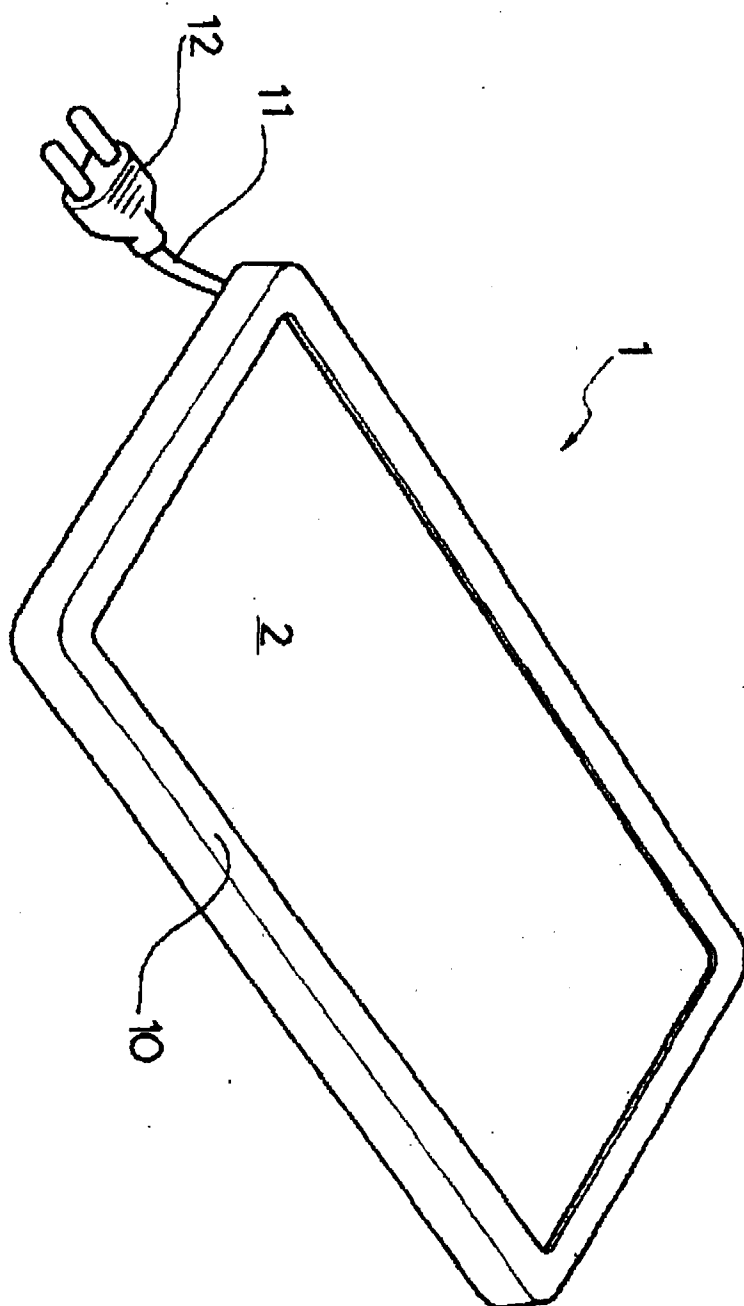


FIG. 1

FIG. 2

