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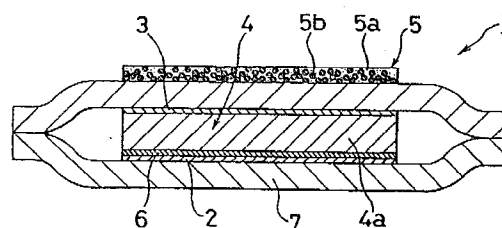
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D-80714 München (DE)(54) **Electroluminescent device.**

(57) An electroluminescent device having a light-emitting surface, comprising a layer (4) of phosphor (4a) capable of producing a luminescence and directing the luminescence to the light-emitting surface when the layer of phosphor is excited by a voltage, and a chromatic light converter filter (5) converting the luminescence into a light of a color different from the color of the luminescence. The chromatic light converter filter is provided on a light-emitting surface side of the electroluminescent device. The chromatic light converter filter is a film made of a transparent resin and the organic fluorescent pigment mixed with the transparent resin. The electroluminescent device commercially can be used outdoors.

FIG.1

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an electroluminescent device and more particularly to an electroluminescent device in which a light-emitting surface side includes a chromatic light converter filter to produce a light of a desired color.

2. Background Art

FIG.3 Shows a first prior-art electroluminescent (EL) panel 90 without chromatic light converter filter. In order to emit white light, the EL panel 90 comprises a back electrode 91, a transparent electrode 92 disposed in parallel to the back electrode 91, a luminescent layer 93 sandwiched therebetween. The luminescent layer 93 is made of phosphor 93a and an organic fluorescent pigment 93b mixed with the phosphor 93a.

Mixing the organic fluorescent pigment 93b with the phosphor 93a first reduces packing ratio of the phosphor 93a in the luminescent layer 93 to reduce luminous efficacy of the luminescent layer 93 and second significantly deteriorates the organic fluorescent pigment 93b to significantly shorten service life of the EL panel 90.

FIG.4 shows a second prior-art EL panel 80 for eliminating the above-described drawbacks in the EL panel 90. The EL panel 80 comprises a back electrode 81, a transparent electrode 82 disposed in parallel to the back electrode 81, a luminescent layer 83 made of only phosphor 83a, and a chromatic light converter filter 84 attached to the light-emitting surface of the EL panel 80. The chromatic light converter filter 84 comprises a film 84a of a transparent resin, e.g., polyethylene terephthalate, a film 84b of an organic fluorescent pigment applied by printing or the like to the inner surface of the transparent film 84a, an ultraviolet cut film 84c attached to the outer surface of the transparent film 84a.

The second prior-art EL panel 80 increases the luminous efficacy and life of the organic fluorescent pigment 84b. On the other hand, the ultraviolet cut film 84c secures at most only a 200-day (about 7-month) service life of the EL panel 80 in an outdoor exposure test. This means the EL panel 80 commercially cannot be used outdoors.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an EL device which increases life of an organic fluorescent pigment to increase service life of the EL device.

A first aspect of the present invention is an electroluminescent device having a light-emitting surface, comprising a layer of phosphor capable of producing a luminescence and directing the luminescence to the light-emitting surface when the layer of phosphor is excited by a voltage, and a chromatic light converter filter converting the luminescence into a light of a color different from the color of the luminescence. The chromatic light converter filter is provided on a light-emitting surface side of the electroluminescent device and comprises a film made of a transparent resin and of the organic fluorescent pigment mixed with the transparent resin.

A second aspect of the present invention is an electroluminescent panel, comprising a panel-shaped casing having a transparent flat portion the exterior surface of which constitutes a light-emitting surface of the electroluminescent panel, a layer of phosphor housed in said casing, the layer of phosphor being capable of producing luminescence and directing the luminescence to the light-emitting surface when the layer of phosphor is excited by a voltage, and a chromatic light converter filter converting the luminescence into a light of a color different from the color of the luminescence. The chromatic light converter filter is attached to the light-emitting surface and comprises a film made of a transparent resin and of the organic fluorescent pigment mixed with the transparent resin.

Since the organic fluorescent pigment is mixed with the transparent resin, the transparent resin seals particles of the organic fluorescent pigment from outside air to protect the organic fluorescent pigment from deterioration due to ultraviolet radiation to increase life or durability of the organic fluorescent pigment. Thus the inventive EL device commercially can be used outdoors.

Other objects, features and advantages of the present invention will be apparent from a consideration of the following description, taken in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG.1 is a cross section of an EL panel according to an embodiment of the present invention; FIG.2 is a graph indicative of a result of sunlight exposure test of the EL panel of FIG.1 and those of prior-art EL panels; FIG.3 is a cross section of a first prior-art EL panel according to an embodiment of the present invention; and FIG.4 is a cross section of an EL panel according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A preferred embodiment of the present invention will be described with reference to the drawings hereinafter.

An EL panel 1 according to an embodiment of the present invention comprises a back electrode 2, a transparent electrode 3 disposed in parallel to the back electrode 2, a luminescent layer 4 sandwiched therebetween and made of only phosphor 4a, and a chromatic converter filter 5 attached to the light-emitting surface of the EL panel 1 for converting luminescence from the luminescent layer 4 to white light.

The chromatic converter filter 5 comprises a film or lamination in which an organic fluorescent pigment 5b of a relatively high transparency is blended with or uniformly scattered in a matrix 5a of a transparent resin, e.g., acrylic resin. Thus the chromatic converter filter 5 has substantially the same structure as a film of a colored transparent resin.

The EL panel 1 further comprises an insulating layer 6 and a moistureproof casing film 7. The insulating layer 6 is sandwiched between the luminescent layer 4 and the back electrode 2 to prevent a short circuit between the back electrode 2 and the transparent electrode 3. The casing film 7 protects the fluorescent layer 4 from a deterioration due to moisture. Both of the insulating film 6 and the casing film 7 are produced in a conventional manner. Since the organic fluorescent pigment 5b is blended with the transparent resin 5a, the transparent resin 5a seals particles of the organic fluorescent pigment 5b from outside air to increase life or durability of the organic fluorescent pigment 5b.

FIG.2 is a graph indicative of a result of sunlight exposure test of the EL panel 1. FIG.2 further shows results of sunlight exposure test of the prior-art EL panels of FIGS.3 and 4 for comparison. The solid line F represents the result of sunlight exposure test of the inventive EL panel. The dotted line S represents the result of sunlight exposure test of the Prior-art EL panel of FIG.3. The dashed line M represents the result of sunlight exposure test of the prior-art EL panel of FIG.4. The X-values of chromaticity coordinates Y_{xy} of emitted lights from all of the inventive EL panel and the prior-art EL panels of FIGS.3 and 4 are measured. The fading of the emitted lights from all of them were confirmed. Y-axis represents x-values of chromaticity coordinate Y_{xy} . X-axis represents test days. As shown in the line M, the x-value of chromaticity coordinates Y_{xy} of the prior-art EL panel of FIG.3 is lowered under the bottom value (=0.28) of whiteness about 30 days after start of the test. As shown

in the line S, the x-value of chromaticity coordinates Y_{xy} of the prior-art EL panel of FIG.4 is lowered under the bottom value 200 days and a fraction after start of the test. As shown in the line F, the x-value of chromaticity coordinates Y_{xy} of the inventive EL panel maintains a level at which the emitted light is recognizable as white light, even 500 days after start of the test.

In the embodiment described above, the organic fluorescent pigment 5b of the chromatic light converter filter 5 converts phosphorescence of the phosphor 4a into white light. However, the present invention is also applicable to a conversion of the phosphorescence into color visible light other than white light.

The present invention is not rigidly restricted to the embodiment described above. It is to be understood that a person skilled in the art can easily change and modify the present invention without departing from the scope of the invention defined in the appended claims.

Claims

1. An electroluminescent device having a light-emitting surface, comprising:
 - a layer of phosphor capable of producing a luminescence and directing the luminescence to the light-emitting surface when said layer of phosphor is excited by a voltage; and
 - a chromatic light converter filter converting the luminescence into a light of a color different from the color of the luminescence, said chromatic light converter filter being provided on a light-emitting surface side of the electroluminescent device, said chromatic light converter filter comprising a film made of a transparent resin and of an organic fluorescent pigment mixed with the transparent resin.
2. The electroluminescent device having a light-emitting surface as recited in claim 1, wherein said chromatic light converter filter converts the luminescence into white light.
3. The electroluminescent panel as recited in claim 1, wherein said film is produced in the steps of blending powder of the organic fluorescent pigment with powder of the transparent resin and transforming the resulting mixture into said film.
4. An electroluminescent panel, comprising:
 - a panel-shaped casing having a transparent flat portion the exterior surface of which constitutes a light-emitting surface of the electroluminescent panel;
 - a layer of phosphor housed in said casing,

said layer of phosphor being capable of producing luminescence and directing the luminescence to the light-emitting surface when said layer of phosphor is excited by a voltage; and

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a chromatic light converter filter converting the luminescence into a light of a color different from the color of the luminescence, said chromatic light converter filter being attached to the light-emitting surface, said chromatic light converter filter comprising a film made of a transparent resin and of an organic fluorescent pigment mixed with the transparent resin.

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5. The electroluminescent panel as recited in claim 4, wherein said chromatic light converter filter converts the luminescence into white light.

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6. The electroluminescent panel as recited in claim 4, wherein said film is produced in the steps of blending powder of the organic fluorescent pigment with powder of the transparent resin and transforming the resulting mixture into said film.

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FIG.1

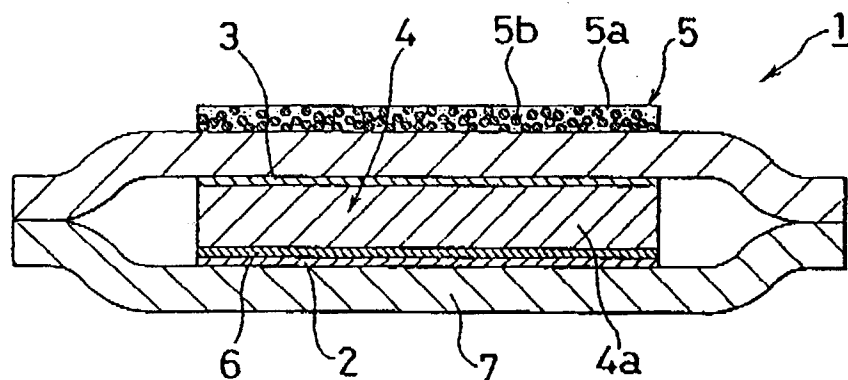


FIG.2

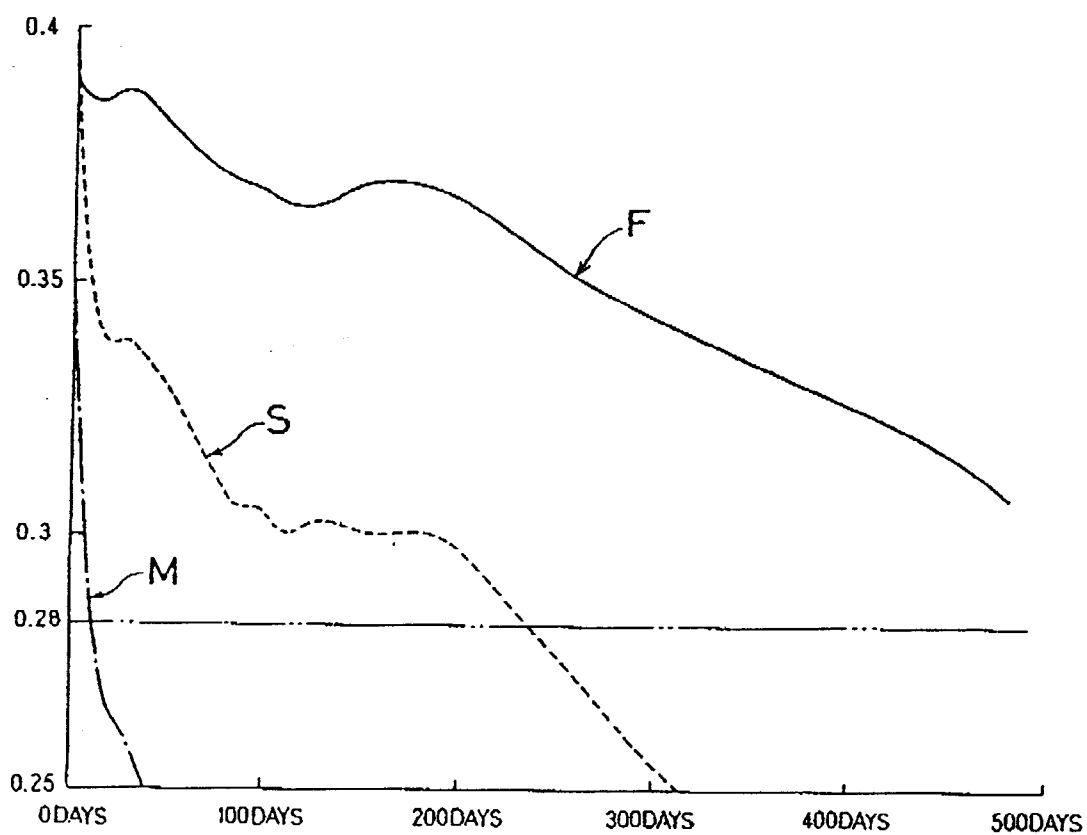


FIG.3

Prior Art

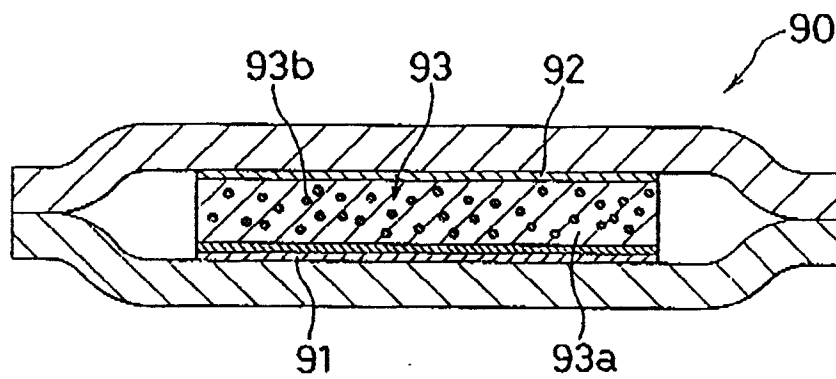
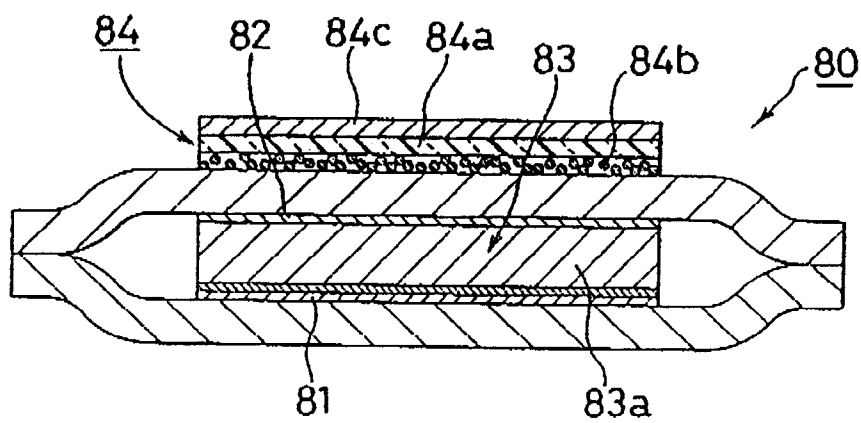


FIG.4

Prior Art





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 11 1947

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	EP-A-0 323 217 (LOCTITE) * the whole document * ---	1, 3, 4, 6	H05B33/12 H05B33/14 H05B33/02
X	DATABASE WPI Section Ch, Week 9110, Derwent Publications Ltd., London, GB; Class A85, AN 91-067947 & JP-A-3 014 540 (MITSUBISHI KASEI) 23 January 1991 * abstract * ---	1, 2, 4, 5	
A	EP-A-0 387 715 (IDEMITSU KOSAN) * the whole document * -----	1, 4	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			H05B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 29 October 1993	Examiner DROUOT, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			