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(54) LIGHT-EMITTING DEVICE

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See application file for complete search history.

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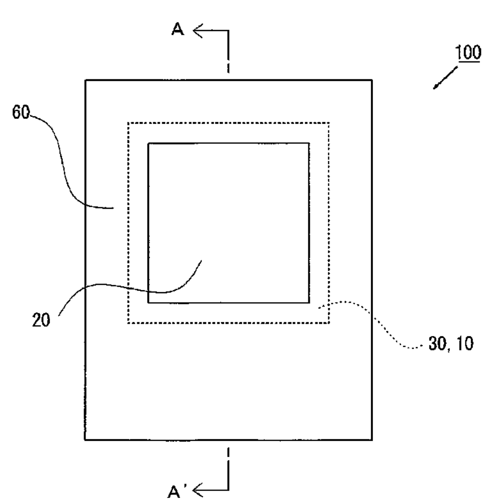
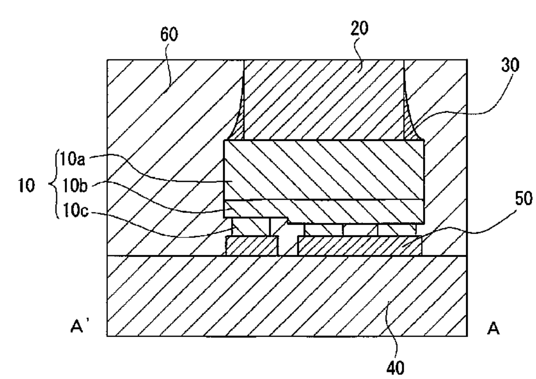
(57) ABSTRACT

A light emitting device includes a light emitting element, a first light transmissive member, a second light transmissive member, and a light reflective member. The first light transmissive member contains a first phosphor. The first light transmissive member is in contact with an upper surface of the light emitting element, and has an area smaller than the light emitting element in a plan view. The second light transmissive member contains a second phosphor. The second light transmissive member covers lateral surfaces of the first light transmissive member and a part of the upper surface of the light emitting element that is exposed from the first light transmissive member, with an upper surface of the first light transmissive member being not covered by the second light transmissive member. The light reflective member covers lateral surfaces of the second light transmissive member and lateral surfaces of the light emitting element.

13 Claims, 6 Drawing Sheets





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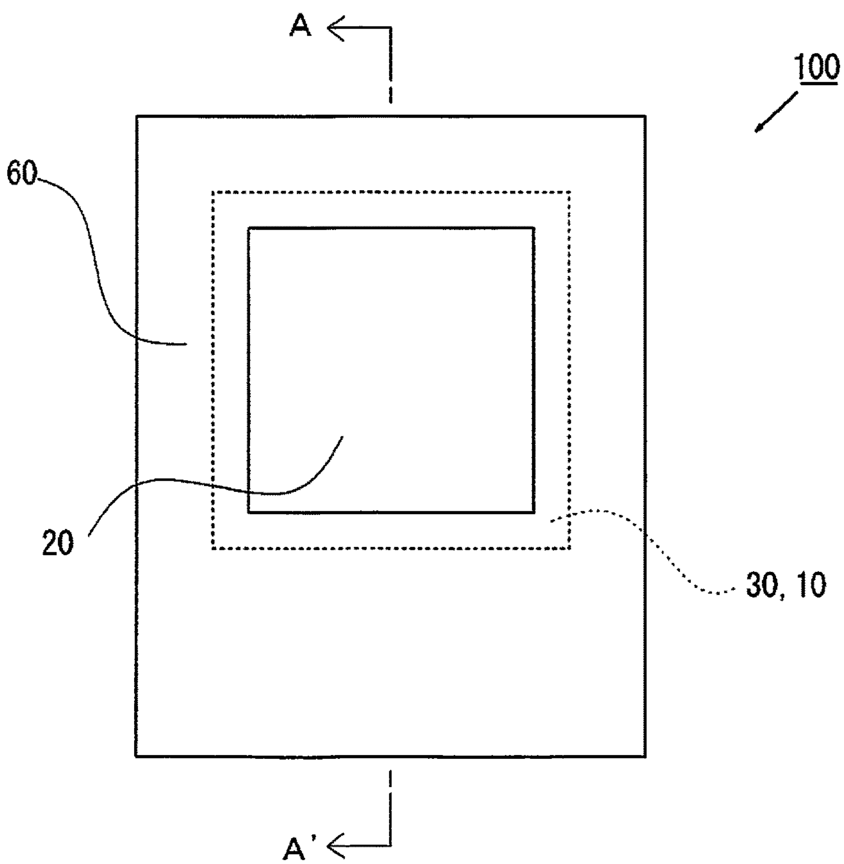

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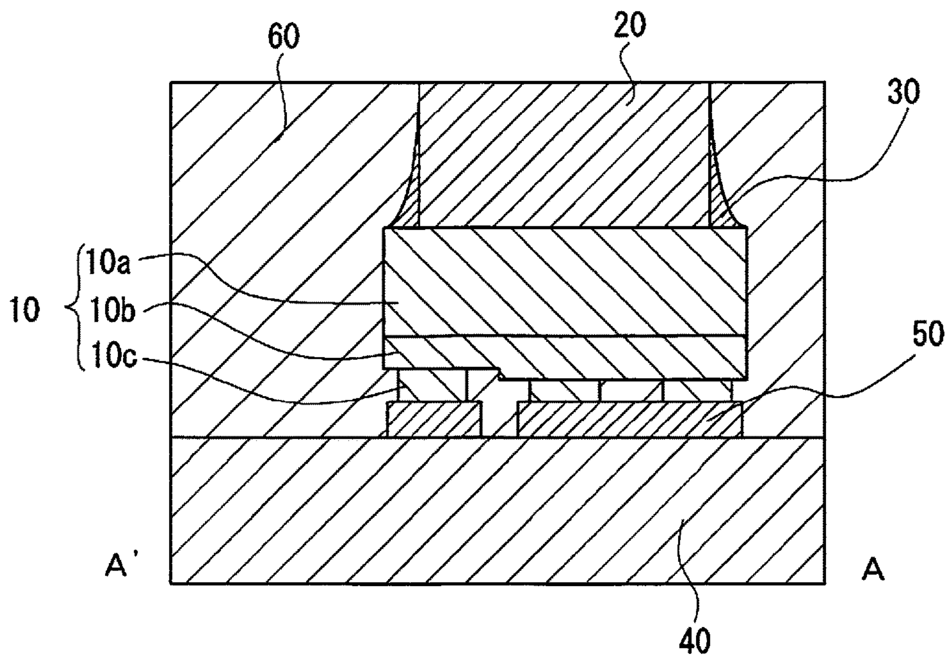

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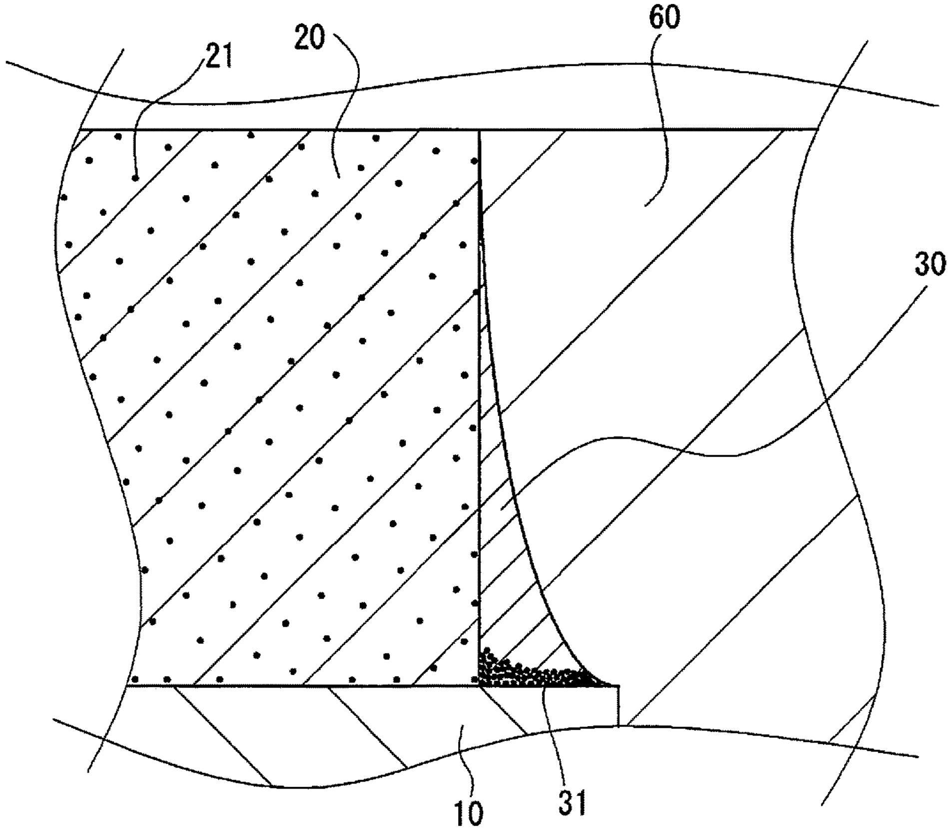

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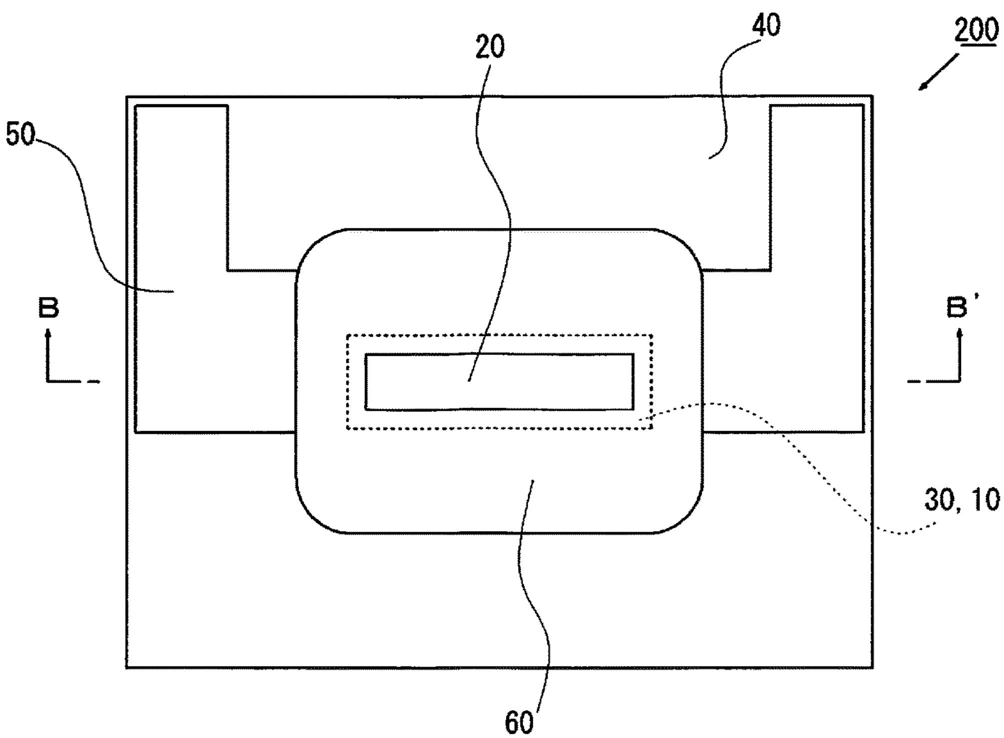

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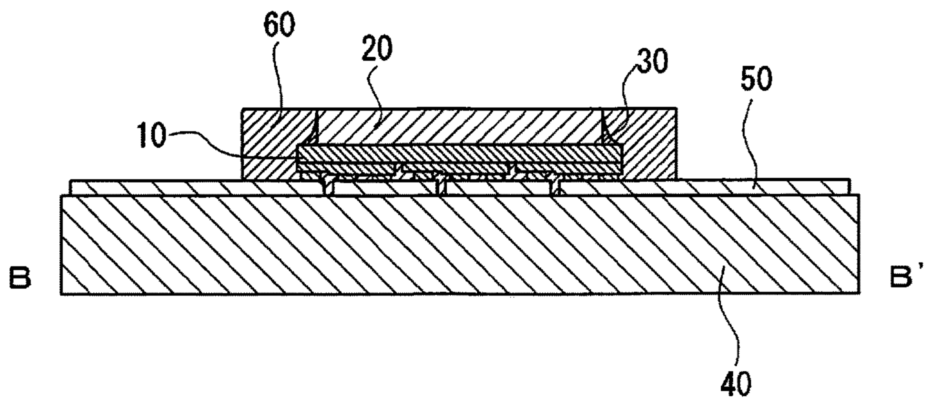

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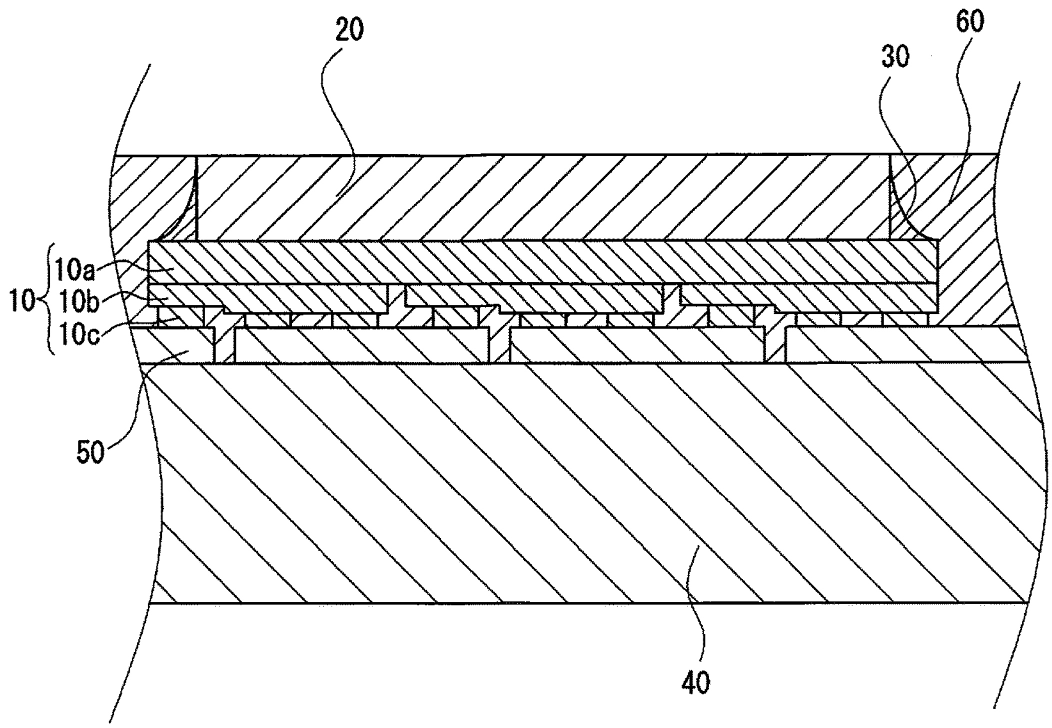

LIGHT-EMITTING DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to Japanese Patent Application No. 2016-151344, filed on Aug. 1, 2016, the disclosure of which is hereby incorporated by reference in its entirety.

BACKGROUND

The present disclosure relates to a light emitting device.

Light emitting elements are used as high luminance light sources for, not only for lighting replacing a fluorescent light, but also for example, automotive headlights and other such light projectors, floodlight, and so forth that require high directionality and high luminance.

For example, a Japanese Patent Publication No. 2010-272847 discloses a light emitting device in which lateral surfaces of a light transmissive member adhering to and covering a light emitting element outwardly inclines toward a lower surface of the light transmissive member. The inclined lateral surfaces and a portion of the lower surface that is not in contact with the light emitting element are covered by a light reflective member, in order to realize high luminance.

SUMMARY

Light emitting devices used for vehicle component require a light sources having even higher luminance.

A light emitting device includes a light emitting element, a first light transmissive member, a second light transmissive member, and a light reflective member. The first light transmissive member contains a first phosphor. The first light transmissive member is in contact with an upper surface of the light emitting element, and has an area smaller than the light emitting element in a plan view. The second light transmissive member contains a second phosphor. The second light transmissive member covers lateral surfaces of the first light transmissive member and a part of the upper surface of the light emitting element that is exposed from the first light transmissive member, with an upper surface of the first light transmissive member being not covered by the second light transmissive member. The light reflective member covers lateral surfaces of the second light transmissive member and lateral surfaces of the light emitting element.

With the certain embodiment disclosed herein, a high-luminance light emitting device can be produced.

BRIEF DESCRIPTION OF DRAWINGS

A more complete appreciation of the disclosure and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings.

FIG. **1**A is a schematic plan view showing a light emitting device of a first embodiment according to the present disclosure.

FIG. **1**B is a schematic cross-sectional view taken along lines A-A' in FIG. **1**A.

FIG. **1**C is a schematic cross-sectional view showing a periphery of a second light transmissive member of the first embodiment.

FIG. **2**A is a schematic plan view showing a light emitting device of a second embodiment according to the present invention.

FIG. **2**B is a schematic cross-sectional view taken along lines B-B' in FIG. **2**A.

FIG. **2**C is a schematic cross-sectional view showing a periphery of a light emitting element of the light emitting device according to the second embodiment.

DESCRIPTION

There is a case where a magnitude or positional relation of members illustrated in each drawing is exaggerated so as to clarify the description. In the description below, the same term or reference number represents the same or homogenous member in principle, and its detailed description will be omitted as appropriate. The description given in certain examples and embodiments are applicable to the other examples and embodiments.

First Embodiment

A light emitting device **100** according to the present disclosure includes a light emitting element **10**, a first light transmissive member **20**, a second light transmissive member **30**, and a light reflective member **60** as shown in FIG. **1**A to FIG. **1**C. The first light transmissive member **20** is in contact with an upper surface of the light emitting element **10**, has an area smaller than the light emitting element **10** in a plan view, and contains a first phosphor **21**. The second light transmissive member **30** exposes an upper surface of the first light transmissive member **20**, covers lateral surfaces of the first light transmissive member **20** and a part of the upper surface of the light emitting element **10** that is exposed from the first light transmissive member **20**, and contains a second phosphor **31**. The light reflective member **60** covers lateral surfaces of the second light transmissive member **30** and lateral surfaces of the light emitting element **10**.

The elements and members are described in detail below.

Light Emitting Element **10**

For the light emitting element **10**, a semiconductor light emitting element such as light emitting diode can be used. The light emitting element **10** having an appropriate wavelength can be selected. The light emitting element **10** can include a light transmissive substrate **10***a*, a semiconductor layered body **10***b* formed on the light transmissive substrate **10***a*, and a set of positive and negative electrodes **10***c* provided on a surface of the semiconductor layered body **10***b*. The number of the light emitting element **10** included in a light emitting device can be one or more. The light emitting element **10** may has a structure of a single semiconductor layered body **10***b* provided on a single light transmissive substrate **10***a*, or a structure of a plurality of semiconductor layered bodies **10***b* provided on the single transmissive substrate **10***a*.

The semiconductor layered body **10***b* provided in the light emitting element **10** is a multilayered semiconductor body. As an example, a semiconductor layered body can include three semiconductor layers configured with a first conductive semiconductor layer (i.e., n-type semiconductor layer), a light emitting layer (i.e., active layer), and a second conductive semiconductor layer (i.e., p-type semiconductor layer). In case of a semiconductor layer capable of emitting ultraviolet light or visible light in a range of blue light to green light, a semiconductor layer can be formed of a semiconductor material such as a Group III-V compound semiconductor material and a Group II-VI compound semiconductor material, for example. Specifically, nitride-based semiconductor material such as $In_XAl_YGa_{1-X-Y}N$ ($0 \leq X$, $0 \leq Y$, $X+Y \leq 1$) can be used.

For the light transmissive substrate **10***a* in the light emitting element **10**, in the case of nitride semiconductor materials as mentioned above, a insulating material having light transmission such as sapphire (Al_2O_2) or spinel ($MgAl_2O_4$), or semiconductor materials transmitting light from a semiconductor layered body (e.g., nitride semiconductor material) can be used. The term "light transmission" may refer to a property capable of transmitting 60% or more, preferably 80% or more of light emitted from a light emitting element.

The set of electrodes **10***c* of light emitting element **10** are disposed on one surface of the semiconductor layered body **10***b* (i.e., the opposite surface of the light transmissive substrate **10***a*). In the light emitting element **10**, the surface, on which the set of electrodes **10***c* are formed, is defined as a lower surface thereof, and an upper surface opposite the lower surface is defined as a light extraction surface (i.e., a surface of the light transmissive substrate **10***a*). Each of the electrodes **10***c* may have a single layer structure or multi-layer structure as long as the above-mentioned first conductive semiconductor layer and second conductive semiconductor layer are respectively connected to the corresponding electrodes **10***c* to make ohmic connection that provides linear or almost linear current-voltage characteristic. Such electrodes may employ a material and structure that are known in the art, and may be formed in a desired thickness. Examples of suitable electrodes include metal such as Cu, Au, AuSn.

First Transmissive Member **20**

The first transmissive member **20** is disposed on the upper surface of the light emitting element **10**, and capable of transmitting and outputting light emitted from the light emitting element **10**. The first transmissive member **20** contains a first phosphor **21**. The light transmissive member **20** includes an upper surface, a lower surface opposite the upper surface, lateral surfaces positioned between the upper surface and the lower surface. The upper surface is a light emitting surface of the light emitting device **100** serving as a surface outputting light from the light emitting element **10**, and the lower surface is a surface covering the light emitting surface of the light emitting element **10**.

Preferably, the upper surface and the lower surface of the first light transmissive member **20** are both substantially flat surfaces and substantially parallel to each other. The term "substantially parallel" in the present specification may have ±5% of tolerance of inclination with respect to one surface to the other surface. Such shape allows the light emitting device **100** to have uniform front luminance and less color non-uniformity on the upper surface of the light transmissive member **20** serving as the light emitting surface. The light transmissive member **20** has a thickness (i.e., a height from the lower surface and the upper surface), for example, 50 μm to 300 μm.

The first transmissive member **20** has an area smaller than that of the light emitting element **10**. In a plane view of the light emitting device **100**, an outer edge of the light transmissive member **20** is positioned inside an outer edge of the light emitting element **10**. Accordingly, with the upper surface of the light transmissive member **20** serving as the light emitting surface of the light emitting device **100**, the light emitting device **100** with high front luminance can be produced by narrowing the light emitting surface.

The lateral surfaces of the first light transmissive member **20** are preferably substantially flat, and substantially perpendicular to the upper surface of the first transmissive member **20**. Accordingly, with the upper surface of the light transmissive member **20** serving as the light emitting surface of the light emitting device **100**, a border is clearly defined between the upper surface of the first light transmissive member **20** serving as a light emission part of the light emitting device **100** and a light reflective member **60** (described below) surrounding the upper surface of the first light transmissive member **20**, thereby enabling realization of the light emitting device **100** in which a border is clearly defined between the light emission part and a non-light emission part. The term "substantially perpendicular" in the present specification refers that an angle defined by one surface and the other surface is approximately 90°±5°.

In the present embodiment, the first transmissive member **20** contains the first phosphor **21** capable of converting wavelength of at least a part of light emitted from the light emitting element **10**. By containing the first phosphor **21** in the first light transmissive member **20**, light extracted to outside from the upper surface of the first light transmissive member **20** is a mixture of light emitted from the light emitting element **10** and light experiencing wavelength conversion by the first phosphor **21**. Thus, by mixing blue light emitted from the light emitting element **10** and yellow light emitted from the first phosphor **21** resulting from wavelength conversion of a part of the blue light, the light emitting device **100** emitting white-color-based light can be obtained. Examples of the first light transmissive member **20** containing the first phosphor **21** include phosphor sintered body, and materials made of resins, glass, or other inorganic materials which contain a phosphor powder.

For the phosphor **21** contained in the first light transmissive member **20**, a phosphor excitable by light emitted from the light emitting element **10** can be used. For example, one of the specific examples listed below can be used alone, or two or more thereof can be used in combination. Examples of phosphors excitable by light emitted from a blue light emitting element or an ultraviolet light emitting element include: cerium-activated yttrium aluminum garnet-based phosphors (e.g., $Y_3(Al,Ga)_5O_{12}:Ce$); cerium-activated lutetium aluminum garnet-based phosphors (e.g., $Lu_3(Al,Ga)_5O_{12}:Ce$); europium- and/or chromium-activated nitrogen-containing calcium aluminosilicate-based phosphors (e.g., $CaO—Al_2O_3—SiO_2:Eu$); europium-activated silicate-based phosphors (e.g., $(Sr,Ba)_2SiO_4:Eu$); nitride-based phosphors, such as β-SiAlON phosphors (e.g., $Si_{6-Z}Al_ZO_ZN_{8-Z}:Eu$ ($0<Z<4.2$)), CASN-based phosphors (e.g., $CaAlSiN_3:Eu$), and SCASN-based phosphors (e.g., $(Sr,Ca)AlSiN_3:Eu$); manganese-activated potassium fluorosilicate-based phosphors (e.g., $K_2SiF_6:Mn$); sulfide-based phosphors; and quantum dot phosphors. By combining one or more phosphors with a blue or ultraviolet light emitting element, desired emission color of light emitting devices (e.g., a white light emitting device) can be produced. In the case of a white light emitting device, types and concentrations of the one or more phosphors contained in the first light transmissive member **20** are adjusted to generate white light. In the case where such one or more phosphors are contained in the first light transmissive member **20**, concentrations of the phosphors are preferably, for example, 5 mass % to 50 mass %.

The first light transmissive member **20** can contain one or more light diffusion materials in addition to the phosphors.

Examples of the light diffusion material capable of being contained in the first light transmissive member **20** include titanium oxide, barium titanate, aluminum oxide, silicon oxide, or the like.

Joining of First Light Transmissive Member and Light Emitting Element

Preferably, the light emitting element **10** and the first light transmissive member **20** are directly joined together without using a joining material such as an adhesive agent. The term "directly join" as used herein refers to joining an interface to be joined (i.e., an upper surface of the light emitting element **10** and the lower surface of the first light transmissive member **20**) using atomic bonding, but not using a joining material such as an adhesive agent.

By directly joining the first light transmissive member **20** and the light emitting element **10**, heat dissipation of the first light transmissive member **20** can be increased, thereby enhancing reliability of the light emitting device **100**. Specifically, the first light transmissive member **20** contains one or more phosphors, and heat generated by phosphors can be efficiently dissipated through the light emitting element **10**.

Methods of the direct joining suitable for the present embodiment can be, for example, surface activated joining, atomic diffusion joining, hydroxyl group joining, or the like. The surface activated joining is performed by irradiating an interface with inactive ion in an ultrahigh vacuum environment in order to clean and activate surfaces to be joined (See International Patent Publication No. 2011/126000). The atomic diffusion joining is performed by sputtering a metal in an ultrahigh vacuum environment to join surfaces with metal diffusion. It is confirmed that the joining can be performed without affecting light extraction by making the sputtered film sufficiently thin (See Japanese Patent Publication No. 2015-29079). In the case of atomic diffusion joining, the light emitting element **10** and the first light transmissive member **20** are joined interposing a sufficiently thin metal film that does not substantially affect light extraction. In the present disclosure, however, atomic diffusion joining is regarded that the light emitting element **10** and the first light transmissive member **20** are directly in contact with each other. In the case of hydroxyl group joining, hydroxyl groups are formed on an interface to be joined, and the light emitting element **10** and the first light transmissive member **20** are joined together by hydrogen bonding using hydroxyl groups (See Japanese Patent Publication No. 2014-232866). The above-mentioned three joining methods can be performed at room-temperature, however in some cases, heat treatment can be performed as necessary to enhance joining strength. In such cases, heat treatment can be performed at 400° C. or less, preferably at 300° C. or less, more preferably at 200° C. or less.

Second Light Transmissive Member **30**

The second light transmissive member **30** exposes an upper surface of the first light transmissive member **20**, while covering the lateral surfaces of the first light transmissive member **20**, the part of the upper surface of the light emitting element **10** that are exposed on the first light transmissive member **20**. The second light transmissive member **30** contains the second phosphor **31**. In the upper surface of the light emitting element **10** serving as a joined surface with the first light transmissive member **20**, the second light transmissive member **30** preferably covers the part of the upper surface of the light emitting element **10** that is exposed from the first light transmissive member **20**. With this structure, light emitted from the part of the upper surface of the light emitting element **10** that is exposed from the first light transmissive member **20** is incident on the second light transmissive member **30** containing the second phosphor **31**, then is converted the wavelength by the second phosphor **31**.

The second light transmissive member **30** covers at least one portion of the lateral surfaces of the first light transmissive member **20**. For example, the lateral surfaces of the first light transmissive member **20** may be entirely covered by the second light transmissive member **30**, or may each have a portion that is partially exposed from (not covered by) the second light transmissive member **30** at the upper surface side. In this case, the greatest length of an portion of the lateral surfaces of the first light transmissive member **20** exposed from the second light transmissive member **30** is about ⅕ or less than the height of the first light transmissive member **20** (i.e., a distance between the upper surface and the lower surface of the first light transmissive member **20**). When the second light transmissive member **30** covers the first light transmissive member **20** up to an edge of its upper surface, a width of the second light transmissive member **30** is preferably thin at the above-mentioned portion of the first light transmissive member **20** covered by the second light transmissive member **30**, in a cross-sectional view. Specifically, the width of the second light transmissive member **30** covering the above-mentioned portion of the first light transmissive member **20** is preferably 10 μm or less, in a cross-sectional view. This structure can discourage light from directly exiting from the second light transmissive member **30**. Accordingly, a luminance difference is clearly defined between the upper surface of the first light transmissive member **20** serving as the light emission part of the light emitting device **100** and the peripheral edge of the light emission part serving as a non-light emission part (i.e., an upper surface of the light reflective member **60** surrounding the first light transmissive member **20**), thereby enabling realization of the light emitting device **100** with clear difference of luminance and less color non-uniformity.

A cross-sectional shape of the second light transmissive member **30** may be a triangular defined by, for example, the upper surface of the light emitting element **10** exposed form the first light transmissive member **20** and one of the lateral surfaces of the first light transmissive member **20**. A width of the second light transmissive member **30** that covers the lateral surfaces of the first light transmissive member **20** preferably differs depending on a position of the lateral surfaces of the first light transmissive member **20** in the height direction. Specifically, the width of the second light transmissive member **30** is preferably tapered toward the upper surface. More specifically, the second light transmissive member **30** has curved outer surfaces at a later-described light reflective member **60** side. This curved surfaces are preferably in contact with both of the lateral surfaces of the first light transmissive member **20** and an upper edge of the light emitting element **10**, and preferably are concave to the light reflective member **60** side. Such a shape can form an appropriate light reflective surface by the light reflective member **60** extending along with the second light transmissive member **30**. This can allow light emitted from the light emitting element **10** to be reflected by the light reflective surface of the light reflective member **60**, therefore the reflected light can travel toward light emitting surface side of the light emitting device **100**. This allows the light emitting device **100** to provide enhanced light extraction efficiency, even higher luminance, and higher luminous flux.

It is preferable that the second light transmissive member **30** continuously covers outer lateral surfaces of the first light transmissive member **20**. In other words, it is preferable that the second light transmissive member **30** continuously covers the lateral surfaces of the first light transmissive member **20** and the part of the upper surface of the light emitting element **10** that is exposed from the first light transmissive member **20**, in such a manner as to be along the outer periphery of the first light transmissive member **20**. Accordingly, light emitted from the part of the upper surface of the light emitting element **10** that is exposed from the first light transmissive member **20** tends to be incident in the first light transmissive member **20** interposing the second light transmissive member **30**, thereby enabling realization of the light emitting device **10** with high luminance and high luminous flux.

The second light transmissive member **30** is preferably formed of a material containing a resin for ease of handling and processing, and the resin material preferably contains the second phosphor **31**. Examples of the resin material include one or more resins selected from the group consisting of silicone resins, modified silicone resins, epoxy resins, modified epoxy resins, acrylic resin, and fluorine resin, or hybrid resin thereof. The second light transmissive member **30** can be formed on the outer periphery of the first light transmissive member **20** and the upper surface of the light emitting element **10** by a known method such as printing, jetting, molding, potting, or the like, while the first light transmissive member **20** and the light emitting element **10** are joined together. Specifically, the potting method is preferable, because the curved surfaces of the second light transmissive member **30** can be readily formed in such a manner as to be concave to the later-described light reflective member **60** side.

The second phosphor **31** contained in the second light transmissive member **30** is preferably arranged on the lower side of the second light transmissive member **30**. In other words, it is preferable that near the light emitting element **10** is, higher the density of particles of the second phosphor **31** contained in the second light transmissive member **30** becomes. Light from the light emitting element **10** is incident on the lower surface of the second light transmissive member **30**. Therefore, arranging the particles of the second phosphor **31** more densely at the lower side of the light transmissive member **30** can discourage multiple light diffusion in the second light transmissive member **30**, thereby enabling effective wavelength conversion. The above-mentioned structure allows heat generated at the phosphor particles to be effectively dissipated. When the second light transmissive member **30** is formed of a resin material containing the second phosphor **31**, the second light transmissive member **30**, in which the particles of the second phosphor **31** are densely arranged at the lower side thereof, can be readily formed by settling the particles of the second phosphor **31** in the resin member.

For the second phosphor **31** contained in the light transmissive member **30**, a phosphor that can be excited by light emitted from the light emitting element **10**. For example, the second phosphor **31** can employ a phosphor selected from the above-mentioned specific examples of the first phosphor **21**.

A different type of phosphor or combination of phosphors can be used for the first phosphor **21** and the second phosphor **31**, however, at least one phosphor contained in either the first phosphor **21** or the second phosphor **31** is preferably contained in the other one of those. When the same type of phosphor is contained in the first phosphor **21** and the second phosphor **31**, it can be discouraged that color non-uniformity and chromaticity shift due to temperature change on the light emitting surface of the light emitting device **100**.

Light Reflective Member 60

The light emitting device **100** includes a light reflective member **60** that surrounds light emitting element **10**, the first light transmissive member **20**, and the second light transmissive member **30**. Specifically, the light transmissive member **60** is disposed in such a manner as to cover the lateral surfaces of the first light transmissive member **20** and the upper surface of the light emitting element **10** interposing the second light transmissive member **30**. When the portion of each of the lateral surfaces of the first light transmissive member **20** are exposed from the second light transmissive member **30**, the light reflective member **60** is disposed in such a manner as to directly cover the portion of each of the lateral surfaces of the first light transmissive member **20** that are exposed from the second light transmissive member **30**. The lateral surfaces of the light emitting element **10** that are not covered by the second light transmissive member **30** are covered by the light reflective member **60**. The upper surface of the first light transmissive member **20** is exposed from the light reflective member **60**, serving as the light emitting surface of the light emitting device **100**.

When the light emitting element **10** is disposed on a mounting board **40**, the light reflective member **60** is preferably disposed between the light emitting element **10** and the mounting board **40**. When the light emitting element **10** includes a plurality of semiconductor layered bodies as shown in FIGS. **2**B and **2**C, the light reflective member **60** is preferably disposed between each of the plurality of semiconductor bodies. This is because light emitted by one of the multi-layer semiconductor bodies is less likely to be attenuated by traveling to an adjacent semiconductor body, thereby increasing the light extraction efficiency.

The light reflective member **60** can be formed of a material capable of reflecting light emitted from the light emitting element **10**. Specifically, the light reflective member **60** can be formed by adding at least one light reflective substance to the same or similar resin material as that of the second light transmissive member **30**. Examples of the light reflective substance include titanium oxide, silicon oxide, zirconium oxide, potassium titanate, alumina, aluminum nitride, boron nitride, mullite, or the like. The light reflective substance content in the light reflective member **60** is preferably, for example, in a range between 30 and 60 parts by weight with respect to 100 parts by weight of the resin as a base material, more preferably in a range between 45 and 60 parts by weight. This light reflective substance content is preferable because light leakage to outside of the light emitting device can be discouraged or prevented.

The light reflective member **60** can be formed by, for example, injection molding, potting, printing, transfer molding, compression molding, or the like.

The light emitting device **100** can incorporates a protection device, such as Zener diode. Embedding the protection device in the light reflective member **60** can prevent or discourage reductions in light extraction attributable to absorption or blocking of the light from the light emitting element **10** by the protection device.

As described above, the upper surface of the first light transmissive member **20** is determined as the light emitting surface of the light emitting device **100** by the light reflecting member **60** that exposes the upper surface of the first light transmissive member **20** having an area smaller than the light emitting element in a plane view, and covers the lateral surfaces continued from the upper surface. This can realize the light emitting device **100** with high front luminance by having a narrowed light emitting surface. High front luminance light emitting devices are especially suitable for vehicle lighting such as headlights. For vehicle lighting, emission colors of lighting or the like are specified by various standards. For example, the standards specify that light emitted from a headlight shall be white or yellow color, and shall be a single color as a whole.

In the present disclosure, high density of light exits from lateral side areas of the first light transmissive member **20** and an area on the upper surface of the light emitting element **10** exposed from the first light transmissive member **20** because light from the lateral surfaces of the first light transmissive member **20** and light from the upper surface of the light emitting element **10** are concentrated. Therefore, it is considered that the light reflective member **60** may be cracked or delaminated at the area where light from a plurality of directions is concentrated. When a crack or delamination is generated at the light reflective member **60** of a light emitting device in which the first light transmissive member **20** or the second light transmissive member **30** does not exist between the light reflective member **60** and the upper surface of the light emitting element **10**, light emitted from the upper surface of the light emitting element **10** may leak from the light emitting surface of the light emitting device passing through the crack or delaminated part. For example, the light emitting device **100** emitting white light that is created by mixing blue light from the light emitting element **10** and yellow light having experienced wavelength conversion by portion of the blue light, may be used for a vehicle lighting application. In this case, if blue light emitted from the light emitting element **10** leaks besides the white light from the light emitting surface, such a device does not comply with the above-mentioned standards for vehicle lighting applications, as a result, a safety of the vehicle may be impaired.

In the present embodiment, however, the second light transmissive member **30** containing the second phosphor **31** covers the portion of the upper surface of the light emitting element **10** that is exposed from the first light transmissive member **20**. Therefore, even when a crack is generated, light leaking from the crack would be mixed with light emitted from the first light emitting element **10** and wavelength converted light by the second phosphor **31**, hence light other than the mixed light is less likely to leak from a portion at the light emitting surface side of the light emitting device **100**. In the present embodiment, the second light transmissive member **30** covers portions around corners that the lateral surfaces of the first light transmissive member **20** are in contact with the upper surface of the light emitting element **10**. Accordingly, light is less likely to be concentrated on the portions around corners, and therefore, the generation of crack can be reduced.

Mounting Board 40

In the light emitting device **100**, the light emitting element **10** is mounted on the mounting board **40**, as shown in FIG. **1**A and FIG. **1**B. Examples of materials used for the mounting board **40** include insulating materials such as glass epoxy, resins, and ceramics; and metal materials on which an insulating material is formed. Specifically, the mounting board is preferably formed of a ceramic material with highly heat resistant and highly environmental resistant. Examples of ceramic materials include alumina, aluminum nitride, and mullite. These ceramic materials can also be combined with an insulating material, such as BT resin, glass epoxy, and epoxy-based resin.

The mounting board **40** having a wiring pattern **50** formed thereon to be connected to the light emitting elements **10** is used. The wiring pattern **50** can be formed using a metal, for example, copper, aluminum, gold, silver, platinum, titanium, tungsten, palladium, iron, and nickel, or an alloy of these. The wiring pattern formed on the upper surface of the mounting board is preferably covered by a highly reflective material, such as silver or gold, in order for its uppermost surface to efficiently extract light from the light emitting elements **10**. The wiring pattern **50** can be formed by electroplating, electroless plating, vapor deposition, sputtering, or the like. When Au bumps are used to mount a light emitting element on the mounting board, for example, using Au on the uppermost surface of the wiring pattern can improve the bonding between the light emitting element and the mounting board.

Such mounting board can be one known in the art, and any mounting board for use in mounting a light emitting element and the like can be used.

Second Embodiment

A light emitting device **200** according to the present disclosure is described as below. As shown in FIG. **2**A to FIG. **2**C, the light emitting device in the second embodiment, differs from the light emitting device **100** of the first embodiment in that a light emitting element **10** includes a plurality of semiconductor layered bodies disposed on a single light transmissive substrate **10***a*. The light emitting device in the second embodiment **200** can also be a high luminance light emitting device having a narrowed light emitting surface by considering an upper surface of a first light transmissive member **20** to be a light emitting surface of the light emitting device **200**.

The light emitting device **200** with less non-uniformity in luminance or color can be produced because the plurality of semiconductor layered bodies are formed on the single light transmissive substrate. In FIG. **2**C, the plurality of the semiconductor layered bodies **10***b* is disposed under the light transmissive substrate **10***a*.

Regions between the plurality of semiconductor layered bodies are subject to concentration of light from multiple directions, therefore, as mentioned above, it is considered that a crack or delamination tends to be generated on a light reflective member **60** disposed between the semiconductor layered bodies. In the preset embodiment, however, the plurality of semiconductor layered bodies **10***b* are provided on the single light transmissive substrate **10***a*. Hence, if a crack or delamination is occurred at the light reflective member positioned between the plurality of the semiconductor layered bodies, light other than intended light emission color of the second light emitting device **200** is less likely to leak, because the upper surface of the light emitting element **10** (i.e., the surface of the light transmissive substrate) is covered by the second light transmissive member **30**.

The light emitting device of the present disclosure can be used for a variety of light sources, for example, lighting, various kinds of indicators, display, liquid crystal backlight lights, signaling devices, components installed in vehicles, and signage channel letters, as well as interior and exterior lighting for vehicles.

What is claimed is:

1. A light emitting device comprising:

a light emitting element;

a first light transmissive member containing a first phosphor, the first light transmissive member being in contact with an upper surface of the light emitting element, and having an area smaller than the light emitting element in a plan view;

a second light transmissive member containing a second phosphor, the second light transmissive member covering lateral surfaces of the first light transmissive member and a part of the upper surface of the light emitting element that is exposed from the first light transmissive member, with an upper surface of the first light transmissive member being not covered by the second light transmissive member; and

a light reflective member covering lateral surfaces of the second light transmissive member and lateral surfaces of the light emitting element.

2. The light emitting device according to claim 1, wherein a portion of each of the lateral surfaces at an upper surface side of the first light transmissive member is not covered by the second light transmissive member.

3. The light emitting device according to claim 1, wherein the light reflective member directly covers a portion of each of the lateral surfaces of the first light transmissive member that is not covered by the second light transmissive member.

4. The light emitting device according to claim 1, wherein the second light transmissive member includes at least one curved surface on a light reflective member side.

5. The light emitting device according to claim 4, wherein the at least one curved surface is concave to the light reflective member.

6. The light emitting device according to claim 1, wherein the second light transmissive member continuously covers the lateral surfaces of the first light transmissive member disposed on an outer side.

7. The light emitting device according to claim 1, wherein the first light transmissive member is a phosphor sintered body containing the first phosphor.

8. The light emitting device according to claim 1, wherein the second light transmissive member is a resin member containing the second phosphor.

9. The light emitting device according to claim 8, wherein the resin member is made of a silicone resin.

10. The light emitting device according to claim 1, wherein

a density of particles of the second phosphor contained in the second light transmissive member becomes higher toward a light emitting element side.

11. The light emitting device according to claim 1, wherein

the first phosphor and the second phosphor contain the same phosphor material.

12. The light emitting device according to claim 1, wherein

the light emitting element includes a plurality of semiconductor layered bodies per a single light transmissive substrate.

13. The light emitting device according to claim 1, wherein

the light emitting device emits white light.

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