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Inventor(s)	Nakamura; Tomoharu

Light-emitting device, display apparatus, and illumination apparatus

Abstract

Provided is a light-emitting device that makes it possible to emit, with high efficiency, light having higher uniformity. The light-emitting device includes a light source, a wavelength conversion unit, and a wall member. The light source is disposed on a substrate. The wavelength conversion unit includes a wavelength conversion member and a transparent member that contains the wavelength conversion member therein. The wavelength conversion member is disposed to face the light source in a thickness direction and converts first wavelength light from the light source to second wavelength light. The wall member is provided on a substrate and surrounds the light source in a plane that is orthogonal to the thickness direction. A region occupied by the wavelength conversion member is wider than a region surrounded by the wall member, and entirely overlaps with the region surrounded by the wall member in the thickness direction.

Inventors: **Nakamura; Tomoharu (Tokyo, JP)**

Applicant: **SATURN LICENSING LLC** (New York, NY)

Family ID: **1000008747461**

Assignee: **SATURN LICENSING LLC (New York, NY)**

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Primary Examiner: Maruf; Sheikh

Attorney, Agent or Firm: SATURN LICENSING LLC

Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS (1) This application is a continuation of U.S. patent application Ser. No. 16/952,643, filed on Nov. 19, 2020, which is a continuation of U.S. patent application Ser. No. 16/084,642, filed on Sep. 13, 2018 (now U.S. Pat. No. 10,877,346, issued on Dec. 29, 2020), which application is a national phase entry under 35 U.S.C. 371 of International Application No. PCT/JP2017/002717 filed on Jan. 26, 2017, which claims priority from Japanese Patent Application No. JP 2016-060359 filed on Mar. 24, 2016, all of which are incorporated herein by reference.

TECHNICAL FIELD

(1) The present disclosure relates to a light-emitting device, and a display apparatus and an illumination apparatus that include the light-emitting device.

BACKGROUND ART

(2) A light-emitting device using blue LEDs (Light Emitting Diode) is employed for a backlight of a liquid crystal display apparatus or an illumination apparatus. For example, PTL 1 describes a so-called direct backlight that generates white color light through the combination of a plurality of the blue LEDs disposed on a substrate and a wavelength conversion sheet that covers them as a whole. Further, PTL 2 discloses a surface light source that generates white color light. The surface light source includes, in order, a blue LED, a reflection plate, a diffusion sheet, and a phosphor layer that performs wavelength conversion, in a stacked manner. In addition, PTL 3 also discloses a light-emitting device that performs wavelength conversion on light from a light-emitting element.

CITATION LIST

Patent Literature

(3) PTL 1: Japanese Unexamined Patent Application Publication No. 2012-155999

(4) PTL 2: International Publication No. WO 2010/150516

(5) PTL 3: Japanese Unexamined Patent Application Publication No. 2009-140822

SUMMARY OF THE INVENTION

(6) Incidentally, it is generally desired strongly for such a light-emitting device to efficiently emit light having reduced luminance unevenness, reduced color unevenness, etc. in a plane.

(7) Therefore, it is desirable to provide a light-emitting device, and a display apparatus and an illumination apparatus that include the light-emitting device, that make it possible to emit, with high efficiency, light having higher uniformity in a plane.

(8) A light-emitting device according to an embodiment of the present disclosure includes a light source, a wavelength conversion unit, and a wall member. The light source is disposed on a substrate. The wavelength conversion unit is disposed to face the light source in a thickness direction, and includes a wavelength conversion member and a transparent member. The wavelength conversion member converts first wavelength light from the light source to second wavelength light. The transparent member contains therein the wavelength conversion member. The wall member is provided on a substrate and surrounds the light source in a plane that is orthogonal to the thickness direction. Here, a region occupied by the wavelength conversion member is wider than a region surrounded by the wall member, and entirely overlaps with the region surrounded by the wall member in the thickness direction.

(9) It is to be noted that “a wall member provided to surround each of the light sources” is a concept that encompasses not only a shape in which the wall member is integrally formed without any gap to surround the light source, but also a shape in which a slit is provided to a part of the wall member. The concept further encompasses a shape in which the wall member includes a plurality of parts, and the plurality of parts surround a single light source as a whole while each providing a slight gap therebetween.

(10) Further, a display apparatus and an illumination apparatus according to the respective embodiments of the present disclosure include the above-described light-emitting device.
(11) In the light-emitting device according to the embodiment of the present disclosure, the wavelength conversion member that is disposed to face the light source and performs wavelength conversion is contained in the transparent member. Therefore, it is possible to prevent the wavelength conversion member from being exposed to the external atmosphere including oxygen and moisture, and thereby the degradation of the wavelength conversion member is suppressed. Further, the region occupied by the wavelength conversion member is wider than the region surrounded by the wall member. In addition, the region occupied by the wavelength conversion member entirely overlaps with the region surrounded by the wall member in the thickness direction. Therefore, the first wavelength light from the light source is mostly converted to the second wavelength light. This leads to the improvement of conversion efficiency.
(12) Another light-emitting device according to an embodiment of the present disclosure includes a light source, a wall member, and a wavelength conversion unit. The light source is disposed on a substrate. The wall member is provided on the substrate and surrounds the light source in a plane that is orthogonal to a thickness direction. The wavelength conversion unit includes a wavelength conversion member and a transparent member. The wavelength conversion member is disposed to face the light source in the thickness direction and converts first wavelength light from the light source to second wavelength light. The transparent member is placed to be directly or indirectly in contact with the wavelength conversion member and the wall member. Here, a region occupied by the wavelength conversion member is wider than a region surrounded by the wall member, and entirely overlaps with the region surrounded by the wall member in the thickness direction.
(13) It is to be noted that “the transparent member is placed to be directly or indirectly in contact with the wavelength conversion member and the wall member” means that another member such as an adhesive may be provided between the wavelength conversion member and the transparent member, and between a plurality of wall members and the transparent member.
(14) In another light-emitting device according to the embodiment of the present disclosure, the region occupied by the wavelength conversion member is wider than the region surrounded by the wall member, and entirely overlaps with the region surrounded by the wall member in the thickness direction. Thus, the first wavelength light from the light source is mostly converted to the second wavelength light. Therefore, the conversion efficiency is improved. Further, the transparent member is placed to be directly or indirectly in contact with the wavelength conversion member and the plurality of the wall members. Therefore, high thermal dissipation is ensured, and the deterioration of the wavelength conversion member is suppressed. Moreover, the distance between the light source and the wavelength conversion member is made shorter, thereby improving the luminance efficiency.
(15) According to the light-emitting devices of the embodiments of the present disclosure, it is possible to suppress the deterioration of the wavelength conversion member and improve the conversion efficiency. Accordingly, it is possible to efficiently emit the light having reduced luminance unevenness or reduced color unevenness in a plane. Therefore, according to the display apparatus using this light-emitting device, it is possible to achieve display performance having superior color reproductivity, etc. Further, according to the illumination apparatus using this light-emitting device, it is possible to perform illumination to an object with more uniformity. It is to be noted that effects of the present disclosure are not limited to those described above, and may be any of effects that are described in the following.

Description

BRIEF DESCRIPTION OF DRAWINGS

(1) FIG. **1** is a perspective view of an entire configuration example of a light-emitting device according to a first embodiment of the present disclosure.

(2) FIG. **2** is an enlarged perspective view of a configuration of a light-emitting section illustrated in FIG. **1**.

(3) FIG. **3** is a cross-sectional view of a main part configuration of the light-emitting device illustrated in FIG. **1**.

(4) FIG. **4** is an enlarged cross-sectional view of a configuration of a light-emitting section illustrated in FIG. **3**.

(5) FIG. **5** is a cross-sectional view of a configuration of a first modification example of the light-emitting section illustrated in FIG. **1**.

(6) FIG. **6** is a cross-sectional view of a configuration of a second modification example of the light-emitting section illustrated in FIG. **1**.

(7) FIG. **7** is a cross-sectional view of a configuration of a third modification example of the light-emitting section illustrated in FIG. **1**.

(8) FIG. **8** is a cross-sectional view of a main part configuration example of a light-emitting device according to a second embodiment of the present disclosure.

(9) FIG. **9** is a perspective view of an appearance of a display apparatus according to a third embodiment of the present disclosure.

(10) FIG. **10** is an exploded perspective view of a main body section illustrated in FIG. **9**.

(11) FIG. **11** is an exploded perspective view of a panel module illustrated in FIG. **10**.

(12) FIG. **12**A is a perspective view of an appearance of a tablet terminal apparatus including a display apparatus of the present disclosure.

(13) FIG. **12**B is a perspective view of an appearance of another tablet terminal apparatus including the display apparatus of the present disclosure.

(14) FIG. **13** is a perspective view of an appearance of a first illumination apparatus including a light-emitting device of the present disclosure.

(15) FIG. **14** is a perspective view of an appearance of a second illumination apparatus including the light-emitting device of the present disclosure.

(16) FIG. **15** is a perspective view of an appearance of a third illumination apparatus including the light-emitting device of the present disclosure.

(17) FIG. **16**A is a characteristic diagram illustrating a chromaticity distribution at a location directly above a wavelength conversion unit in Experimental Example 1-1.

(18) FIG. **16**B is a characteristic diagram illustrating a chromaticity distribution at a location directly above the wavelength conversion unit in Experimental Example 1-2.

(19) FIG. **16**C is a characteristic diagram illustrating a chromaticity distribution at a location directly above the wavelength conversion unit in Experimental Example 1-3.

(20) FIG. **17** is a characteristic diagram illustrating, as a curved line, a variation of a chromaticity at a location directly above the wavelength conversion unit in Experimental Examples 1-1 and 1-3.

(21) FIG. **18**A is a characteristic diagram illustrating a chromaticity distribution of light that has passed through an optical sheet, in Experimental Example 1-1.

(22) FIG. **18**B is a characteristic diagram illustrating a chromaticity distribution of light that has passed through the optical sheet, in Experimental Example 1-2.

(23) FIG. **18**C is a characteristic diagram illustrating a chromaticity distribution of light that has passed through the optical sheet, in Experimental Example 1-3.

(24) FIG. **19** is a characteristic diagram illustrating, as a curved line, a variation of a chromaticity of light that has passed through the optical sheet, in Experimental Examples 1-1 and 1-3.

(25) FIG. **20** is a cross-sectional view of a configuration example of a light-emitting device as a fourth modification example of the present disclosure.

(26) FIG. **21** is a perspective view of a configuration example of a light-emitting section as a fifth modification example of the present disclosure.

MODES FOR CARRYING OUT THE INVENTION

(27) In the following, some embodiments of the present disclosure are described in detail with reference to the drawings. It is to be noted that description is given in the following order.

(28) 1. First Embodiment and Modification Examples Thereof

(29) An example of a light-emitting device including a wavelength conversion unit in which a wavelength conversion member is sealed inside a transparent member

(30) 2. Second Embodiment

(31) An example of a light-emitting device in which a wavelength conversion member is placed on a holder with a transparent member provided therebetween

(32) 3. Third Embodiment (Display Apparatus; Liquid Crystal Display Apparatus)

(33) 4. Application Examples of Display Apparatus

(34) 5. Application Examples of Illumination Apparatus

(35) 6. Experimental Examples

(36) 7. Other Modification Examples

1. First Embodiment

(37) [Configuration of Light-Emitting Device **1**]

(38) FIG. **1** is a perspective view of an entire configuration example of a light-emitting device **1** as a first embodiment of the present disclosure. FIG. **2** is an enlarged perspective view of a light-emitting section **11** as a main part of the light-emitting device **1**. FIG. **3** illustrates a cross section taken along the line illustrated in FIG. **1**. FIG. **4** is a further enlarged cross-sectional view of a single light-emitting section **11**. The light-emitting device **1** is used, for example, as a backlight that illuminates a transmissive liquid crystal panel from behind, or as an illumination apparatus in a room, etc. As illustrated in FIG. **1**, the light-emitting device **1** includes a plurality of light-emitting sections **11** and an optical sheet **50**. The plurality of light-emitting sections **11** are disposed, for example, in a matrix on a substrate **10**. The optical sheet **50** is so disposed, in common to the plurality of light-emitting sections **11**, as to face the plurality of light-emitting sections **11**. It is to be noted that FIG. **1** illustrates an example in which the plurality of light-emitting sections **11** are disposed along both an X-axis direction and a Y-axis direction that are orthogonal to each other; however, the present disclosure is not limited thereto.

(39) In the specification, a distance direction of the substrate **10** and the optical sheet **50** is defined as a Z-axis direction (a front-back direction or a thickness direction). A vertical direction in a main surface (the widest surface) of the substrate **10** and the optical sheet **50** is defined as an X direction, and a horizontal direction in the main surface thereof is defined as a Y direction.

(40) (Configuration of Light-Emitting Section **11**)

(41) With reference to FIGS. **2** to **4**, description is given of a configuration of the light-emitting section **11**. The plurality of light-emitting sections **11** each include a light-emitting element **12**, a holder **20**, and a wavelength conversion unit **30**. Here, the light-emitting element **12** is a specific example that corresponds to a “light source” of the present disclosure. The holder **20** is a specific example that corresponds to a “wall member” of the present disclosure. The wavelength conversion unit **30** is a specific example that corresponds to a “wavelength conversion unit” of the present disclosure.

(42) The light-emitting elements **12** are disposed in a matrix on a front surface **10**S of the substrate **10**. The light-emitting element **12** is a point light source. Specifically, the light-emitting element **12** includes an LED (Light Emitting Diode; light-emitting diode). The light-emitting element **12** includes, for example, an optical axis CL that coincides with the Z-axis direction. For example, the light-emitting element **12** faces a back surface **30**S2 (refer to FIG. **4**) of the wavelength conversion unit **30**. The light-emitting element **12** may include a package structure having a light-emitting layer that is contained in a resin layer, or may alternatively be a flip chip LED (light-emitting

diode) having a light-emitting layer provided in an exposed manner.
(43) The holder **20** is so provided as to surround a single light-emitting element **12** in an XY plane that is orthogonal to the Z-axis direction, on the front surface **10**S of the substrate **10**. The holder **20** forms an air layer between the light-emitting element **12** and the wavelength conversion unit **30**. In other words, the light-emitting element **12** is provided on the surface **10**S of the substrate **10** in an opening part located at the middle of the holder **20**. The center location in the XY plane of the holder **20** may coincide with the optical axis CL, for example. It is to be noted that the holder **20** may have a shape in which the holder **20** is integrally formed without any gap to surround the light-emitting element **12**. The holder **20** may alternatively have a shape in which a slit is so provided to a part of the holder **20** as to have a discontinued part. Further, the holder **20** may include a plurality of parts which are separated from each other. The plurality of parts may surround a single light-emitting element **12** as a whole while each providing a slight gap therebetween. Furthermore, in the present embodiment, a single light-emitting element **12** is provided on a single light-emitting section **11** basis, and the holder **20** surrounds the single light-emitting element **12**; however, the present disclosure is not limited thereto. For example, a plurality of light-emitting elements **12** may be provided to the single light-emitting section **11**, and the holder **20** may surround the plurality of light-emitting elements **12**.
(44) The holder **20** includes an inner wall surface **21** and a top surface **22**. The inner wall surface **21** faces the light-emitting element **12**. The top surface **22** is located on side opposite to the substrate **10**. The inner wall surface **21** is a reflection surface that reflects first wavelength light from the light-emitting element **12**. The inner wall surface **21** is so inclined as to be away from the light-emitting element **12**, as the inner wall surface **21** goes toward the wavelength conversion unit **30** from the substrate **10**. Therefore, the area of a region R**21**U surrounded by an upper end edge **21**TU of the inner wall surface **21** in the XY plane is larger than the area of a region R**21**B surrounded by a lower end edge **21**TB of the inner wall surface **21** in the XY plane. In other words, the area of the region R**21** in the XY plane, in a space surrounded by the inner wall surface **21** of the holder **20**, becomes gradually larger as the area of the region R**21** goes from the substrate **10** toward the wavelength conversion unit **30**.
(45) The holder **20** is formed, for example, by cutting-out from a plate-shaped member, injection molding, hot press molding, or the like. A constituent material of the holder **20** desirably includes a high thermally-conductive material having higher thermal conductivity than the thermal conductivity of the wavelength conversion unit **30**, for example. Specifically, examples thereof include a metallic material including at least one of aluminum (Al) or copper (Cu). Alternatively, as a constituent material of the holder **20**, a thermoplastic resin is also applicable, in addition to the metallic material. Examples of the thermoplastic resin include a polycarbonate resin, an acrylic resin such as PMMA (a polymethyl methacrylate resin), a polyester resin such as PET (polyethylene terephthalate), an amorphous copolymer polyester resin such as MS (a copolymer of methyl methacrylate and styrene), a polystyrene resin, and a polyvinyl chloride resin. Further, as in a light-emitting section **11**A as a first modification example illustrated in FIG. **5**, a thin film **21**F including a high reflectance material may be formed on the inner wall surface **21** of the holder **20**. Examples of the high reflectance material include an evaporated silver film, an evaporated aluminum film, or a multilayer film-reflection film. This makes it possible to improve the reflectance of the inner wall surface **21**, and further improve the light emission efficiency of the light-emitting device **1**. It is to be noted that the high reflectance material refers to a material having higher reflectance than the reflectance of a transparent material **32** of the wavelength conversion unit **30**, for example.
(46) In this light-emitting device **1**, the holder **20** including the inclined inner wall surface **21** is provided. This causes the first wavelength light emitted from the light-emitting element **12** to be reflected against the inner wall surface **21**, following which the first wavelength light travels toward the wavelength conversion unit **30**. Therefore, the inner wall surface **21** of the holder **20**

allows the first wavelength light that is emitted diagonally from the light-emitting element **12** (a direction inclined with respect to the Z-axis direction) to be raised in a front direction (+Z direction), which leads to the contribution to the improvement of front luminance.
(47) It is to be noted that, in the light-emitting device **1**, the dimension W**21** of the region R**21**U in the X-axis direction and the Y-axis direction is 3.5 mm, for example. The angle between the inner wall surface **21** and the front surface **10**S of the substrate **10** is 45°, for example. Further, the height H**20** (the dimension in the Z-axis direction) of the holder **20** is 0.55 mm, for example. Further, the dimension W**12** of the light-emitting element **12** in the X-axis direction and the Y-axis direction is 1 mm, for example. The height H**12** of a light-emitting point of the light-emitting element **12** is 0.3 mm, for example.
(48) The top surface **22** of the holder **20** is directly or indirectly in contact with the back surface **30**S**2** (described later) of the wavelength conversion unit **30**. This allows the holder **20** to so function as to hold the wavelength conversion unit **30**. It is to be noted that the direct contacting of the top surface **22** of the holder **20** with the back surface **30**S**2** of the wavelength conversion unit **30** refers to, for example, a state in which the top surface **22** is directly joined with the back surface **30**S**2**, through fusing, welding, or the like, without any other member interposed therebetween. Further, the direct contacting of the top surface **22** of the holder **20** with the back surface **30**S**2** of the wavelength conversion unit **30** refers to, for example, a state in which the top surface **22** is indirectly joined with the back surface **30**S**2** with another member such as an adhesive, a pressure sensitive adhesive, or the like, interposed therebetween.
(49) The wavelength conversion unit **30** is disposed between the light-emitting element **12** and the optical sheet **50** in the Z-axis direction. The wavelength conversion unit **30** includes a wavelength conversion member **31** and the transparent member **32** containing the wavelength conversion member **31**. The wavelength conversion unit **30** is so disposed as to face, in the Z-axis direction, the light-emitting element **12** surrounded by the holder **20**. In other words, the wavelength conversion unit **30** is so disposed as to cover a location directly above the light-emitting device **12**. The wavelength conversion unit **30** converts the wavelength of the light (the first wavelength light) that enters the back surface **30**S**2** from the light-emitting element **12** in the wavelength conversion member **31**, and outputs second wavelength light (converted light) from a front surface **30**S**1**, to thereby improve coloring characteristics, for example.
(50) The wavelength conversion member **31** includes a phosphor (fluorescent substance) such as fluorescent pigment, fluorescent dye, or the like, or a light-emitting substance having a wavelength converting action such as a quantum dot. The wavelength conversion member **31** is a member based on processing, into a sheet-shaped shape, of a resin including, for example, a fluorescent material or a light-emitting body.
(51) The wavelength conversion member **31** is excited by the first wavelength light from the light-emitting element **12**. The first wavelength light enters the back surface **31**S through the back surface **30**S**2**. The wavelength conversion member **31** performs wavelength conversion on the first wavelength light under the principle of fluorescence emission, etc., to thereby output the second wavelength light from the front surface **31**S**1**. The second wavelength light has a wavelength (second wavelength) that is different from that of the first wavelength. Here, the first wavelength and the second wavelength are not particularly limited. However, for example, in a case of a display device application, the first wavelength light may be blue color light (for example, a wavelength ranging from about 440 nm to about 460 nm), and the second wavelength light may be red color light (for example, a wavelength ranging from about 620 nm to about 750 nm) or green color light (for example, a wavelength ranging from about 495 nm to about 570 nm). In other words, a light-emitting element **12** is a blue color light source. In such a case, the wavelength conversion member **31** performs wavelength conversion on the blue color light into the red color light or the green color light.
(52) The wavelength conversion member **31** preferably includes a quantum dot. The quantum dot is

a particle having a long diameter in a range from about 1 nm to about 100 nm, and has a discrete energy level. An energy state of the quantum dot depends on a size thereof, and therefore, a change in the size allows for free selection of an emission wavelength. Further, emitted light of the quantum dot has a narrow spectrum width. A color gamut is expanded by combining light having such a steep peak. Therefore, the use of the quantum dot as a wavelength conversion material allows the color gamut to be expanded with ease. Moreover, the quantum dot has high responsiveness, thus allowing for efficient use of the light from the light-emitting element **12**. In addition, the quantum dot is high in stability as well. The quantum dot is, for example, a compound of Group 12 elements and Group 16 elements, a compound of Group 13 elements and Group 16 elements, or a compound of Group 14 elements and Group 16 elements. Examples of the quantum dot include CdSe, CdTe, ZnS, CdS, PdS, PbSe, and CdHgTe.
(53) In the XY plane, a region R**31** occupied by the wavelength conversion member **31** is wider than the region R**21**U surrounded by the upper end edge **21**TU of the holder **20**. Further, the region R**31** entirely overlaps with the region R**21**U surrounded by the holder **20** in the Z-axis direction (refer to FIG. **4**). In other words, the end edge of the wavelength conversion member **31** in the XY plane extends outside the upper end edge **21**TU of the holder **20**. Therefore, the first wavelength light from the light-emitting element **12** is prevented from directly entering the optical sheet **50** not through the wavelength conversion member **31**. In other words, all of the pieces of the first wavelength light from the light-emitting element **12** enter the wavelength conversion member **31** through the transparent member **32** and are subjected to wavelength conversion, following which the converted light travels toward the optical sheet **50**. As a result, luminance unevenness and color unevenness are sufficiently reduced.
(54) In addition, in the light-emitting device **1**, the dimension W**31** of the region R**31** occupied by the wavelength conversion member **31** in the X-axis direction and the Y-axis direction is 3 mm, for example. The dimension W**32**, in the X-axis direction and the Y-axis direction, of the region R**32** occupied by the transparent member **32** is 3.8 mm, for example. In addition, the thickness H**31** of the wavelength conversion member **31** is 0.2 mm, for example. The thickness H**32** of the transparent member **32** is 0.5 mm, for example.
(55) The transparent member **32** protects the wavelength conversion member **31** by sealing the wavelength conversion member **31** so that the wavelength conversion member **31** is not exposed to the air containing oxygen and moisture. The transparent member **32** includes, for example, a transparent material such as glass or resin. The wavelength conversion member **31** serves as an active part that performs wavelength conversion on the light from the light-emitting element **12**, while the transparent member **32** serves as a non-active part that allows incident light to transmit therethrough without performing wavelength conversion on the incident light.
(56) The wavelength conversion unit **30** is placed on the top surface **22** of the holder **20**. In other words, as described above, the back surface **30**S**2** of the wavelength conversion unit **30** (the transparent member **32**) is directly or indirectly in contact with the top surface **22** of the holder **20**, which allows the wavelength conversion unit **30** to be held by the holder **20**. In this light-emitting device **1**, a plurality of wavelength conversion members **31** (wavelength conversion units **30**) are so provided as to be divided for each light-emitting section **11**. Therefore, for example, as compared with a single wavelength conversion sheet that expands over the entire surface along the front surface **10**S of the substrate **10**, the amount of materials to be used is saved, which is advantageous in terms of cost saving and weight reduction.
(57) Further, in the light-emitting device **1**, as in a light-emitting section **11**B as a second modification example illustrated in FIG. **6**, for example, a low reflection layer **33** may be so provided as to cover the back surface **30**S**2**. The low reflection layer **33** has lower reflectance than the reflectance of the inner wall surface **21**. The first wavelength light that reaches the back surface **30**S**2** directly from the light-emitting element **12** or that is reflected against the inner wall surface **21** and then reaches the back surface **30**S**2** is less likely to be reflected against the back surface

30S**2**. This leads to the reduction. The first wavelength light emitted from the light-emitting element **12** is mostly subjected to wavelength conversion by the wavelength conversion member **31**.

(58) Further, in the light-emitting device **1**, as in a light-emitting section **11**C as a third modification example illustrated in FIG. **7**, for example, a wavelength selective reflection layer **34** may be so provided as to cover the back surface **30**S**2**. This is because it is possible to remove light components of unnecessary wavelength regions and select desired light components of wavelength regions to thereby allow the selected light component to enter the wavelength conversion member **31**.

(59) The optical sheet **50** is disposed to face the front surface **30**S**1** of the wavelength conversion unit **30**. The optical sheet **50** includes, for example, a diffusion plate, a diffusion sheet, a lens film, a polarization separating sheet, etc. Providing such an optical sheet **50** makes it possible to allow the light that is emitted diagonally from the light-emitting element **12** or the wavelength conversion unit **30** to be raised in the front direction, which leads to further improvement of front luminance.

[Workings and Effects of Light-Emitting Device **1**]

(60) In the light-emitting device **1**, the light-emitting element **12** of the light-emitting section **11** is a point light source. Therefore, the first wavelength light emitted from the light-emitting element **12** spreads in all 360-degree directions from the center of light emission of the light-emitting element **12**. The first wavelength light emitted from the light-emitting element **12** directly enters the back surface **30**S**2** of the wavelength conversion unit **30** as it is, or reflected against the inner wall surface **21** of the holder **20** followed by entering the back surface **30**S**2**. The first wavelength light that has entered the wavelength conversion unit **30** is converted to the second wavelength light by the wavelength conversion member **31**, following which the converted light is outputted from the front surface **30**S**1**. Finally, the converted light passes through the optical sheet **50** and is observed as light emission.

(61) In the light-emitting device **1** according to the present embodiment, the wavelength conversion member **31** that is disposed to face the light-emitting element **12** and performs wavelength conversion is contained in the transparent member **32**. Therefore, it is possible to prevent the wavelength conversion member **31** from being exposed to the air including oxygen and moisture, and thereby the degradation of the wavelength conversion member **31** is suppressed. Further, the region R**31** occupied by the wavelength conversion member **31** is wider than the region R**21**U surrounded by the holder **20**. In addition, the region R**31** entirely overlaps with the region R**21**U in the thickness direction. Therefore, the first wavelength light from the light-emitting element **12** is mostly converted to the second wavelength light without being leaked. Therefore, occurrence of color unevenness is suppressed, and the conversion efficiency at each light-emitting section **11** is improved. Accordingly, color unevenness and light emission efficiency for the entire light-emitting device **1** are also improved.

(62) In the light-emitting device **1** according to the present embodiment, the wavelength conversion unit **30** is placed on the top surface **22** in such a manner to be directly or indirectly in contact with the holder **20**. Therefore, heat of the wavelength conversion member **31** is absorbed by the holder **20** through the transparent member **32**, and thus, is easily dissipated to the outside. Therefore, high heat dissipation is ensured, and the deterioration of the wavelength conversion member **31** due to overheating is suppressed. Moreover, as compared with a case where the wavelength conversion unit **30** is spaced apart from the holder **20**, the distance between the light-emitting element **12** and the wavelength conversion member **31** becomes shorter. Therefore, the improvement of luminance efficiency is expected.

(63) In the light-emitting device **1** according to the present embodiment, the holder **20** has the reflection function of reflecting the first wavelength light from the light-emitting element **12** toward the wavelength conversion unit **30**. In addition, the holder **20** also has a holding function of holding the wavelength conversion unit **30**. This allows for a more compact configuration, which is

advantageous in terms of size reduction, higher integration, and lower cost reduction.
(64) As described, according to the light-emitting device **1**, it is possible to improve the conversion efficiency while suppressing the deterioration of the wavelength conversion member **31**. Accordingly, it is possible to efficiently emit the light having reduced luminance unevenness or reduced color unevenness in a plane. Therefore, according to a display apparatus using the light-emitting device **1**, it is possible to achieve display performance having superior color reproductivity, etc. Further, according to an illumination apparatus using this light-emitting device **1**, it is possible to perform further uniform illumination to an object.
2. Second Embodiment
(65) [Configuration of Light-Emitting Device **2**]
(66) FIG. **8** is an enlarged cross-sectional view of a main part of a light-emitting device **2** according to a second embodiment of the present disclosure. The light-emitting device **2** includes a wavelength conversion unit **30**A in place of the wavelength conversion unit **30**. In the wavelength conversion unit **30**A, the wavelength conversion member **31** is not sealed by the transparent member **32** but is placed on a sheet-shaped or plate-shaped transparent member **35**. The transparent member **35** includes a front surface **35**S**1** and a back surface **35**S**2**. The wavelength conversion member **31** is placed on the front surface **35**S**1**. The back surface **35**S**2** is in contact with the top surface **22** of the holder **20** directly or indirectly. The light-emitting device **2** has the similar configuration to that of the light-emitting device **1** according to the first embodiment, excluding these points.
(67) [Workings and Effects of Light-Emitting Device **2**]
(68) In such a light-emitting device **2** as well, the region R**31** occupied by the wavelength conversion member **31** is wider than the region R**21**U surrounded by the holder **20**. Further, the region R**31** entirely overlaps with the region R**21**U in the thickness direction. Therefore, the first wavelength light from the light-emitting element **12** is mostly converted to the second wavelength light without being leaked. Therefore, occurrence of color unevenness is suppressed, and the conversion efficiency at each light-emitting section **11** is improved. Accordingly, color unevenness and light emission efficiency for the entire light-emitting device **2** are also improved.
(69) In the light-emitting device **2**, the wavelength conversion unit **30**A is placed on the top surface **22** in such a manner to be directly or indirectly in contact with the holder **20**. Therefore, heat of the wavelength conversion member **31** is absorbed by the holder **20** through the transparent member **35**, and thus, is easily dissipated to the outside. Therefore, high heat dissipation is ensured, and the deterioration of the wavelength conversion member **31** due to overheating is suppressed. Moreover, as compared with a case where the wavelength conversion unit **30** is spaced apart from the holder **20**, the distance between the light-emitting element **12** and the wavelength conversion member **31** becomes shorter. Therefore, the improvement of luminance efficiency is expected.
(70) In the light-emitting device **2** according to the present embodiment, the holder **20** has the reflection function of reflecting the first wavelength light from the light-emitting element **12** toward the wavelength conversion unit **30**. In addition, the holder **20** also has a holding function of holding the wavelength conversion unit **30**. This allows for a more compact configuration, which is advantageous in terms of size reduction, higher integration, and lower cost reduction.
(71) Accordingly, it is expected that the light-emitting device **2** achieves similar effects to these of the light-emitting device **1**.
3. Third Embodiment
(72) FIG. **9** illustrates an appearance of a display apparatus **101** according to a third embodiment of the present technology. The display apparatus **101** includes the light-emitting device **1**, and is used as, for example, a low-profile television apparatus. The display apparatus **101** has a configuration in which a flat plate-shaped main body section **102** for image display is supported by a stand **103**. It is to be noted that the display apparatus **101** is used as a stationary type that is placed on a level surface such as a floor, a shelf, or a table with the stand **103** attached to the main body section **102**;

however, the display apparatus **101** may be used as a wall-mounted type with the stand **103** being detached from the main body section **102**.

(73) FIG. **10** illustrates the main body section **102** illustrated in FIG. **9** in an exploded manner. The main body section **102** includes, for example, a front exterior member (bezel) **111**, a panel module **112**, and a rear exterior member (rear cover) **113** in this order from front side (viewer side). The front exterior member **111** is a bezel-shaped member that covers a front circumferential section of the panel module **112**, and a pair of speakers **114** are disposed on the lower side of the front exterior member **111**. The panel module **112** is fixed to the front exterior member **111**, and a power supply board **115** and a signal board **116** are mounted on the rear side of the panel module **112**, and a mounting fixture **117** is fixed on the rear side of the panel module **112**. The mounting fixture **117** is adapted for mounting of a wall-mounting bracket, mounting of a board etc., and mounting of the stand **103**. The rear exterior member **113** covers a rear surface and side surfaces of the panel module **112**.

(74) FIG. **11** illustrates the panel module **112** illustrated in FIG. **10** in an exploded manner. The panel module **112** includes, for example, a front chassis (top chassis) **121**, a liquid crystal panel **122**, a bezel-shaped member (middle chassis) **123**, the optical sheet **50**, the light source unit **1**, a rear chassis (back chassis) **124**, and a timing controller board **127** in this order from the front side (viewer side). The light source unit **1** includes a plurality of the light-emitting sections **11** arranged on the substrate **10**.

(75) The front chassis **121** is a bezel-shaped metallic component that covers a front circumferential section of the liquid crystal panel **122**. The liquid crystal panel **122** has, for example, a liquid crystal cell **122**A, a source substrate **122**B, and a flexible substrate **122**C such as a COF (Chip On Film). The flexible substrate **122**C couples the liquid crystal cell **122**A the source substrate **122**B together. The bezel-shaped member **123** is a bezel-shaped resin component that holds the liquid crystal panel **122** and the optical sheet **50**. The rear chassis **124** is a metallic component of a metal such as iron (Fe), and contains the liquid crystal panel **122**, the bezel-shaped member **123**, and the light-emitting device **1**. The timing controller board **127** is also mounted on the rear side of the rear chassis **124**.

(76) In the display apparatus **101**, light from the light-emitting device **1** is caused to selectively transmit by the liquid crystal panel **122** to perform image display. Here, the display apparatus **101** includes the light-emitting device **1** having superior light emission efficiency and improved in-plane color evenness as described in the first embodiment, resulting in enhancement of display quality of the display apparatus **101**.

(77) It is to be noted that a case in which the display apparatus **101** includes the light-emitting device **1** according to the first embodiment has been described in the above-described embodiment. However, the display apparatus **101** may include the light-emitting device **2** according to the second embodiment, in place of the light-emitting device **1**.

4. Application Examples of Display Apparatus

(78) Hereinafter, description is given of application examples of the display apparatus **101** as described above to electronic apparatuses. Examples of the electronic apparatuses include a television apparatus, a digital camera, a notebook personal computer, a mobile terminal apparatus such as a mobile phone, and a video camera. In other words, the above-described display apparatus is applicable to electronic apparatuses in every field that display image signals inputted from the outside or image signals generated inside as images or video pictures.

(79) FIG. **12**A illustrates an appearance of a tablet terminal apparatus to which the display apparatus **101** according to the above-described embodiment is applied. FIG. **12**B illustrates an appearance of another tablet terminal apparatus to which the display apparatus **101** according to the above-described embodiment is applied. Each of these tablet terminal apparatuses includes, for example, a display section **210** and a non-display section **220**, and the display section **210** includes the display apparatus **101** according to the above-described embodiment.

5. Application Examples to Illumination Apparatuses

(80) Each of FIGS. **13** and **14** illustrates an appearance of a desktop illumination apparatus to which, for example, the light-emitting device **1** according to the above-described embodiment is applied. For example, this illumination apparatus includes an illuminating section **843** that is attached to a supporting post **842** provided on a base mount **841**, and the illuminating section **843** includes, for example, the light-emitting device **1**. Forming, for example, the substrate **10**, and the optical sheet **50** in curved shapes allows the illuminating section **843** to take any form, such as a cylindrical shape illustrated in FIG. **13** or a curved shape illustrated in FIG. **14**.

(81) FIG. **15** illustrates an appearance of an indoor illuminating apparatus to which, for example, the light-emitting device **1** of the above-described embodiment, etc., is applied. This illuminating apparatus has, for example, illuminating sections **844** that include, for example, the light-emitting device **1**. The appropriate number of illuminating sections **844** are disposed at appropriate spacing intervals on a ceiling **850**A of a building. It is to be noted that installation locations of the illuminating sections **844** are not limited to the ceiling **850**A, but the illuminating sections **844** may be installed at any location such as a wall **850**B or a floor (not illustrated) depending on the intended use.

(82) In these illuminating apparatuses, illumination is performed using light from, for example, the light-emitting device **1**. Here, the illuminating apparatuses each include, for example, the light-emitting device **1** having superior light emission efficiency and improved in-plane luminance distribution, resulting in enhancement of illumination quality.

6. Experimental Examples

Experimental Examples 1-1 to 1-3

(83) Samples of the light-emitting device **1** including the light-emitting sections **11** described in the above-described first embodiment were fabricated to compare states of color unevenness. Specifically, a light-emitting element **12** in a single light-emitting section **11** in the light-emitting device **1** was lighted, and chromaticity distribution at a location directly above the wavelength conversion unit **30** was measured. The results are as illustrated in FIGS. **16**A, **16**B, **16**C, and **17**. FIGS. **16**A, **16**B, and **16**C are characteristic diagrams illustrating chromaticity distribution in an XY plane. FIGS. **16**A, **16**B, and **16**C respectively correspond to Experimental Examples 1-1 to 1-3. In FIGS. **16**A, **16**B and **16**C, the horizontal axis represents positions in the X-axis direction, and the vertical axis represents positions in the Y-axis direction. FIG. **17** is a characteristic diagram illustrating, as a curved line, a variation of chromaticity in the X-axis direction. In FIG. **17**, the horizontal axis represents the distance (mm) from the optical axis CL in the X-axis direction, and the vertical axis represents chromaticity.

(84) Further, in each of the samples of the above-described light-emitting device **1**, 25 pieces of the light-emitting sections **11** were arranged each with the interval of 11 mm (5 rows×5 columns), and all of the light-emitting sections **11** were lighted to measure the chromaticity distribution of the light that has transmitted the optical sheet **50**. The results are illustrated in FIGS. **18**A, **18**B, **18**C, and **19**. FIGS. **18**A, **18**B, and **18**C are characteristic diagrams illustrating chromaticity distribution in an XY plane. FIGS. **18**A, **18**B, and **18**C respectively correspond to Experimental Examples 1-1 to 1-3. In FIGS. **18**A, **18**B and **18**C, the horizontal axis represents positions in the X-axis direction, and the vertical axis represents positions in the Y-axis direction. FIG. **19** is a characteristic diagram illustrating, as a curved line, a variation of chromaticity in the X-axis direction. In FIG. **19**, the horizontal axis represents the distance (mm) from the optical axis CL in the X-axis direction, and the vertical axis represents chromaticity.

(85) Here, the dimension W**31** of the wavelength conversion member **31** was set to 3.8 mm in Experimental Example 1-1, 4.0 mm in Experimental Example 1-2, and 3.5 mm in Experimental Example 1-3 (refer to FIG. **4**). Conditions other than the dimension thereof were the same in Experimental Examples 1-1 to 1-3. Specifically, the wavelength conversion unit **30** was set to have the thickness H**31** of 0.2 mm and the thickness H**32** of 0.5 mm. A quantum dot was used for the

wavelength conversion member **31**. Glass was used for the transparent member **32**. Further, the holder **20** was set to have the dimension W**21** of 3.5 mm, the height H**20** of 0.55 mm, and the angle of the inner wall surface **21** with respect to the front surface of **10**S of 30°. Further, for the light-emitting element **12**, a blue color LED package was used which had the dimension W**12** of 1 mm and the height of a light-emitting point H**12** of 0.3 mm. Further, the distance OD from the front surface **10**S of the substrate **10** to the back surface of the optical sheet **50** (the surface facing the light-emitting section **11**) was set to 10 mm.

(86) As illustrated in FIGS. **16**C and **17** (the curved line **17**C**3**), in Experimental Example 1-3, a state in which blue color light was leaked from the vicinity of the end edge of the wavelength conversion member **31** was confirmed. This is presumably due to the dimension W**31** of the region R**31** being the same as the dimension W**21** of the region R**21**U. In other words, a reason is that a portion of the blue color light from the light-emitting element **12** was transmitted through the transparent member **32** that covered the end edge of the wavelength conversion member **31**, and was outputted from the front surface **3051** without being subjected to wavelength conversion.

(87) To the contrary, as illustrated in FIGS. **16**A and **17** (the curved line **17**C**1**), in Experimental Examples 1-1 and 1-2, leakage of blue color light even from the vicinity of the end edge of the wavelength conversion member **31** was not visually confirmed. This is because the dimension W**31** of the region R**31** is larger than the dimension W**21** of the region R**21**U, and the region R**31** occupied by the wavelength conversion member **31** entirely overlaps with the region R**21**U.

(88) Further, as is apparent from FIGS. **18**A, **18**B, **18**C, and **19**, the color unevenness in the XY plane, after having caused the light to transmit through the optical sheet **50** including the diffusion sheet, was reduced more in Experimental examples 1-1 and 1-2 than Experimental Example 1-3. It is to be noted that, in FIG. **19**, the curved line **19**C**1** corresponds to Experimental Example 1-1, and the curved line **19**C**3** corresponds to Experimental Example 1-3.

(89) As described, according to the present disclosure, it was confirmed that the color unevenness was sufficiently reduced.

7. Other Modification Examples

(90) Although description has been given of the present disclosure by referring to the embodiments and the modification examples, the present disclosure is not limited thereto, and may be modified in a variety of ways. For example, the material and the thickness of each layer described in the above-described embodiments are not limited thereto, and another material and thickness may be employed.

Fourth Modification Example

(91) Further, in the above-described embodiments, etc., the wavelength conversion unit **30** is directly or indirectly in contact with the holder **20**; however, as in a light-emitting device **3** as illustrated in FIG. **20**, for example, the wavelength conversion unit **30** may be placed on a transparent member **36**, and the transparent member **36** may be spaced apart from the top surface **22** of the holder **20**.

Fifth Modification Example

(92) Further, in the above-described embodiments, etc., the planar shape of the wavelength conversion unit **30**, the outer rim of the holder **20**, the planar shape of the opening, etc. are formed in a square shape; however, the present technology is not limited thereto. For example, as in a light-emitting section **11**D illustrated in FIG. **21**, for example, the planar shape of the wavelength conversion unit **30**, the outer rim of the holder **20**, the planar shape of the opening, etc. may be formed in a circular shape. Alternatively, they may be formed in a polygonal shape such as hexagon, other than square. In such a case, the planar shapes of all of the light-emitting sections in the light-emitting device may be in an identical shape, or some of them may be in a different shape.

(93) Additionally, for example, in the above-described embodiments and modification examples, the description has been given by specifically referring to configurations of the light-emitting devices **1** to **3** and the display apparatus **101** (the television apparatus); however, it is unnecessary

to provide all of the components, and other components may be provided.
(94) It is to be noted that the effects described herein are merely illustrative and non-limiting, and may further include other effects. Further, the present technology may have the following configurations.
(95) (1)
(96) A light-emitting device including: a light source disposed on a substrate; a wavelength conversion unit that is disposed to face the light source in a thickness direction and includes a wavelength conversion member and a transparent member, the wavelength conversion member converting first wavelength light from the light source to second wavelength light, the transparent member containing therein the wavelength conversion member; and a wall member that is provided on the substrate and surrounds the light source in a plane that is orthogonal to the thickness direction, a region occupied by the wavelength conversion member being wider than a region surrounded by the wall member, and entirely overlapping with the region surrounded by the wall member in the thickness direction.
(2)
(97) The light-emitting device according to (1), in which the wall member is directly or indirectly in contact with the wavelength conversion unit, and holds the wavelength conversion unit.
(98) (3)
(99) The light-emitting device according to (1) or (2), further including a light diffusion member that covers a plurality of the light sources in common, in which the wavelength conversion unit is disposed between the plurality of light sources and the light diffusion member in the thickness direction.
(100) (4)
(101) The light-emitting device according to any one of (1) to (3), in which the wall member includes an inner wall surface that reflects the first wavelength light derived from the light source, and the inner wall surface is inclined to be away from the light source, as the inner wall surface goes toward the wavelength conversion unit from the substrate.
(102) (5)
(103) The light-emitting device according to any one of (1) to (4), in which the wall member includes a high thermally-conductive material having higher thermal conductivity than thermal conductivity of the wavelength conversion unit.
(104) (6)
(105) The light-emitting device according to (5), in which the high thermally-conductive material includes at least one of aluminum or copper.
(106) (7)
(107) The light-emitting device according to any one of (1) to (6), in which the wall member includes an inner wall surface that reflects the first wavelength light derived from the light source, and the inner wall surface is a surface of a high reflectance material that has a higher reflectance than a reflectance of the wavelength conversion unit.
(8)
(108) The light-emitting device according to (7), in which the high reflectance material includes at least one of aluminum or silver.
(109) (9)
(110) The light-emitting device according to any one of (1) to (8), in which the light source is a flip chip LED (light-emitting diode).
(111) (10)
(112) The light-emitting device according to any one of (1) to (9), including an air layer provided between the light source and the wavelength conversion unit.
(113) (11)
(114) The light-emitting device according to any one of (1) to (10), in which the wavelength

conversion material is a quantum dot.
(115) (12)
(116) The light-emitting device according to any one of (1) to (11), in which the wall member includes an inner wall surface that reflects the first wavelength light derived from the light source, and a low reflection layer is provided on a light-incidence surface of the wavelength conversion unit, the light-incidence surface facing the light source, the low reflection layer having a lower reflectance than a reflectance of the inner wall surface.
(13)
(117) The light-emitting device according to any one of (1) to (12), in which a wavelength selective reflection layer is provided on a light-incidence surface of the wavelength conversion unit, the light-incidence surface facing the light source.
(118) (14)
(119) The light-emitting device according to any one of (1) to (13), in which all of pieces of the first wavelength light from the light source enter the wavelength conversion member via the transparent member.
(120) (15)
(121) A light-emitting device including: a light source disposed on a substrate; a wall member that is provided on the substrate and surrounds the light source in a plane that is orthogonal to a thickness direction; and a wavelength conversion unit including a wavelength conversion member and a transparent member, the wavelength conversion member being disposed to face the light source in the thickness direction and converting first wavelength light from the light source to second wavelength light, the transparent member being placed to be directly or indirectly in contact with the wavelength conversion member and the wall member, a region occupied by the wavelength conversion member being wider than a region surrounded by the wall member, and entirely overlapping with the region surrounded by the wall member in the thickness direction.
(16)
(122) A display apparatus provided with a liquid crystal panel and a light-emitting device on rear side of the liquid crystal panel, the light-emitting device including: a plurality of light sources disposed on a substrate; a plurality of wavelength conversion units that are disposed to face the respective plurality of light sources in a thickness direction and each including a wavelength conversion member and a transparent member, the wavelength conversion member converting first wavelength light from the plurality of light sources to second wavelength light, the transparent member containing therein the wavelength conversion member; and a plurality of wall members that are provided on the substrate and surround the respective plurality of light sources in a plane that is orthogonal to the thickness direction, a region occupied by the wavelength conversion member being wider than a region surrounded by the plurality of wall members, and entirely overlapping with the region surrounded by the wall member in the thickness direction.
(17)
(123) An illumination apparatus provided with a light-emitting device, the light-emitting device including: a plurality of light sources disposed on a substrate; a plurality of wavelength conversion units that are disposed to face the respective plurality of light sources in a thickness direction and each including a wavelength conversion member and a transparent member, the wavelength conversion member converting first wavelength light from the plurality of light sources to second wavelength light, the transparent member containing therein the wavelength conversion member; and a plurality of wall members that are provided on the substrate and surround the respective plurality of light sources in a plane that is orthogonal to the thickness direction, a region occupied by the wavelength conversion member being wider than a region surrounded by the plurality of wall members, and entirely overlapping with the region surrounded by the wall member in the thickness direction.
(124) The present application is based on and claims priority from Japanese Patent Application No.

2016-60359 filed with the Japan Patent Office on Mar. 24, 2016, the entire contents of which is hereby incorporated by reference.
(125) It should be understood by those skilled in the art that various modifications, combinations, sub-combinations and alterations may occur depending on design requirements and other factors insofar as they are within the scope of the appended claims or the equivalents thereof.

Claims

1. A display device comprising, a first exterior member holding a light-emitting device; and a second exterior member covering a back surface of the light-emitting device; wherein the light-emitting device comprises: a plurality of light sources disposed on a substrate; a plurality of wavelength conversion units that are disposed to face the plurality of light sources in a thickness direction and including a wavelength conversion member, the wavelength conversion member included in one of the plurality of the wavelength conversion units converts first wavelength light from one of the plurality of light sources to second wavelength light, the wavelength conversion member comprises quantum dot being particles having a long diameter in a range from 1 nm to 100 nm; a transparent member positioned on either a light-incidence surface or a light exit surface of the wavelength conversion member, the transparent member being thicker than a thickness of the wavelength conversion member in the thickness direction; and a plurality of wall members that are provided above the substrate and surround the plurality of light sources in a plane that is orthogonal to the thickness direction; wherein the first wavelength light being blue color light and the second wavelength light being red color light or green color light.
2. The display device according to claim 1, wherein a top surface of each of the plurality of wall members is under a back surface of each of the plurality of wavelength conversion units.
3. The display device according to claim 1, wherein a top surface of each of the plurality of wall members is indirectly in contact with a back surface of each of the plurality of wavelength conversion units.
4. The display device according to claim 1 comprising a wavelength selective reflection layer comprising a continuous film provided on the light-incidence surface of the wavelength conversion units.
5. The display device according to claim 1, wherein regions occupied by the wavelength conversion member are wider than regions surrounded by the wall members and the regions occupied by the wavelength conversion member entirely overlaps the regions surrounded by the wall members in the thickness direction.
6. The display device according to claim 1, wherein the wall members support the wavelength conversion units.
7. The display device according to claim 1, further comprising a single light diffusion member that commonly covers a plurality of the light sources.
8. The display device according to claim 7, wherein the wavelength conversion units are disposed between the plurality of light sources and the light diffusion member in the thickness direction.
9. The display device according to claim 1, wherein the wall members include inner wall surfaces that reflects the first wavelength light derived from at least one of the plurality of light sources.
10. The display device according to claim 1, wherein the first exterior member comprises a metal.
11. The display device according to claim 1, wherein the wavelength conversion units comprise the transparent member and heat from the wavelength conversion member is absorbed by the wall members through the transparent member.
12. The display device according to claim 1, wherein the wavelength conversion units comprise the transparent member and the transparent member protects the wavelength conversion member from moisture.
13. The display device according to claim 1, wherein at least one of the wall members forms a

rectangular shape.

14. The display device according to claim 1, wherein at least one of the wall members forms a circular shape.

15. The display device according to claim 1, wherein at least one of the wall members forms a polygon having more than four sides.

16. The display device according to claim 1, wherein an air layer is provided between the light sources and the wavelength conversion units.

17. The display device according to claim 1, wherein the wavelength conversion units comprise the transparent member, the wavelength conversion units are placed on top surfaces of the wall members, and heat of the wavelength conversion member is absorbed by the wall members through the transparent member.

18. The display device according to claim 1, comprising a liquid crystal panel over the light emitting device.

19. The display device according to claim 18, comprising a wavelength selective reflection layer comprising a continuous film provided on the light-incidence surface of the wavelength conversion units.

20. The display device according to claim 1, comprising a wavelength selective reflection layer, the wavelength selective reflection layer comprising a continuous film provided on the light-incidence surface of the wavelength conversion units.