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Odnoblyudov

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(54) **LINEAR LED MODULE**

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F21V 23/00	(2015.01)
F21V 7/22	(2006.01)
F21S 8/04	(2006.01)
F21Y 101/02	(2006.01)

(52) **U.S. Cl.**

CPC . ***F21V 3/049*** (2013.01); ***F21S 8/04*** (2013.01); ***F21V 7/22*** (2013.01); ***F21V 23/005*** (2013.01); *F21Y 2101/02* (2013.01)

(58) **Field of Classification Search**

CPC F21V 3/049; F21V 23/005; F21V 7/22; F21V 7/005; F21S 8/04; F21Y 2101/02; F21Y 2103/00; F21Y 2103/03; H01L 2924/12041; H01L 23/4985; H05K 1/189; H05K 2201/10106; G02F 1/133603

USPC 362/217.4, 223, 249.02, 241, 225, 236, 362/362, 218, 145, 217.17, 240, 222, 184, 362/351, 311.02

See application file for complete search history.

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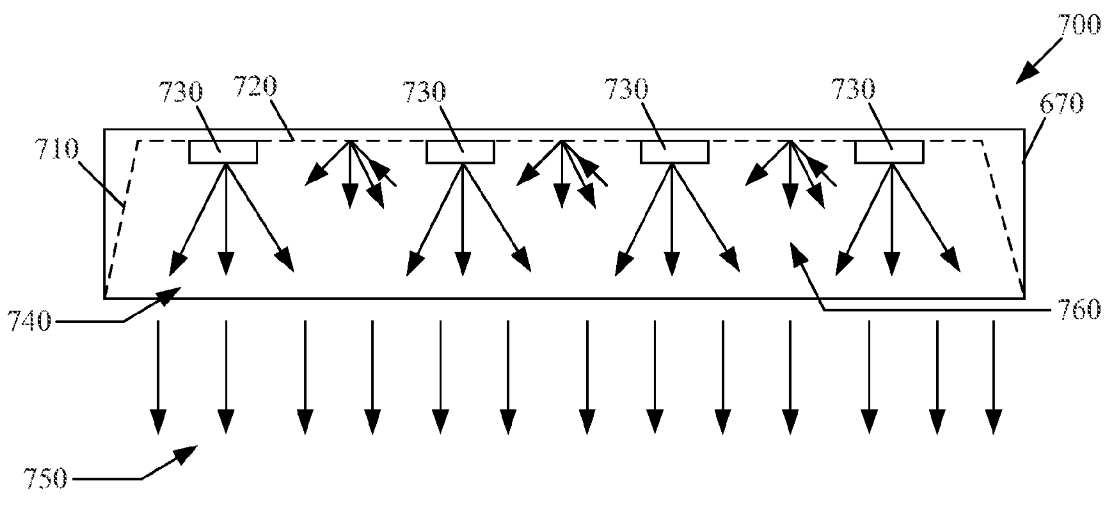
(57) **ABSTRACT**

Various aspects of a light emitting apparatus include a substrate having at least one angled portion. Some aspects of the light emitting apparatus include at least one light emitting device arranged on the substrate. Some aspects of the light emitting apparatus include a plurality of conductors arranged on the substrate. In some aspects of the light emitting apparatus, the conductors are electrically coupled to the at least one light emitting device.

21 Claims, 4 Drawing Sheets



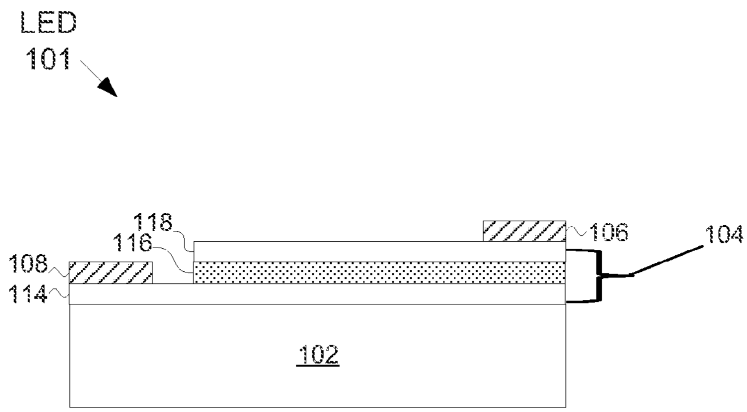
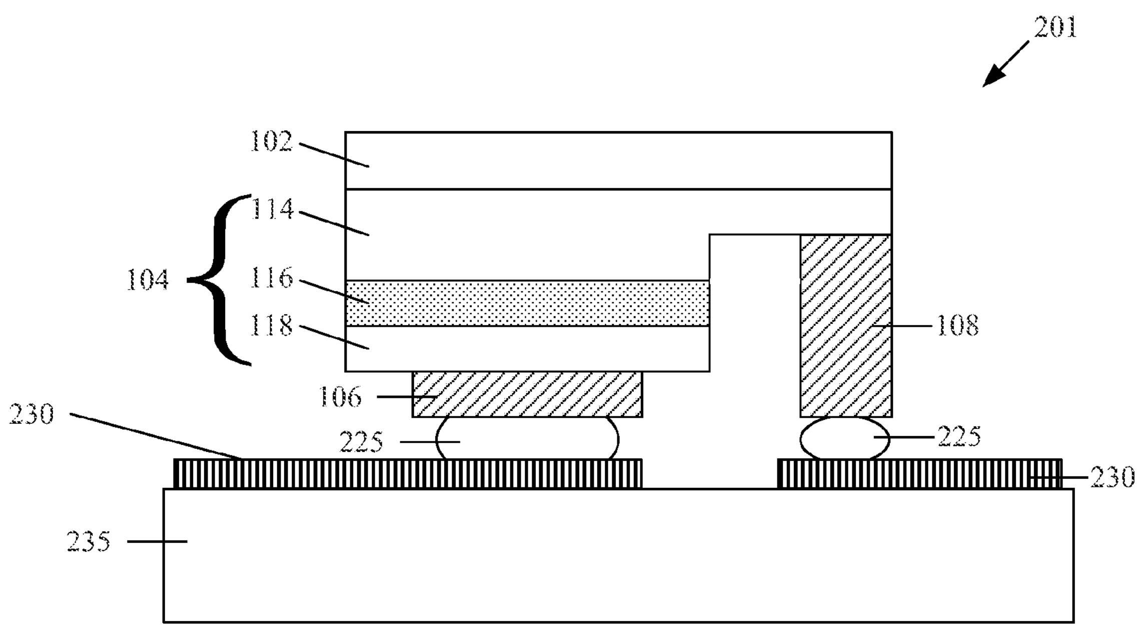

LED
101
118
116
108
114
106
104
102

FIG. 1


201
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114
104
116
118
108
106
225
225
230
230
235

FIG. 2

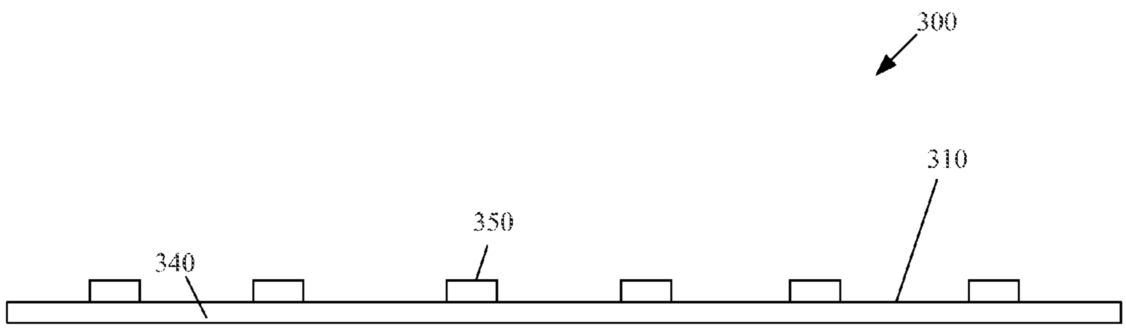

FIG. 3a

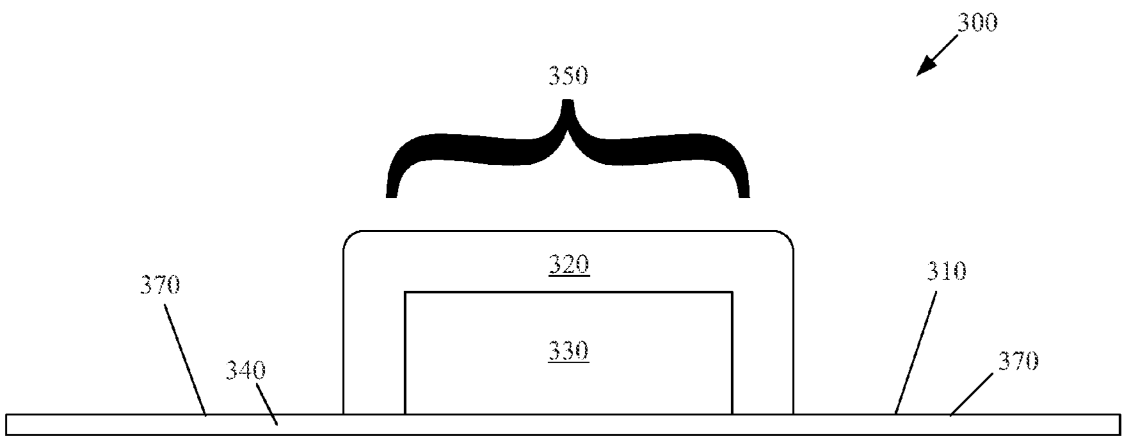

FIG. 3b

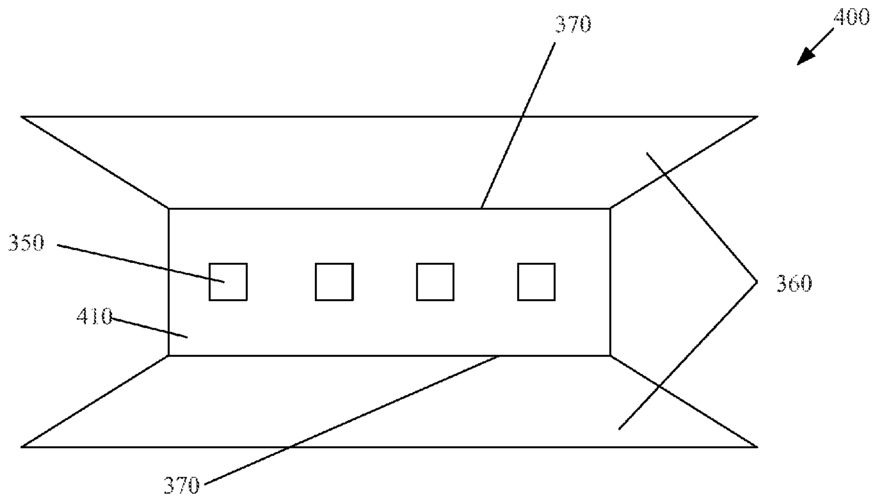

FIG. 4a

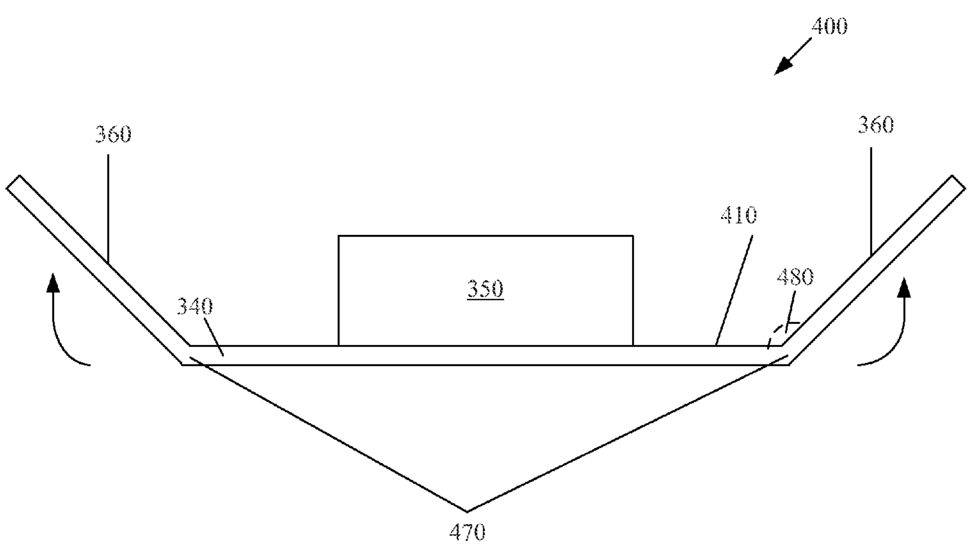

FIG. 4b

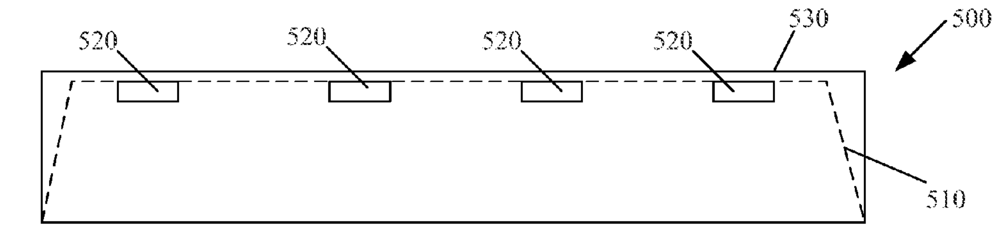

FIG. 5

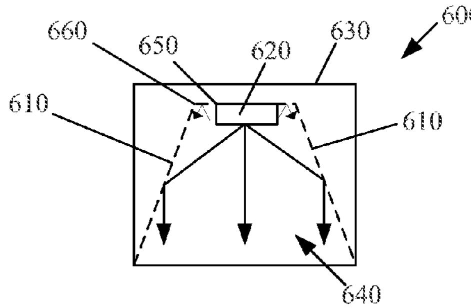

FIG. 6

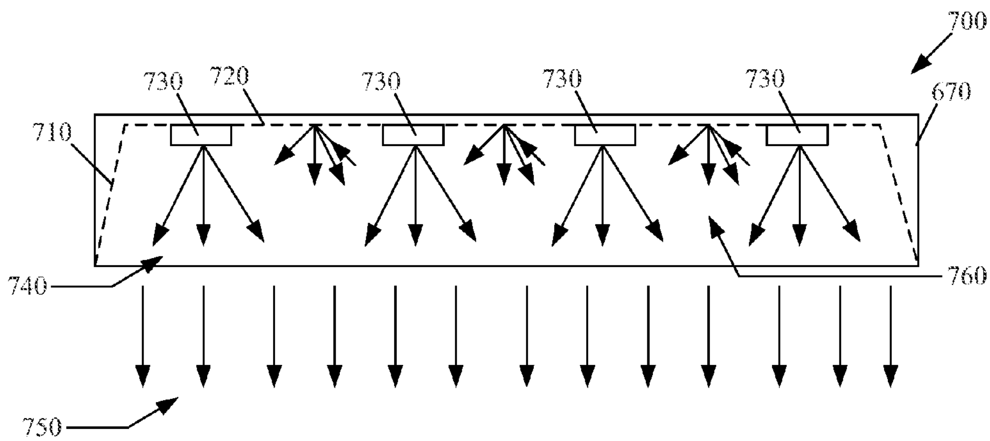

FIG. 7

LINEAR LED MODULE

BACKGROUND

1. Field

The present disclosure relates generally to a linear LED module and, more particularly, to a linear LED module that uses a flexible substrate with angled portions.

2. Background

Solid state light emitting devices, such as light emitting diodes (LEDs), are attractive candidates for replacing conventional light sources such as incandescent, halogen, and fluorescent lamps. LEDs have substantially longer lifetimes than all three of these types of conventional light sources. In addition, some types of LEDs now have higher conversion efficiencies than fluorescent light sources and still higher conversion efficiencies have been demonstrated in laboratories. Finally, LEDs contain no mercury or other potentially dangerous materials, therefore, providing various safety and environmental benefits.

A troffer is a light fixture resembling an inverted trough that is either recessed in, or suspended from, the ceiling. Troffers are typically designed to emit light using fluorescent lighting tubes. The fluorescent tubes emit light along the entire length of the troffer to produce a focused light distribution pattern. However, fluorescent lighting tubes may be expensive, require a warm up period, and produce flicker that is undesirable.

More recently, solid state light emitting devices have been used to replace fluorescent lamps conventionally used in troffer assemblies. LEDs are attractive candidates for replacing fluorescent lighting tubes because LEDs have no warm up time, are long lasting and power efficient, and do not flicker. Troffer assemblies with LED light sources are sometimes referred to as linear LED modules, and conventional linear LED modules have been widely utilized in the global troffer market.

Typically, conventional linear LED designs utilize rigid FR4 or Metal Core Printed Circuit Board (MCPCB) substrates coated with a white solder mask for light reflection and diffusion. Such boards are commonly mounted on rigid metal plates (such as aluminum) with reflective sides for directing light down into a diffuser lens and out of the metal troffer tube. The metal plate sometimes also doubles as a heat sink.

The conventional linear LED assembly can be expensive, heavy, and overly complex. It is therefore difficult to design a linear LED assembly that is both cost efficient, lightweight, and is not overly complex.

SUMMARY

Several aspects of the present invention will be described more fully hereinafter with reference to various apparatuses.

One aspect of a light emitting apparatus includes a substrate having at least one angled portion. The light emitting apparatus includes at least one light emitting device arranged on the substrate. The light emitting apparatus includes a plurality of conductors arranged on the substrate. The conductors are electrically coupled to the at least one light emitting device.

Another aspect of the light emitting apparatus includes at least one light emitting device. The light emitting apparatus includes a flexible substrate having a member supporting the at least one light emitting device. The light emitting apparatus includes an angled portion extending from the member.

An aspect of a lamp includes a housing. The lamp includes a light emitting apparatus coupled to the housing. The light emitting apparatus includes at least one light emitting device. The light emitting apparatus includes a flexible substrate carried by the housing. The flexible substrate includes a reflective portion and a diffusive portion, wherein the at least one light emitting device is arranged on the diffusive portion.

BRIEF DESCRIPTION OF THE DRAWINGS

The various aspects of the present invention illustrated in the drawings may not be drawn to scale. Rather, the dimensions of the various features may be expanded or reduced for clarity. In addition, some of the drawings may be simplified for clarity. Thus, the drawings may not depict all of the components of a given apparatus or method.

Various aspects of the present invention will be described herein with reference to drawings that are schematic illustrations of idealized configurations of the present invention. As such, variations from the shapes of the illustrations as a result, for example, manufacturing techniques and/or tolerances, are to be expected. Thus, the various aspects of the present invention presented throughout this disclosure should not be construed as limited to the particular shapes of elements (e.g., regions, layers, sections, substrates, bulb shapes, etc.) illustrated and described herein but are to include deviations in shapes that result, for example, from manufacturing. By way of example, an element illustrated or described as a rectangle may have rounded or curved features and/or a gradient concentration at its edges rather than a discrete change from one element to another. Thus, the elements illustrated in the drawings are schematic in nature and their shapes are not intended to illustrate the precise shape of an element and are not intended to limit the scope of the present invention.

Various aspects of apparatuses will now be presented in the detailed description by way of example, and not by way of limitation, with reference to the accompanying drawings, wherein:

FIG. **1** illustrates an exemplary embodiment of an LED

FIG. **2** illustrates an exemplary embodiment of an LED chip having a flip-chip architecture.

FIG. **3***a* illustrates a plan view of an exemplary embodiment of a light emitting apparatus having several LEDs arranged on a flexible substrate.

FIG. **3***b* illustrates a cross-section view of an exemplary embodiment of a light emitting apparatus having an encapsulated LED arranged on a flexible substrate.

FIG. **4***a* illustrates a top view of an exemplary embodiment of a light emitting apparatus having several LEDs arranged on a flexible substrate.

FIG. **4***b* illustrates a cross-section view of an exemplary embodiment of a light emitting apparatus having the flexible substrate of FIG. **4***a*.

FIG. **5** illustrates a cross-section view of a troffer device of an exemplary embodiment of the light emitting device having a flexible substrate.

FIG. **6** illustrates a side view of a troffer device of an exemplary embodiment of the light emitting device.

FIG. **7** illustrates a cross-section view of a troffer device that provides light distribution pattern.

DETAILED DESCRIPTION

The detailed description set forth below in connection with the appended drawings is intended as a description of various exemplary embodiments of the present invention and is not intended to represent the only embodiments in which the present invention may be practiced. The detailed description includes specific details for the purpose of providing a thorough understanding of the present invention. However, it will be apparent to those skilled in the art that the present invention may be practiced without these specific details. In some instances, well-known structures and components are shown in block diagram form in order to avoid obscuring the concepts of the present invention. Acronyms and other descriptive terminology may be used merely for convenience and clarity and are not intended to limit the scope of the invention.

The word "exemplary" is used herein to mean serving as an example, instance, or illustration. Any embodiment described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other embodiments. Likewise, the term "embodiment" of an apparatus, method or article of manufacture does not require that all embodiments of the invention include the described components, structure, features, functionality, processes, advantages, benefits, or modes of operation.

The various aspects of the present invention illustrated in the drawings may not be drawn to scale. Rather, the dimensions of the various features may be expanded or reduced for clarity. In addition, some of the drawings may be simplified for clarity. Thus, the drawings may not depict all of the components of a given apparatus or method. Various aspects of the present invention will be described herein with reference to drawings that are schematic illustrations of idealized configurations of the present invention. As such, variations from the shapes of the illustrations as a result, for example, manufacturing techniques and/or tolerances, are to be expected. Thus, the various aspects of the present invention presented throughout this disclosure should not be construed as limited to the particular shapes of elements (e.g., regions, layers, sections, substrates, etc.) illustrated and described herein but are to include deviations in shapes that result, for example, from manufacturing. By way of example, an element illustrated or described as a rectangle may have rounded or curved features and/or a gradient concentration at its edges rather than a discrete change from one element to another. Thus, the elements illustrated in the drawings are schematic in nature and their shapes are not intended to illustrate the precise shape of an element and are not intended to limit the scope of the present invention.

It will be understood that when an element such as a region, layer, section, substrate, or the like, is referred to as being "on" another element, it can be directly on the other element or intervening elements may also be present. In contrast, when an element is referred to as being "directly on" another element, there are no intervening elements present. It will be further understood that when an element is referred to as being "formed" on another element, it can be grown, deposited, etched, attached, connected, coupled, or otherwise prepared or fabricated on the other element or an intervening element.

Furthermore, relative terms, such as "beneath" or "bottom" and "above" or "top," may be used herein to describe one element's relationship to another element as illustrated in the drawings. It will be understood that relative terms are intended to encompass different orientations of an apparatus in addition to the orientation depicted in the drawings. By way of example, if an apparatus in the drawings is turned over, elements described as being "above" other elements would then be oriented "below" other elements and vice versa. The term "above", can therefore, encompass both an orientation of "above" and "below," depending of the particular orientation of the apparatus. Similarly, if an apparatus in the drawing is turned over, elements described as "below" other elements would then be oriented "above" the other elements. The terms "below" can, therefore, encompass both an orientation of above and below.

It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. The term "and/or" includes any and all combinations of one or more of the associated listed items.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by a person having ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and the present disclosure and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

In the following detailed description, various aspects of the present invention will be presented in the context of a light-emitting device. A light-emitting die shall be construed broadly to include any suitable solid state light source such as, by way of example, a light emitting diode (LED) or other solid state material which releases photons or light through the recombination of electrons and holes flowing across a p-n junction. Accordingly, any reference to an LED or light throughout this disclosure is intended only to illustrate the various aspects of the present invention, with the understanding that such aspects may have a wide range of applications.

The following description describes a linear LED module that is designed to minimize cost while providing the same efficacy as conventional linear LED modules. The linear LED module utilizes a flexible substrate, which will be described in greater detail below. The flexible substrate minimizes the complexity associated with designing linear LED modules for troffer devices by providing bendable portions which can be adjusted to fit most designs. Moreover, the flexible substrate negates the need for a rigid substrate coupled to a heavy reflector. The flexible substrate is capable of providing the same directed light effect of both the rigid substrate and attached reflector, but at a lower cost. As will be discussed in greater detail below, several LEDs having different designs may be arranged on the flexible substrate. FIG. **1** is an example of one such LED design.

FIG. **1** illustrates an exemplary embodiment of an LED **101**. An LED is a semiconductor material impregnated, or doped, with impurities. These impurities add "electrons" or "holes" to the semiconductor, which can move in the material relatively freely. Depending on the kind of impurity, a doped region of the semiconductor can have predominantly electrons or holes, and is referred respectively as n-type or p-type semiconductor regions.

Referring to FIG. **1**, the LED **101** includes an n-type semiconductor region **114** and a p-type semiconductor region **118**. A reverse electric field is created at the junction between the two regions, which cause the electrons and holes to move away from the junction to form an active region **116**. When a forward voltage sufficient to overcome the reverse electric field is applied across the p-n junction through a pair of electrodes **108**, **106**, electrons and holes are forced into the active region **116** and recombine. When electrons recombine with holes, they fall to lower energy levels and release energy in the form of light.

In this example, the n-type semiconductor region **114** is formed on a substrate **102** and the p-type semiconductor region **118** is formed on the active layer **116**, however, the regions may be reversed. That is, the p-type semiconductor region **118** may be formed on the substrate **102** and the n-type semiconductor region **114** may formed on the active layer **116**. As those skilled in the art will readily appreciate, the various concepts described throughout this disclosure may be extended to any suitable layered structure. Additional layers or regions (not shown) may also be included in the LED **101**, including but not limited to buffer, nucleation, contact and current spreading layers or regions, as well as light extraction layers.

The p-type semiconductor region **118** is exposed at the top surface, and therefore, the p-type electrode **106** may be readily formed thereon. However, the n-type semiconductor region **114** is buried beneath the p-type semiconductor layer **118** and the active layer **116**. Accordingly, to form the n-type electrode **108** on the n-type semiconductor region **114**, a cutout area or "mesa" is formed by removing a portion of the active layer **116** and the p-type semiconductor region **118** by means well known in the art to expose the n-type semiconductor layer **114** there beneath. After this portion is removed, the n-type electrode **108** may be formed.

FIG. **2** illustrates an exemplary embodiment of an LED chip having a flip-chip architecture. Flip-chip LED **201** includes similar features of the LED illustrated in FIG. **1**. However, the features are flipped over. For instance, electrodes **106** and **108** are positioned beneath p-type semiconductor region **118** and n-type semiconductor region **114** rather than above the p-type semiconductor region **118** and n-type semiconductor region **114** as shown in FIG. **1**. As a result solders **225** couple the flip-chip LED **201** to conductive layer **230**. The conductive layer is arranged over substrate **235**. As will be discussed in greater detail in the following sections, the substrate **235** may be a flexible substrate capable of being bent into different configurations.

FIG. **3***a* illustrates a plan view of an exemplary embodiment of a light emitting apparatus **300** having several LEDs **350** arranged on a flexible substrate **340**. An example of a flexible substrate **340** is an Al substrate having a thickness between 0.1 mm and 0.5 mm. Alternatively, the substrate **340** may be a multi-layer structure having a similar thickness between 0.1 mm and 0.5 mm. The multi-layer structure may be formed with two Al layers separated by a dielectric layer, Al and Cu layers separated by a dielectric layer, two Cu layers separated by a dielectric layer, or some other suitable layered structure. Those skilled in the art will be readily able to determine the appropriate material and thickness of the material to produce a flexible substrate suitable for any particular application.

The plan view includes LEDs **350**, flexible substrate **340** and a top surface of the flexible substrate **310**. The LEDs **350**, in some aspects of the apparatus, may be lateral LEDs such as the LED architecture described with respect to FIG. **1** or flip-chip LEDs such as the LED architecture described with respect to FIG. **2**. The flexible substrate **340** of some aspects of the apparatus may be manufactured using a reel-to-reel process. The reel-to-reel process involves creating an electronic device (or substrate) on a roll of flexible plastic or metal foil. LEDs are then mounted to the substrate. In the example shown in FIG. **3***a*, the substrate **340** may be an aluminum substrate manufactured using the reel-to-reel process.

As will be shown in greater detail in the following drawings, the LED **350** may be a chip on board package that is mounted directly to the substrate **340**. In addition, the LEDs **350** may be lateral LEDs or flip-chip LEDs. The substrate **340** may also include conductors **310** to interconnect the LEDs **350**. An insulation layer (not shown) may be formed between the substrate **334** and the conductors **310** to electrically insulate the two.

In one embodiment, the top surface of the substrate **340** may include a reflective layer (not shown). An insulation layer (not shown) may be formed between the reflective layer and the conductors **310** with vias to provide electrical connections between the conductors **310** and the LEDs **350**. In an alternative embodiment, the reflective layer may be an insulator, thereby eliminating the need for a separate insulation layer between the reflective layer and the conductors **310**. By way of example, the reflective layer may be a white solder mask such as those manufactured by Taiyo America or other manufacturers.

The substrate **340** provides a thinner lightweight substrate for linear LEDs, which is more customizable and cost efficient. The substrate **340** replaces the need for a heavy reflector and rigid substrate combination. Thus, the flexible substrate provides a less complex design that produces the same directed lighting effect.

FIG. **3***b* illustrates a cross-section view of an exemplary embodiment of a light emitting apparatus **300** having an encapsulated LED arranged on a flexible substrate. In some aspects of the apparatus, FIG. **3***b* is a cross-sectional view of the light emitting apparatus illustrated in FIG. **3***a*. Similar to FIG. **3***a*, the cross-sectional view includes the LED **350**, the flexible substrate **340**, and the top surface of the flexible substrate **310**. The cross-sectional view additionally includes bending points **370**. The LED **350** includes a flip-chip LED **330** and an encapsulant **320**, forming a chip-on-board package. In some aspects of the apparatus, a phosphor may also be disposed over LED **330** and the encapsulant may be a lens. Although this exemplary view includes a flip-chip LED **330**, any suitable LED design could be mounted on the substrate **340**. Furthermore, the design illustrated in FIGS. **3***a* and **3***b* is not only limited to chip-on-board packages.

The flexible substrate **340** is configured to bend at bending points **370**. The ability to bend the flexible substrate **340** at the bending points **370** replaces the need for a reflector in addition to the rigid substrate used in conventional linear LED modules. Additionally, the angle of the bend can be customized, making the same flexible substrate **340** capable of accommodating different troffer designs. By bending the flexible substrate **340**, the light emitting apparatus may be capable of focusing light in a downward direction to a diffusive lens, which is typically used in troffer assemblies.

FIG. **4***a* illustrates a top view of an exemplary embodiment of a light emitting apparatus **400** having several LEDs arranged on a flexible substrate. FIG. **4***a* includes similar features to those already discussed with respect to FIGS. **3***a* and **3***b*. However, FIG. **4***a* differs from FIGS. **3***a* and **3***b* in that it includes angled portions **360** that have been bent up at bending points **370**.

As discussed above portions of the substrate **340** may include reflective surfaces. In this example, angled portions **360** may include the reflective portions of the substrate. The top portion **410** of the substrate that is between the bending points **370** may include the diffusive layer. However, as discussed above, the angled portions **360** and horizontal surface **410** may have a diffusive material layered above the surface such as a white solder mask. In some aspects of the apparatus, the diffusive material may be printed around the LEDs **350** on the horizontal surface **410**. The angled portions **360** may have a reflective material layered above the diffusive material. Conversely, the angled portions **360** may have exposed aluminum. Thus, the reflective surfaces of the flexible substrate provide the same effect as the rigid metal reflector plate used in conventional linear LED modules. Additionally, a conductive layer may be arranged over the surface **410** depending on the type of LED utilized for the design.

FIG. **4***b* illustrates a cross-section view of an exemplary embodiment of a light emitting apparatus having the flexible substrate of FIG. **4***a*. As illustrated in more detail, the bent portions **360** of the flexible substrate are bent up at bending points **470**. The angled portions **360** are bent at a particular angle **480**. The particular angle **480** may be a predetermined angle based on specifications of a lighting module that will use the flexible substrate. Preferably, the angle **480** may be between 30° and 60°, bit other angle may be used depending on the particular application. Thus, the exemplary design illustrated in FIG. **4***b* provides the same effect as conventional linear LED modules, but uses a less costly and less complex design.

In some aspects of the apparatus, the flexible substrate **340** may be mounted on an inexpensive linear plastic object. Additionally, the angle may be adjusted to suit different troffer designs, while still providing the requisite focusing effect on the emitted light.

FIG. **5** illustrates a cross-section view of a troffer device **500** of an exemplary embodiment of the light emitting device having a flexible substrate. The illustrated troffer device **500** may be suitable for use an as internal lighting device, such as a ceiling light. The troffer device **500** includes a housing **530**. In some aspects of the light emitting device, the housing **540** may be a housing that is typically used for fluorescent lighting. The housing **540** includes a flexible substrate **510** and several LEDs **520**. As shown, the LEDs **520** are arranged on the flexible substrate **510**. The flexible substrate and light distribution pattern emitted from the troffer device **500** will be discussed in greater detail with respect to FIGS. **6** and **7**.

FIG. **6** illustrates a side view of a troffer device **600** of an exemplary embodiment of the light emitting device. The side view illustrated in FIG. **6** may be a side view of the troffer device **500** described with respect to FIG. **5**. As shown, the troffer device **600** includes a housing **630**, a reflective surface **610** of the flexible substrate, a diffusive surface **650** of the flexible substrate, and a bending point **660**. FIG. **6** also illustrates a light distribution pattern **640**.

As shown, the LED **620** is arranged on the diffusive surface **650**. In some aspects of the light emitting device, the diffusive surface **650** covers a portion of the flexible substrate around the LED **620** and between angled portions of the flexible substrate. The angled portion of the flexible substrate may include the reflective surface **610**. As shown, the flexible substrate is bent at bending point **660** to fit the housing **630**. The flexible substrate may be bent along any point to form various different angles and configurations. Thus, the flexible substrate may be configured to fit a variety of different sized troffer housings.

The troffer device **600** is configured to focus light in a downward direction as is shown by light distribution pattern **640**. Specifically, the reflective portions **610** of the flexible substrate are angled such that light emitted from the LED **620** may reflect off of the reflective surface **610** to enhance the light distribution effects of the troffer device **600** by focusing the light downward. The light may be focused toward a diffusive lens positioned at the bottom of the troffer device, which produces a more uniform light distribution. Additionally, some of the light emitted from LED **620** may be diffused by the diffusive surface **650** further enhancing the lighting efficacy. The combination of the diffusive surface **650** and reflective surfaces **610** of the flexible substrate provides a downward focused light distribution pattern **640** similar to the light distribution pattern of conventional linear LED modules that use a substrate mounted on a reflector.

FIG. **7** further illustrates a cross-section view of a troffer device **700** that provides light distribution pattern **750**. FIG. **7** illustrates similar components to those described with respect to FIGS. **5** and **6**. For instance, troffer device **700** includes a housing **670** similar to housing **530**. The housing includes a flexible substrate **710** similar to the flexible substrate **510**. The flexible substrate **510** includes a diffusive portion **720**, which is similar to the diffusive portion **650**. Additionally, the housing includes several LEDs **730**, similar to the LED **620**, arranged on the diffusive portion of the flexible substrate.

As shown, LEDs **730** may emit light **740**, which is reflective off of the angled portions of the flexible substrate as described with respect to FIG. **6**. Additionally, some of the emitted light **760** may be diffused by the diffusive portion **720** of the flexible substrate. The combination of the diffused and reflected light produces a focused light distribution pattern which may be diffused by a lens to produce the more desirable uniform lighting pattern **750**. Thus, the flexible substrate arrangement a suitable replacement for the rigid reflector and substrate of conventional linear LED lighting systems because it produces the same lighting effect while using a simpler design.

The various aspects of this disclosure are provided to enable one of ordinary skill in the art to practice the present invention. Various modifications to exemplary embodiments presented throughout this disclosure will be readily apparent to those skilled in the art, and the concepts disclosed herein may be extended to other devices. Thus, the claims are not intended to be limited to the various aspects of this disclosure, but are to be accorded the full scope consistent with the language of the claims. All structural and functional equivalents to the various components of the exemplary embodiments described throughout this disclosure that are known or later come to be known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed by the claims. Moreover, nothing disclosed herein is intended to be dedicated to the public regardless of whether such disclosure is explicitly recited in the claims. No claim element is to be construed under the provisions of 35 U.S.C. §112(f) unless the element is expressly recited using the phrase “means for” or, in the case of a method claim, the element is recited using the phrase “step for.”

What is claimed is:

1. A light emitting apparatus comprising:

a substrate having at least one angled portion;

at least one light emitting device arranged on the substrate; and

a plurality of conductors arranged on the substrate, wherein the conductors are electrically coupled to the at least one light emitting device,

wherein a portion of the substrate comprises a diffusive surface, the diffusive surface comprising a white solder mask arranged around the at least one light emitting device.

2. The light emitting apparatus of claim **1**, wherein the substrate further comprises a member supporting the light emitting device, and wherein the angled portion is coupled to the member at an obtuse angle between the member and the angled portion.

3. The light emitting apparatus of claim **1**, wherein the angled portion comprises a reflective surface, wherein the angled portion has greater reflectivity than the member.

4. The light emitting apparatus of 2, wherein an angle between the member and angled portion is selected to fit a troffer light fixture.

5. The light emitting apparatus of claim 1, wherein the at least one light emitting device comprises a flip chip LED.

6. The light emitting apparatus of claim 5, further comprising an encapsulant that encapsulates the flip chip LED.

7. The light emitting apparatus of claim 1, wherein the substrate comprises aluminum.

8. The light emitting apparatus of claim 1, where the at least one light emitting device comprises a chip-on-board package.

9. A light emitting apparatus comprising:

at least one light emitting device;

a flexible substrate having a member supporting the at least one light emitting device; and

an angled portion extending from the member,

wherein the member comprises a diffusive surface comprising a white solder mask arranged around the at least one light emitting device.

10. The light emitting apparatus of claim 9, wherein the angled portion comprises a reflective surface, and wherein the angled portion has greater reflectivity than the member.

11. The light emitting apparatus of claim 9, wherein an angle between the member and angled portion is selected to fit a troffer light fixture.

12. The light emitting apparatus of claim 9, wherein the at least one light emitting device is a flip chip LED.

13. The light emitting apparatus of claim 12, further comprising an encapsulant that encapsulates the flip chip LED.

14. The light emitting apparatus of claim 9, wherein the substrate comprises aluminum.

15. The light emitting apparatus of claim 9, where the at least one light emitting device comprises a chip-on-board package.

16. A lamp comprising:

a housing;

a light emitting apparatus coupled to the housing, the apparatus comprising:

at least one light emitting device; and

a flexible substrate carried by the housing, the flexible substrate comprising a reflective portion and a diffusive portion, wherein the at least one light emitting device is arranged on the diffusive portion, wherein the diffusive portion comprises a white solder mask arranged around the at least one light emitting device.

17. The lamp of claim 16, wherein the housing comprises plastic.

18. The lamp of claim 16, wherein the housing is configured for mounting to a troffer light fixture.

19. The lamp of claim 16, wherein the flexible substrate is configured to bend to fit a shame of the housing.

20. The lamp of claim 16, wherein the housing comprises a member and an angled portion extending from the member, and wherein the diffusive portion is arranged on the member and the reflective portion is arranged on the angled portion.

21. The lamp of claim 16, wherein the reflective and diffusive portions are configured to focus light in a downward direction.

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