Preferably, the light emitting layer comprises one or more quantum wells of indium gallium nitride and gallium nitride (InGaN/GaN) heterostructures.

Preferably, the first material layer comprises an n-type nitride material, and the second material layer comprises a p-type nitride material.

Preferably, the first material is selected from a group consisting of an n-type GaN, an n-type AlGaN, an n-type InAlGaN, and the second material is selected from a group consisting of a p-type GaN, a p-type AlGaN, and a p-type InAlGaN.

Preferably, the photonic nanostructures are generally pillar-type nanostructures.

~~According to a second aspect of the present invention, there is provided a vertical light emitting diode comprising:~~

~~a light emitting diode structure including:~~

~~a first material layer of a first conductivity type;~~

~~a second material layer of a second conductivity type; and~~

~~a light emitting layer disposed in between the first material layer and the second material layer;~~

~~wherein a surface of the first material layer has a plurality of generally ordered photonic nanostructures formed thereat using a self-assembled template for enhancing light extraction efficiency of the vertical light emitting diode, the self-assembled template comprising generally ordered nanoparticles on said surface of the first material layer to function as a mask for forming the photonic nanostructures at said surface of the first material layer.~~

~~Preferably, the vertical light emitting diode further comprises a first electrode formed on the second material layer, and a second electrode formed on the first material layer, wherein the first and second electrodes are configured to receive a bias voltage for providing power to the light emitting layer to generate light.~~

~~Preferably, the first material layer is selected from a group consisting of an n-type GaN, an n-type AlGaN, and an n-type InAlGaN, the second material is selected from~~

~~a group consisting of a p-type GaN, a p-type AlGaN, and a p-type InAlGaN, and the light emitting layer comprises one or more quantum wells of indium gallium nitride and gallium nitride (InGaN/GaN) heterostructures.~~

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention will be better understood and readily apparent to one of ordinary skill in the art from the following written description, by way of example only, and in conjunction with the drawings, in which:

Fig. 1A schematically depicts an exemplary LED structure initially formed on a sacrificial SOI substrate according to an example embodiment of the present invention;

Fig. 1B schematically depicts an exemplary completed VLED formed after the LED structure shown in Fig. 1A has been transferred to a receiving or conducting substrate according to the example embodiment of the present invention;

Fig. 1C schematically depicts an exemplary LED structure initially formed on a sapphire substrate according to another example embodiment of the present invention;

Fig. 1D schematically depicts an exemplary LED structure initially formed on a bulk silicon substrate according to a further example embodiment of the present invention;

Fig. 2 generally depicts a flow diagram illustrating a method of fabricating the VLED.

Figs. 3A to 3D schematically depict the steps involved in fabricating the VLED up to the completion of the layer transfer process according to an embodiment of the present invention;

Fig. 4 schematically depicts the reverse micelles of block copolymers used to form the self-assembled template;

Figs 5A to 5E schematically depict the steps involved in fabricating the VLED after the layer transfer process according to an embodiment of the present invention;

12. The method according to claim 11, wherein the second electrode is formed at a surface area of the first material layer without the photonic nanostructures.

13. The method according to claim 12, wherein the first electrode comprises a combination of two or more elements selected from a group consisting of titanium, aluminium, nickel and gold, and the second electrode comprises a combination of two or more elements selected from a group consisting of nickel, gold, silver, and platinum.

14. The method according to any one of claims 1 to 13, wherein the light emitting layer comprises one or more quantum wells of indium gallium nitride and gallium nitride (InGaN/GaN) heterostructures.

15. The method according to any one of claims 1 to 14, wherein the first material layer comprises an n-type nitride material, and the second material layer comprises a p-type nitride material.

16. The method according to claim 15, wherein the first material is selected from a group consisting of an n-type GaN, an n-type AlGaN, an n-type InAlGaN, and the second material is selected from a group consisting of a p-type GaN, a p-type AlGaN, and a p-type InAlGaN.

17. The method according to any one of claims 1 to 16, wherein the photonic nanostructures are generally pillar-type nanostructures.

~~18. A vertical light emitting diode comprising:~~

~~a light emitting diode structure including:~~

~~a first material layer of a first conductivity type;~~

~~a second material layer of a second conductivity type; and~~

~~a light emitting layer disposed in between the first material layer and the second material layer;~~

~~wherein a surface of the first material layer has a plurality of generally ordered photonic nanostructures formed thereat using a self-assembled template for enhancing light extraction efficiency of the vertical light emitting diode, the self-~~

assembled template comprising generally ordered nanoparticles on said surface of the first material layer to function as a mask for forming the photonic nanostructures at said surface of the first material layer.

19. The vertical light emitting diode according to claim 18, further comprises a first electrode formed on the second material layer, and a second electrode formed on the first material layer, wherein the first and second electrodes are configured to receive a bias voltage for providing power to the light emitting layer to generate light.

20. The vertical light emitting diode according to claim 18 or 19, wherein the first material layer is selected from a group consisting of an n-type GaN, an n-type AlGaN, and an n-type InAlGaN, the second material is selected from a group consisting of a p-type GaN, a p-type AlGaN, and a p-type InAlGaN, and the light emitting layer comprises one or more quantum wells of indium gallium nitride and gallium nitride (InGaN/GaN) heterostructures.