

CLAIMS:

1. A light emitting device array comprising:
a light emitting stack having a light emitting surface and a contact surface, the light emitting surface and the contact surface defining opposing sides of the light emitting stack,
5 the light emitting stack comprising a plurality of Group III-nitride layers including a first semiconducting layer provided towards the light emitting surface of the light emitting stack, a second semiconducting layer provided towards the contact surface, and an active layer arranged between the first semiconducting layer and the second semiconducting layer, the active layer configured to generate light having a first wavelength,
10 wherein the light emitting surface and the contact surface are parallel to each other and aligned with the plurality of Group III-nitride layers;
a first electrical contact layer provided on the light emitting stack and configured to be in electrical contact with the first semiconducting layer;
an array of second electrical contacts provided on the contact surface of the light
15 emitting stack, each second electrical contact defining a light emitting device between the first semiconducting layer and the second electrical contact, wherein each of the second electrical contacts is spaced apart from the other second electrical contacts to form a two-dimensional array of the light emitting devices; and
an anti-reflection layer provided on the light emitting surface, the anti-reflection layer
20 configured to increase a light extraction efficiency of light generated by the light emitting device layer.
2. A light emitting device array according to claim 1, further comprising
an absorbing layer configured to absorb light of the first wavelength generated by
25 the active layer; the absorbing layer provided on at least a portion of the light emitting stack.
3. A light emitting device array according to claim 2, wherein the absorbing layer is provided on at least one sidewall surface of the light emitting stack extending between the
30 light emitting surface and the contact surface.
4. A light emitting device array according to claim 2 or claim 3, wherein the absorbing layer is provided on the light emitting surface, wherein the absorbing layer comprises a plurality of openings on the light emitting surface, each opening aligned with a second

electrical contact such that light from each light emitting device is transmitted through a respective opening.

5. A light emitting device array according to any of claims 2 to 4, wherein the
5 absorbing layer is provided in regions of the contact surface between adjacent second electrical contacts of the array of second electrical contacts.
6. A light emitting device array according to any preceding claim, wherein
the anti-reflection layer comprises a porous semiconducting layer having an areal
10 porosity of at least 30%.
7. A light emitting device array according to any preceding claim, wherein
the anti-reflection layer comprises a plurality of porous semiconducting sublayers,
wherein the areal porosity of at least two of the plurality of porous semiconducting sublayer
15 is different.
8. A light emitting device array according to any preceding claim, wherein
a pitch of each second electrical contact in the light emitting device array is no
greater than 5 μm , or 2 μm .
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9. A light emitting device array according to any preceding claim, wherein
the first electrical contact layer comprises a transparent conductive oxide provided
on the light emitting surface.
- 25 10. A light emitting device array according to claim 9, wherein the anti-reflection layer is
arranged between the first electrical contact layer and the light emitting surface.
11. A light emitting device array according to claim 9, wherein the first electrical contact
layer is arranged between the anti-reflection layer and the light emitting surface.
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12. A light emitting device array according to any preceding claim, wherein
the anti-reflection layer and the first electrical contact layer are configured to form a
graded refractive index (GRIN) structure having both anti-reflection and electrical contact
functionality.

13. A light emitting device array according to any of claims 1 to 8, wherein the light emitting stack further comprises:
- a via semiconducting portion provided in the light emitting stack extending through the active layer between the first semiconducting layer and the contact surface, and
- the first electrical contact layer is provided on contact surface in electrical contact with the via semiconducting portion.
14. A light emitting device array according to any preceding claim, wherein the first semiconducting layer comprises a n-type doped Group III-nitride; and/or the second semiconducting layer comprises a p-type doped Group III-nitride; and/or the active layer comprises multiple quantum well layers comprising Group III-nitrides.
15. A light emitting device array according to any preceding claim, wherein the active layer extends as a continuous layer between at least two adjacent light emitting devices of the light emitting device array.
16. A method of forming a light emitting device array comprising:
- forming a light emitting stack on a substrate surface of a substrate, the light emitting stack having a light emitting surface orientated towards the substrate surface and a contact surface on an opposing side of the light emitting stack, forming the light emitting stack comprising forming a plurality of Group III-nitride layers including:
- a first semiconducting layer provided towards the substrate surface;
- a second semiconducting layer provided towards a contact surface of the light emitting stack; and
- an active layer provided between the first semiconducting layer and the second semiconducting layer, the active layer configured to generate light having a first wavelength;
- wherein the light emitting surface and the contact surface of the light emitting stack are formed parallel to each other and aligned with the plurality of Group III-nitride layers;
- forming an array of second electrical contacts on the contact surface of the light emitting stack, each second electrical contact defining a light emitting device between the first semiconducting layer and the second electrical contact, wherein each of the second

electrical contacts are spaced apart from the other second electrical contacts to form a two-dimensional array of the light emitting devices;

removing the substrate from the light emitting stack;

- 5 forming a first electrical contact layer on the light emitting stack, the first contact layer configured to be in electrical contact with the first semiconducting layer; and
forming an anti-reflection layer on the light emitting surface, the anti-reflection layer configured to increase a light extraction efficiency of light generated by the light emitting device layer.

- 10 17. A method according to claim 16, further comprising
forming an absorbing layer on at least a portion of the light emitting stack, the absorbing configured to absorb light of the first wavelength generated by the active layer.

- 15 18. A method according to any of claims 16 to 17, wherein
forming the anti-reflection layer comprises:
forming a third semiconducting layer comprising a Group III-nitride and a donor density of at least $1 \times 10^{18} \text{ cm}^{-3}$ on the light emitting surface; and
subjecting the third semiconducting layer to a porosity treatment process to increase an areal porosity of the third semiconducting layer to at least 30%.

- 20 19. A method according to any of claims 16 to 18, wherein
a pitch of each second electrical contact formed in the light emitting device array is no greater than 5 μm , or 2 μm .

- 25 20. A method according to any of claims 16 to 19, wherein
forming the first electrical contact layer comprises forming a transparent conductive oxide on the light emitting surface.

- 30 21. A method according to claim 20, wherein the anti-reflection layer is formed on the light emitting surface, followed by forming the first electrical contact layer on the anti-reflection layer.

- 35 22. A method according to claim 20, wherein the first electrical contact layer is formed on the light emitting surface, following by forming the anti-reflection layer on the first electrical contact layer.

23. A method according to any of claims 16 to 19, wherein
forming the first electrical contact layer comprises:
forming a via semiconducting portion in the light emitting stack extending
through the active layer between the first semiconducting layer and the contact
5 surface, and
forming a first electrical contact layer on the contact surface on the via
semiconducting portion.
24. A method according to any of claims 16 to 23, wherein
10 forming the first semiconducting layer comprises a forming n-type doped Group III-
nitride; and/or
forming the second semiconducting layer comprises forming a p-type doped Group
III-nitride; and/or
forming the active layer comprises forming multiple quantum well layers comprising
15 Group III-nitrides.
25. A method according to any of claims 16 to 24, wherein
the active layer is formed as a continuous layer extending between at least two
adjacent light emitting devices of the light emitting device array.
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