CLAIMS

I/We claim:

1. A solid state lighting (SSL) device, comprising:

a support member;

a silicon SSL formation structure carried by the support member, the SSL structure having a first surface facing toward the support member and a second surface facing oppositely away from the first surface, the second surface having an off-cut angle with a non-zero value up to about 4.5°; and

an SSL structure carried by the silicon SSL formation structure, the silicon SSL formation structure including a P-type region, an N-type region, and an active region between the P-type region and the N-type region.

2. The device of claim 1, wherein the off-cut angle has a value of from about 0.5° to about 2°.

3. The device of claim 1, further comprising a buffer material positioned between the silicon SSL formation structure and the SSL structure.

4. A solid state lighting (SSL) device, comprising:

a support member;

an SSL formation structure carried by the support member, the SSL formation structure having a first surface facing toward the support member and a second surface facing oppositely away from the first surface, the second surface having an off-cut angle with a non-zero value up to about 4.5°;

an SSL structure carried by the SSL formation structure, the SSL structure including a P-type region, an N-type region, and an active region between the P-type region and the N-type region;

a buffer material positioned between the silicon SSL formation structure and the SSL structure; and

an interlayer structure between the buffer material and the SSL formation structure, wherein the interlayer structure includes at least two layers of gallium nitride and a quantity of silicon nitride between the two layers of gallium nitride.

5. The device of claim 1 wherein the silicon SSL formation structure includes a silicon material with a Si(1,1,1) crystal orientation.

6. The device of claim 1 wherein the silicon SSL formation structure includes a silicon material with a Si(1,0,0) crystal orientation.

7. The device of claim 1 wherein the SSL structure is in direct contact with the silicon SSL formation structure.

8. The device of claim 1 wherein the support member comprises polyalumnium nitride.

9. The device of claim 1, further comprising a first material and a second material contained within the first material, the first and second materials being between the silicon SSL formation structure and the SSL structure.

10. A solid state lighting (SSL) device, comprising:

an SSL formation structure having a formation structure coefficient of thermal expansion (CTE); and

an interlayer structure carried by the SSL formation structure, the interlayer structure including—

a first material having a first material CTE greater than the formation structure CTE, and

a second material stacked relative to the first material and positioned between a first portion of the first material and a second portion of the first material, the second material having a second material CTE less than the first material CTE.

11. The device of claim 10 wherein the difference between the second material CTE and the first material CTE is selected to provide a first force that counteracts a second force placed on the SSL formation structure by the first material.

12. The device of claim 10 wherein:

the SSL formation structure includes silicon; and

the device further comprises a polyaluminum nitride support member carrying the SSL formation structure.

13. The device of claim 10, further comprising a buffer material between the SSL formation structure and the interlayer structure.

14. The device of claim 10 wherein the second material is within 300 nm of the buffer material.

15. The device of claim 10 wherein:

the second material includes spaced-apart volumes of the second material; and

a third portion of the first material is disposed between the spaced-apart volumes of the second material.

16. The device of claim 10 wherein the first material includes gallium nitride and the second material includes silicon nitride.

17. The device of claim 10 wherein the first material is doped with a constituent of the second material.

18. The device of claim 10 wherein the first material is doped with silicon.

19. The device of claim 10 wherein the SSL formation structure has an off-cut angle with a non-zero value of up to about 4.5°.

20. The device of claim 10 wherein:

the SSL formation structure includes silicon; and

SSL formation structure has an off-cut angle with a value of from about 0.5° to about 2°.

CLAIMS

I/We claim:

1. A solid state lighting (SSL) device, comprising:

a support member;

a silicon SSL formation structure carried by the support member, the silicon SSL formation structure having a first surface facing toward the support member and a second surface facing oppositely away from the first surface, the second surface having an off-cut angle with a non-zero value up to about 4.5°; and

an SSL structure carried by the silicon SSL formation structure, the SSL structure including a P-type region, an N-type region, and an active region between the P-type region and the N-type region.

2. The device of claim 1, wherein the off-cut angle has a value of from about 0.5° to about 2°.

3. The device of claim 1, further comprising a buffer material positioned between the silicon SSL formation structure and the SSL structure.

4. A solid state lighting (SSL) device, comprising:

a support member;

an SSL formation structure carried by the support member, the SSL formation structure having a first surface facing toward the support member and a second surface facing oppositely away from the first surface, the second surface having an off-cut angle with a non-zero value up to about 4.5°;

an SSL structure carried by the SSL formation structure, the SSL structure including a P-type region, an N-type region, and an active region between the P-type region and the N-type region;

a buffer material positioned between the silicon SSL formation structure and the SSL structure; and

an interlayer structure between the buffer material and the SSL structure, wherein the interlayer structure includes at least two layers of gallium nitride and a quantity of silicon nitride between the two layers of gallium nitride.

5. The device of claim 1 wherein the silicon SSL formation structure includes a silicon material with a Si(1,1,1) crystal orientation.

6. The device of claim 1 wherein the silicon SSL formation structure includes a silicon material with a Si(1,0,0) crystal orientation.

7. The device of claim 1 wherein the SSL structure is in direct contact with the silicon SSL formation structure.

8. The device of claim 1 wherein the support member comprises polyalumnium nitride.

9. The device of claim 1, further comprising a first material and a second material contained within the first material, the first and second materials being between the silicon SSL formation structure and the SSL structure.

10. A solid state lighting (SSL) device, comprising:

an SSL formation structure having a formation structure coefficient of thermal expansion (CTE);

an interlayer structure carried by the SSL formation structure, the interlayer structure including—

a first material having a first material CTE greater than the formation structure CTE, and

a second material stacked relative to the first material and positioned between a first portion of the first material and a second portion of the first material,

the second material having a second material CTE less than the first material CTE; and

an SSL structure carried by the interlayer structure.

11. The device of claim 10 wherein the difference between the second material CTE and the first material CTE is selected to provide a first force that counteracts a second force placed on the SSL formation structure by the first material.

12. The device of claim 10 wherein:

the SSL formation structure includes silicon; and

the device further comprises a polyaluminum nitride support member carrying the SSL formation structure.

13. The device of claim 10, further comprising a buffer material between the SSL formation structure and the interlayer structure.

14. The device of claim 10 wherein the second material is within 300 nm of the buffer material.

15. The device of claim 10 wherein:

the second material includes spaced-apart volumes of the second material; and

a third portion of the first material is disposed between the spaced-apart volumes of the second material.

16. The device of claim 10 wherein the first material includes gallium nitride and the second material includes silicon nitride.

17. The device of claim 10 wherein the first material is doped with a constituent of the second material.

18. The device of claim 10 wherein the first material is doped with silicon.

19. The device of claim 10 wherein the SSL formation structure has an off-cut angle with a non-zero value of up to about 4.5°.

20. The device of claim 10 wherein:

the SSL formation structure includes silicon; and

the SSL formation structure has an off-cut angle with a value of from about 0.5° to about 2°.