CLAIMS

1. A method for fabricating a thin film III-V compound solar cell, the method comprising the steps of:

providing a substrate;

forming a sacrificial layer on the substrate;

forming an active layer on the sacrificial layer;

forming a backing layer on the active layer; and

removing the sacrificial layer from between the active layer and the substrate to separate the thin film III-V compound solar cell from the substrate.

2. The method of claim 1, wherein the thin film III-V compound solar cell is flexible.

3. The method of claim 1, wherein the substrate is formed of a III-V compound.

4. The method of claim 1, wherein the substrate had been previously used in the fabrication of another thin film III-V compound solar cell.

5. The method of claim 3, wherein the substrate is formed of at least one of Gallium Arsenide (GaAs) and Indium Phosphide (InP).

6. The method of claim 1, wherein the sacrificial layer is formed from at least one of Aluminum Gallium Arsenide ($Al_xGa_{1-x}As$), Indium Aluminum Arsenide ($In_xAl_{1-x}As$), Aluminum Phosphide Antimonide (AlP_xSb_{1-x}) and Aluminum Arsenide Antimonide ($AlAs_xSb_{1-x}$).

7. The method of claim 1, wherein the active layer is formed from a III-V compound.

8. The method of claim 7, wherein the III-V compound is any of Gallium Arsenide (GaAs), Gallium Indium Phosphide ($Ga_{1-x}In_xP$), Gallium Indium Arsenide ($Ga_{1-x}In_xAs$), Indium Phosphide (InP) and Gallium Indium Arsenide Phosphide ($Ga_{1-x}In_xAs_{1-y}P_y$), and Aluminum Gallium Indium Phosphide ($(Al_xGa_{1-x})_{1-y}In_yP$).

9. The method of claim 1 further comprising the step of, forming a (n)th active layer on the (n-1)st active layer where n is the total number of active layers and is an integer greater than one.

10. The method of claim 1, wherein the backing layer is formed of a polymer.

11. The method of claim 1, wherein the backing layer is formed of a composite of metal and polymer

12. The method of claim 1, wherein removing the sacrificial layer from between the active layer and the substrate comprises:

immersing the substrate, sacrificial layer, active layer, and backing layer in an acid etch solution to dissolve the sacrificial layer.

13. The method of claim 1 further comprising the steps of,

applying surface metallization to the active layer; and

applying an antireflection coating to the active layer.

14. A method for forming a plurality of thin film III-V compound solar cells, the method comprising:

providing a substrate;

forming a sacrificial layer on the substrate;

forming a wafer-sized III-V compound solar cell on the sacrificial layer; and

removing the sacrificial layer from between the wafer-sized solar cell and the substrate to separate the wafer-sized III-V compound solar cell from the substrate on a wafer sized scale.

15. A method for forming a flexible III-V compound solar cell, the method comprising:

receiving a substrate previously used to form a III-V compound solar cell;

forming a sacrificial layer on the reused substrate;

forming a wafer sized flexible III-V compound solar cell on the sacrificial layer;

forming a backing layer on the solar cell; and

removing the sacrificial layer from between the solar cell and the substrate to separate the wafer-sized solar cell from the substrate on a wafer sized scale.

16. The method of claim 15, wherein the flexible III-V compound solar cell comprises a thin film multiple junction III-V compound solar cell having multiple junctions.

17. A method for forming a thin film multiple junction III-V compound solar cell, the method comprising the steps of,

forming a first thin film III-V compound solar cell on a first substrate,

forming a second thin film III-V compound solar cell on a second substrate,

lifting by epitaxial lift off one of the first thin film III-V compound solar cell from the first substrate or the second thin film III-V compound solar cell from the second substrate,

wafer bonding the first and the second thin film III-V compound solar cell to form a wafer bonded thin film multiple junction III-V compound solar cell, and

lifting by epitaxial lift off the wafer bonded thin film III-V compound solar cell from the remaining substrate.

18. The method of claim 17 further comprising the step of, forming a backing layer on a surface of the wafer bonded thin film multiple junction III-V compound solar cell.

19. The method of claim 18, wherein the backing layer is formed on the surface the junction having the lowest bandgap energy level in the wafer bonded thin film multiple junction III-V compound solar cell.

20. The method of claim 17 further comprising the step of, metallizing a surface of the wafer bonded thin film multiple junction III-V compound solar cell to form one or more metallized conductive paths.

21. The method of claim 20, wherein the surface of the junction having the highest bandgap energy in the wafer bonded thin film multiple junction III-V compound solar is metallized with a grid of metallized conductors.

22. The method of claim 17 further comprising the step of, forming an antireflection coating a surface of the wafer bonded thin film multiple junction III-V compound solar cell.

23. The method of claim 22, wherein the antireflection coating is formed on the surface of the junction having the highest bandgap energy in the wafer bonded thin film multiple junction III-V compound solar.

Claims

1. A method for fabricating one or more thin film III-V compound solar cells, the method comprising the steps of:

providing a substrate;

forming a sacrificial layer on the substrate;

forming an active layer on the sacrificial layer;

forming a metal backing layer on and in direct contact with the active layer; and

removing the sacrificial layer from between the active layer and the substrate to separate the one or more thin film III-V compound solar cells from the substrate.

2. The method of claim 1, wherein the one or more thin film III-V compound solar cells are flexible.

3. The method of claim 1, wherein the substrate is formed of a III-V compound.

4. The method of claim 1, wherein the substrate had been previously used in the fabrication of another thin film III-V compound solar cell.

5. The method of claim 3, wherein the substrate is formed of at least one of Gallium Arsenide (GaAs) and Indium Phosphide (InP).

6. The method of claim 1, wherein the sacrificial layer is formed from at least one of Aluminum Gallium Arsenide ($Al_xGa_{1-x}As$), Indium Aluminum Arsenide ($In_xAl_{1-x}As$), Aluminum Phosphide Antimonide (AlP_xSb_{1-x}) and Aluminum Arsenide Antimonide ($AlAs_xSb_{1-x}$).

7. The method of claim 1, wherein the active layer is formed from a III-V compound.

8. The method of claim 7, wherein the III-V compound is any of Gallium Arsenide (GaAs), Gallium Indium Phosphide ($Ga_{1-x}In_xP$), Gallium Indium Arsenide ($Ga_{1-x}In_xAs$), Indium Phosphide (InP) and Gallium Indium Arsenide Phosphide ($Ga_{1-x}In_xAs_{1-y}P_y$), and Aluminum Gallium Indium Phosphide ($(Al_xGa_{1-x})_{1-y}In_yP$).

9. The method of claim 1 further comprising the step of, forming a (n)th active layer on the (n-l)st active layer where n is the total number of active layers and is an integer greater than one.

10. The method of claim 1, wherein removing the sacrificial layer from between the active layer and the substrate comprises:

immersing the substrate, sacrificial layer, active layer, and backing layer in an acid etch fluid to dissolve the sacrificial layer.

11. The method of claim 1 further comprising the steps of,

applying surface metallization to the active layer; and

applying an antireflection coating to the active layer.

12. The method of claim 1, wherein the substrate is a wafer-sized substrate.

13. The method of claim 1, wherein at least one of the one or more thin film III-V compound solar cells comprises multiple junctions.

14. The method of claim 1, wherein the backing layer provides structural support to the active layer during and after removal of the sacrificial layer from between the active layer and the substrate.

15. The method of claim 1, wherein the substrate is a wafer substrate of up to 152.4 mm (6 inches) in diameter.

16. The method of claim 15, wherein the wafer substrate has a diameter of 101.6-152.4 mm (4-6 inches).

17. The method of claim 16, wherein the wafer substrate has a diameter of 152.4 mm (6 inches).

18. The method of claim 1, wherein the backing layer includes a first surface in direct contact with the active layer and an opposing second outermost surface of the one or more solar cells.