CLAIMS

What is claimed is:

1. A method of forming a silicon carbide epitaxial wafer, the method comprising:

providing a silicon carbide substrate with a predetermined negative substrate bow by ion implantation; and

forming a silicon carbide epitaxial layer on a front surface of the silicon carbide substrate.

2. The method according to claim 1, wherein the predetermined negative substrate bow is in a range less than or equal to -15μm but greater than 0μm.

3. The method according to claim 1, wherein at least one of a dose, an energy or a type of dopants for the ion implantation is determined based on the predetermined negative substrate bow.

4. The method according to claim 1, further comprising:

conducting the ion implantation of predetermined dopants on a back surface of the silicon carbide substrate to form a layer of the predetermined dopants at the back surface of the silicon carbide substrate, thereby forming the silicon carbide substrate with the predetermined negative substrate bow.

5. The method according to claim 4, further comprising:

forming a protective layer on the front surface of the silicon carbide substrate before conducting the ion implantation; and

removing the protective layer from the front surface of the silicon carbide substrate after conducting the ion implantation.

6. The method according to claim 4, wherein the ion implantation is conducted at temperatures between room temperature and 650ºC.

7. The method according to claim 4, wherein the predetermined dopants comprise at least one of Phosphorus, Aluminum, Titanium, Chromium, Iron, Vanadium, or Germanium.

8. The method according to claim 4, wherein a doping concentration of the predetermined dopants is in a range between $1x10^{16}cm^{-3}$ and $1x10^{20}cm^{-3}$.

9. The method according to claim 4, wherein a depth of the layer of the predetermined dopants is in a range between 0.1μm and 2.0μm.

10. The method according to claim 1, wherein a stacking fault density in the silicon carbide epitaxial layer is less than 1.0 per cm^2, and wherein a density of basal plane dislocation with an extra half-plane pointing towards the silicon carbide epitaxial layer is lower than a density of basal plane dislocation with an extra half-plane pointing towards the silicon carbide substrate.

11. A method of preparing a substrate, the method comprising:

forming a protective layer on a front surface of a silicon carbide substrate;

conducting an ion implantation of predetermined dopants on a back surface of the silicon carbide substrate, thereby forming the silicon carbide substrate with a predetermined negative substrate bow; and

removing the protective layer from the front surface of the silicon carbide substrate.

12. The method according to claim 11, wherein the protective layer comprises silicon dioxide or silicon nitride.

13. The method according to claim 11, wherein at least one of a dose, an energy or a type of dopants for the ion implantation is determined based on the predetermined negative substrate bow.

14. A silicon carbide epitaxial wafer, comprising:

a silicon carbide substrate; and

a silicon carbide epitaxial layer on a front surface of the silicon carbide substrate, wherein the silicon carbide epitaxial layer is formed on the silicon carbide substrate having a predetermined negative substrate bow formed by ion implantation.

15. The silicon carbide epitaxial wafer according to claim 14, wherein the predetermined negative substrate bow is in a range less than or equal to -15μm but greater than 0μm.

16. The silicon carbide epitaxial wafer according to claim 14, wherein the silicon carbide substrate comprises a layer of predetermined dopants at a back surface of the silicon carbide substrate.

17. The silicon carbide epitaxial wafer according to claim 16, wherein the predetermined dopants comprise at least one of Phosphorus, Aluminum, Titanium, Chromium, Iron, Vanadium, or Germanium.

18. The silicon carbide epitaxial wafer according to claim 16, wherein a depth of the layer of predetermined dopants is in a range between 0.1μm and 2.0μm.

19. The silicon carbide epitaxial wafer according to claim 14, wherein a stacking fault density in the silicon carbide epitaxial layer is less than 1.0 per cm^2, and

wherein a density of basal plane dislocation with an extra half-plane pointing towards the silicon carbide epitaxial layer is lower than a density of basal plane dislocation with an extra half-plane pointing towards the silicon carbide substrate.