CLAIMS

1. A method of manufacturing an SOI substrate, comprising:

a first step of subjecting a bond substrate to a first heat treatment in an argon atmosphere and then a second heat treatment in an atmosphere of a mixture of oxygen and nitrogen;

a second step of forming an embrittlement region in a bond substrate by irradiating the bond substrate with ions;

a third step of bonding the bond substrate to a base substrate with an insulating layer therebetween; and

a fourth step of splitting the bond substrate at the embrittlement region to form a semiconductor layer over the base substrate with the insulating layer therebetween,

wherein the steps from the second step to the fourth step are repeated *n* times after the first step is performed once, and

wherein *n* is a natural number greater than or equal to 2.

2. The method of manufacturing an SOI substrate according to claim 1,

wherein an oxide film formed on a surface of the bond substrate in the second heat treatment is used as the insulating layer in bond to the base substrate.

3. The method of manufacturing an SOI substrate according to claim 1,

wherein a concentration of the oxygen in the second heat treatment is less than 5 vol.%.

4. The method of manufacturing an SOI substrate according to claim 1,

wherein the atmosphere during the second heat treatment includes chlorine in addition to the oxygen and the nitrogen.

5. The method of manufacturing an SOI substrate according to claim 1,

wherein the argon atmosphere includes argon and hydrogen.

6. The method of manufacturing an SOI substrate according to claim 1,

wherein an oxygen included in the bond substrate is reduced by the first heat

treatment.

7. A method of manufacturing an SOI substrate, comprising:

a first step of subjecting a bond substrate to a first heat treatment in an argon atmosphere and then a second heat treatment in an atmosphere of a mixture of oxygen and nitrogen;

a second step of forming an embrittlement region in a bond substrate by irradiating the bond substrate with ions;

a third step of bonding the bond substrate to a base substrate with an insulating layer therebetween;

a fourth step of splitting the bond substrate at the embrittlement region to form a semiconductor layer over the base substrate with the insulating layer therebetween;

wherein the steps from the second step to the fourth step are repeated *n* times after the first step is performed once, and

wherein *n* is a natural number greater than or equal to 2, and

subjecting a bond substrate to a third heat treatment in an argon atmosphere and then a fourth heat treatment in an atmosphere of a mixture of oxygen and nitrogen after steps from the second step to the fourth step are repeated *n* times.

8. The method of manufacturing an SOI substrate according to claim 7,

wherein an oxide film formed on a surface of the bond substrate in the second heat treatment is used as the insulating layer in bond to the base substrate.

9. The method of manufacturing an SOI substrate according to claim 7,

wherein a concentration of the oxygen in the second heat treatment is less than 5 vol.%.

10. The method of manufacturing an SOI substrate according to claim 7,

wherein the atmosphere during the second heat treatment includes chlorine in addition to the oxygen and the nitrogen.

11. The method of manufacturing an SOI substrate according to claim 7,

wherein the argon atmosphere includes argon and hydrogen.

12. The method of manufacturing an SOI substrate according to claim 7,

wherein an oxygen included in the bond substrate is reduced by the first heat treatment.

13. A method of manufacturing an SOI substrate, comprising:

a first step of subjecting a bond substrate to a first heat treatment in an argon atmosphere and then a second heat treatment in an atmosphere of a mixture of oxygen and nitrogen;

a second step of forming an embrittlement region in a bond substrate by irradiating the bond substrate with ions;

a third step of bonding the bond substrate to a base substrate with an insulating layer therebetween;

a fourth step of splitting the bond substrate at the embrittlement region to form a semiconductor layer over the base substrate with the insulating layer therebetween;

wherein the steps from the second step to the fourth step are repeated *n* times after the first step is performed once, and

wherein *n* is a natural number greater than or equal to 2, and

polishing a surface of the bond substrate split at the embrittlement region after steps from the second step to the fourth step are repeated *n* times; and

subjecting a bond substrate to a third heat treatment in an argon atmosphere and then a fourth heat treatment in an atmosphere of a mixture of oxygen and nitrogen after polishing the surface of the bond substrate.

14. The method of manufacturing an SOI substrate according to claim 13,

wherein an oxide film formed on a surface of the bond substrate in the second heat treatment is used as the insulating layer in bond to the base substrate.

15. The method of manufacturing an SOI substrate according to claim 13,

wherein a concentration of the oxygen in the second heat treatment is less than 5 vol.%.

16. The method of manufacturing an SOI substrate according to claim 13, wherein the atmosphere during the second heat treatment includes chlorine in addition to the oxygen and the nitrogen.

17. The method of manufacturing an SOI substrate according to claim 13, wherein the argon atmosphere includes argon and hydrogen.

18. The method of manufacturing an SOI substrate according to claim 13, wherein an oxygen included in the bond substrate is reduced by the first heat treatment.

CLAIMS

1. A method of manufacturing an SOI substrate, comprising:

a first step of subjecting a bond substrate to a first heat treatment in an argon atmosphere and then a second heat treatment in an atmosphere of a mixture of oxygen and nitrogen;

a second step of forming an embrittlement region in the bond substrate by irradiating the bond substrate with ions;

a third step of bonding the bond substrate to a base substrate with an insulating layer therebetween;

a fourth step of splitting the bond substrate at the embrittlement region to form a semiconductor layer over the base substrate with the insulating layer therebetween;

a fifth step of repeating the steps from the second step to the fourth step n times after the first step is performed once, wherein n is a natural number greater than or equal to 2; and

a sixth step of subjecting the bond substrate to a third heat treatment in an argon atmosphere and then a fourth heat treatment in an atmosphere of a mixture of oxygen and nitrogen after the fifth step,

wherein the insulating layer comprises a metal element.

2. The method of manufacturing an SOI substrate according to claim 1, wherein an oxide film formed on a surface of the bond substrate in the second heat treatment is used as the insulating layer in bond to the base substrate.

3. The method of manufacturing an SOI substrate according to claim 1, wherein a concentration of the oxygen in the second heat treatment is less than 5 vol. %.

4. The method of manufacturing an SOI substrate according to claim 1, wherein the atmosphere during the second heat treatment includes chlorine in addition to the oxygen and the nitrogen.

5. The method of manufacturing an SOI substrate according to claim 1, wherein the argon atmosphere includes argon and hydrogen.

6. The method of manufacturing an SOI substrate according to claim 1, wherein an oxygen included in the bond substrate is reduced by the first heat treatment.

7. A method of manufacturing an SOI substrate, comprising:

a first step of subjecting a bond substrate to a first heat treatment in an argon atmosphere and then a second heat treatment in an atmosphere of a mixture of oxygen and nitrogen;

a second step of forming an embrittlement region in the bond substrate by irradiating the bond substrate with ions;

a third step of bonding the bond substrate to a base substrate with an insulating layer therebetween;

a fourth step of splitting the bond substrate at the embrittlement region to form a semiconductor layer over the base substrate with the insulating layer therebetween;

a fifth step of repeating the steps from the second step to the fourth step n times after the first step is performed once, wherein n is a natural number greater than or equal to 2;

a sixth step of subjecting the bond substrate to a third heat treatment in an argon atmosphere and then a fourth heat treatment in an atmosphere of a mixture of oxygen and nitrogen after the fifth step; and

a seventh step of repeating the steps from the second step to the fourth step at least once after the sixth step.

8. The method of manufacturing an SOI substrate according to claim 7, wherein an oxide film formed on a surface of the bond substrate in the second heat treatment is used as the insulating layer in bond to the base substrate.

9. The method of manufacturing an SOI substrate according to claim 7, wherein a concentration of the oxygen in the second heat treatment is less than 5 vol. %.

10. The method of manufacturing an SOI substrate according to claim 7, wherein the atmosphere during the second heat treatment includes chlorine in addition to the oxygen and the nitrogen.

11. The method of manufacturing an SOI substrate according to claim 7, wherein the argon atmosphere includes argon and hydrogen.

12. The method of manufacturing an SOI substrate according to claim 7, wherein an oxygen included in the bond substrate is reduced by the first heat treatment.

13. A method of manufacturing an SOI substrate, comprising:

a first step of subjecting a bond substrate to a first heat treatment in an argon atmosphere and then a second heat treatment in an atmosphere of a mixture of oxygen and nitrogen;

a second step of forming an embrittlement region in the bond substrate by irradiating the bond substrate with ions;

a third step of bonding the bond substrate to a base substrate with an insulating layer therebetween;

a fourth step of splitting the bond substrate at the embrittlement region to form a semiconductor layer over the base substrate with the insulating layer therebetween;

a fifth step of repeating the steps from the second step to the fourth step n times after the first step is performed once, wherein n is a natural number greater than or equal to 2;

a sixth step of polishing a surface of the bond substrate after the fifth step;

a seventh step of subjecting the bond substrate to a third heat treatment in an argon atmosphere and then a fourth heat treatment in an atmosphere of a mixture of oxygen and nitrogen after the sixth step; and

an eighth step of repeating the steps from the second step to the fourth step at least once after the seventh step.

14. The method of manufacturing an SOI substrate according to claim 13, wherein an oxide film formed on the surface of the bond substrate in the second heat treatment is used as the insulating layer in bond to the base substrate.

15. The method of manufacturing an SOI substrate according to claim 13, wherein a concentration of the oxygen in the second heat treatment is less than 5 vol. %.

16. The method of manufacturing an SOI substrate according to claim 13, wherein the atmosphere during the second heat treatment includes chlorine in addition to the oxygen and the nitrogen.

17. The method of manufacturing an SOI substrate according to claim 13, wherein the argon atmosphere includes argon and hydrogen.

18. The method of manufacturing an SOI substrate according to claim 13, wherein an oxygen included in the bond substrate is reduced by the first heat treatment.

19. The method of manufacturing an SOI substrate according to claim 1, wherein the metal element is selected from the group consisting of copper, iron, and nickel.

20. The method of manufacturing an SOI substrate according to claim 1, wherein the semiconductor layer is subjected to a polishing treatment after the fourth step.

21. The method of manufacturing an SOI substrate according to claim 7, wherein the semiconductor layer is subjected to a polishing treatment after the fourth step.

22. The method of manufacturing an SOI substrate according to claim 13, wherein the semiconductor layer is subjected to a polishing treatment after the fourth step.