Claims

1. A method for cleaning an ion source component of an ion implanter, wherein said ion source component comprises an ionization chamber and one or more components contained within said ionization chamber, and wherein the interior of said ionization chamber and/or said one or more components contained within said ionization chamber have at least some deposits thereon of elements contained within a dopant gas, said method comprising:

introducing into said ionization chamber a cleaning gas, said cleaning gas comprising a mixture of F_2, one or more inert gases selected from noble gases and/or nitrogen, and optionally O_2, or a mixture of an oxygen/fluorine-containing gas and one or more inert gases selected from noble gases and/or nitrogen; and

reacting said cleaning gas with said deposits under conditions sufficient to remove at least a portion of the deposits from the interior of said ionization chamber and/or from said one or more components contained within said ionization chamber.

2. The method of claim 1 wherein the cleaning gas comprises a mixture of F_2 and Ar, a mixture of F_2, Ar and O_2, or a mixture of oxygen difluoride (OF_2) and Ar.

3. The method of claim 2 wherein F_2, Ar and O_2 from separate sources are mixed and said mixture introduced into said ionization chamber; F_2 and Ar from one source and O_2 from a separate source are mixed and said mixture introduced into said ionization chamber; or F_2, Ar and O_2 from one source are introduced into said ionization chamber.

4. The method of claim 2 wherein the $F_2/[Ar + F_2]$ mole ratio is from about 0.1 to about 0.3, and the $O_2/[F_2 + O_2]$ mole ratio is from about 0.01 to about 0.6.

5. The method of claim 2 wherein the $F_2/[Ar + F_2]$ mole ratio is from about 0.15 to about 0.25, and the $O_2/[F_2 + O_2]$ mole ratio is from about 0.25 to about 0.45.

6. The method of claim 1 wherein the dopant gas comprises carborane ($C_2B_{10}H_{12}$).

7. The method of claim 1 wherein the deposits comprise an element selected from B (boron), C (carbon), W (tungsten), and mixtures thereof.

8. The method of claim 1 wherein said method employs thermal and/or plasma based activation of said cleaning gas.

9. The method of claim 1 further comprising (i) prior to introducing said cleaning gas into said ionization chamber, introducing said cleaning gas into a plasma chamber, exciting said cleaning gas in said plasma chamber to create a plasma, and introducing ions, radicals, neutrals and other disassociated species from said plasma into said ionization chamber, (ii) introducing said cleaning gas into said ionization chamber and exciting said cleaning gas in said ionization chamber to create a plasma, or (iii) prior to introducing said cleaning gas into said ionization chamber, introducing said cleaning gas comprising F_2/Ar into a plasma chamber, exciting said cleaning gas in said plasma chamber to create a plasma, removing ions, radicals, neutrals and other disassociated species from the plasma from said plasma chamber, mixing said ions, radicals, neutrals and other disassociated species from the plasma with O_2 to create a gas stream, and introducing said gas stream into said ionization chamber.

10. The method of claim 1 wherein reacting said cleaning gas with said deposits is carried out in said ionization chamber at a temperature of from about 25°C to about 1000°C.

11. The method of claim 1 wherein reacting said cleaning gas with said deposits is carried out in said ionization chamber at a pressure of from about 0.1 torr to about 10 torr.

12. The method of claim 1 wherein reacting said cleaning gas with said deposits is carried out in said ionization chamber at a reaction time of from about 30 seconds to about 45 minutes.

13. The method of claim 1 wherein said cleaning gas is introduced into said ionization chamber at a flow rate of from about 10 sccm to about 1000 sccm.

14. The method of claim 1 further comprising evacuating said ionization chamber after said reacting.

15. The method of claim 14 further comprising repeating said method one or more times.

16. A method for cleaning an ion source component of an ion implanter, wherein said ion source component comprises an ionization chamber and one or more components contained within said ionization chamber, and wherein the interior of said ionization chamber and/or said one or more components contained within said ionization chamber have at least some deposits thereon of elements contained within carborane ($C_2B_{10}H_{12}$) dopant gas, said method comprising:

introducing into said ionization chamber a cleaning gas, said cleaning gas comprising a mixture of F_2, one or more inert gases selected from noble gases and/or nitrogen, and optionally O_2, or a mixture of an oxygen/fluorine-containing gas and one or more inert gases selected from noble gases and/or nitrogen; and

reacting said cleaning gas with said deposits under conditions sufficient to remove at least a portion of the deposits from the interior of said ionization chamber and/or from said one or more components contained within said ionization chamber.

17. A method for preventing or reducing the formation of deposits of elements contained within a dopant gas in an ion source component of an ion implanter, wherein said ion source component comprises an ionization chamber and one or more components contained within said ionization chamber, said method comprising:

introducing into said ionization chamber a dopant gas;

introducing into said ionization chamber a cleaning gas, said cleaning gas comprising a mixture of F_2, one or more inert gases selected from noble gases and/or nitrogen, and optionally O_2, or a mixture of an oxygen/fluorine-containing gas and one or more inert gases selected from noble gases and/or nitrogen; and

reacting said dopant gas and said cleaning gas under conditions sufficient to prevent the formation of deposits of elements contained within said dopant gas on the interior of said ionization chamber and/or on said one or more components contained within said ionization chamber; or reacting said dopant gas, and deposits forming on the interior of said ionization chamber and/or on said one or more components contained within said ionization chamber during ionization of said dopant gas, with said cleaning gas under conditions sufficient to reduce the formation of deposits on the interior of said ionization chamber and/or on said one or more components contained within said ionization chamber.

18. The method of claim 17 further comprising extracting an ion beam from said ionization chamber for implantation into a substrate.

19. The method of claim 17 wherein said method employs thermal/plasma based activation of said dopant gas and said cleaning gas.

20. A method for preventing or reducing the formation of deposits of elements contained within carborane ($C_2B_{10}H_{12}$) dopant gas in an ion source component of an ion implanter, wherein said ion source component comprises an ionization

chamber and one or more components contained within said ionization chamber, said method comprising:

introducing into said ionization chamber a dopant gas, said dopant gas comprising carborane ($C_2B_{10}H_{12}$);

introducing into said ionization chamber a cleaning gas, said cleaning gas comprising a mixture of F_2, one or more inert gases selected from noble gases and/or nitrogen, and optionally O_2, or a mixture of an oxygen/fluorine-containing gas and one or more inert gases selected from noble gases and/or nitrogen; and

reacting said dopant gas and said cleaning gas under conditions sufficient to prevent the formation of deposits of elements contained within said carborane ($C_2B_{10}H_{12}$) dopant gas on the interior of said ionization chamber and/or on said one or more components contained within said ionization chamber; or reacting said dopant gas, and deposits forming on the interior of said ionization chamber and/or on said one or more components contained within said ionization chamber during ionization of said dopant gas, with said cleaning gas under conditions sufficient to reduce the formation of deposits on the interior of said ionization chamber and/or on said one or more components contained within said ionization chamber.

Claims

1. A method for cleaning an ion source component of an ion implanter, wherein said ion source component comprises an ionization chamber and one or more components contained within said ionization chamber, and wherein the interior of said ionization chamber and/or said one or more components contained within said ionization chamber have at least some deposits thereon of elements contained within a dopant gas, said method comprising:

introducing into said ionization chamber a cleaning gas, said cleaning gas comprising a mixture of F_2, one or more inert gases selected from noble gases and/or nitrogen, and optionally O_2, or a mixture of an oxygen/fluorine-containing gas and one or more inert gases selected from noble gases and/or nitrogen;

reacting said cleaning gas with said deposits under conditions sufficient to remove at least a portion of the deposits from the interior of said ionization chamber and/or from said one or more components contained within said ionization chamber;

evacuating said ionization chamber after said reacting; and

further comprising repeating said method one or more times.