

Claims:

1. A dopant gas composition comprising:

a boron-containing dopant gas composition comprising diborane (B_2H_6) at a level ranging from about 0.1% - 10%, H_2 ranging from about 5% - 15% and the balance is BF_3 , wherein said B_2H_6 is selected to have a ionization cross-section higher than that of said BF_3 at an operating arc voltage of an ion source utilized during generation and implantation of active boron ions;

wherein said boron-containing dopant gas composition increases boron ion beam current and extends ion source life in comparison to a beam current generated from boron trifluoride (BF_3).

2. The dopant gas composition of claim 1, wherein said B_2H_6 is at about 2-5%, said H_2 is at a level ranging from about 5-10% and the balance is BF_3 .

3. The dopant composition of claim 1, wherein said B_2H_6 , said H_2 and balance BF_3 is supplied from a single storage and delivery source.

4. The dopant composition of claim 1, wherein said B_2H_6 and BF_3 are supplied in separate storage and delivery sources so as to create the boron-containing dopant composition within a chamber of said ion source.

5. The dopant composition of claim 1, wherein said boron-containing gas composition is characterized by the absence of an inert gas.

6. A system for providing an improved beam current during boron ion implantation, comprising:

an ion source apparatus partially defined by an arc chamber wall, wherein the chamber comprises a boron ion source disposed at least partially within the chamber wall;

one or more supply vessels in fluid communication with said ion source apparatus, said vessels storing a boron-containing dopant gas composition, said composition comprising B_2H_6

at a level ranging from about 0.1% - 10%, H₂ ranging from about 5% - 15% and the balance is BF₃, wherein said B₂H₆ is selected to have a ionization cross-section higher than that of said BF₃ at an operating arc voltage of an ion source utilized during generation and implantation of active boron ions;

one or more supply feed lines corresponding to the one or more supply vessels, said feed lines extending from the one or more supply vessels through the wall into the chamber;

said one or more vessels configured to dispense said boron-containing dopant composition through said supply feed lines and into said ion source apparatus thereby allowing the boron-containing composition to ionize and thereby generate active boron ions;

wherein the active boron ions produce an increased beam current in comparison to a beam current generated solely from BF₃.

7. The system of claim 6, wherein said B₂H₆ is at about 2-5%, said H₂ is at a level ranging from about 5-10% and the balance is BF₃.

8. The system of claim 6, wherein a first supply vessel and a second supply vessel are provided as part of a gas kit, said first supply vessel comprising B₂H₆ in combination with H₂, and said second supply vessel comprising BF₃, each of said first and second supply vessel dispensing B₂H₆, H₂ and BF₃, respectively, to the ion source chamber at controlled flow rates to produce a boron-containing dopant composition within the chamber wherein said B₂H₆ is at about 2-5%, said H₂ is at a level ranging from about 5-10% and the balance is BF₃.

9. The system of claim 8, wherein said gas kit comprises a first flow controller for regulating flow of said B₂H₆ and said H₂ at a first flow rate from said first supply vessel, and said kit further comprises a second flow controller for regulating flow of said BF₃ at a second flow rate from said second supply vessel.

10. The system of claim 6, wherein a single supply vessel is pre-mixed with the boron-containing dopant gas composition, and further wherein said supply vessel is a sub-atmospheric storage and delivery vessel.

11. A method for increasing a quality of an ion beam current during boron ion implantation, comprising:

introducing the boron-containing dopant composition into an ion source chamber,
said boron-containing dopant composition comprising B₂H₆ at a level ranging from about 0.1% - 10%, H₂ ranging from about 5% - 15% and the balance as BF₃;

ionizing said B₂H₆ and said BF₃ at a predetermined operating arc voltage at which said B₂H₆ has an ionization cross-section higher than that of said BF₃;

generating active boron ions; and

producing an increased beam current having an extended source life in comparison to a beam current generated solely from BF₃.

12. The method of claim 11, wherein said boron-containing dopant composition is characterized by an absence of an inert gas.

13. The method of claim 11, wherein a first supply vessel and a second supply vessel are provided as part of a gas kit, said first supply vessel comprising B₂H₆ in combination with H₂, and said second supply vessel comprises BF₃, said first vessel dispensing B₂H₆ and H₂, and said second vessel dispensing said BF₃ to the ion source chamber at controlled flow rates in a co-flowed or sequentially flowed manner to produce the boron-containing dopant composition within the chamber.

14. The method of claim 11, wherein said predetermined operating arc voltage ranges from about 80 V – 120 V.

15. The method of claim 11, wherein a single supply vessel dispenses said boron-containing dopant composition into said chamber.

16. The dopant gas composition of claim 1, wherein at least one of said B₂H₆ and said BF₃ is isotopically enriched.

17. The system of claim 6, wherein at least one of said B₂H₆ and said BF₃ is isotopically enriched.

18. The method of claim 11, wherein at least one of said B₂H₆ and said BF₃ is isotopically enriched.