CLAIMS

1. A method of operating an ion source, comprising:

introducing a composition into the ion source at a flow rate ranging from about 0.5-5 sccm, said composition comprising B2H6 at a level ranging from about 0.1%-10%; H2 ranging from about 5%-15% and the balance isotopically enriched boron trifluoride in boron mass isotope 11 ($11BF_3$), and further wherein said composition is characterized by the substantial absence of higher order boranes, represented by the general formula BxHy, where x is 3 or greater and y is 7 or greater;

operating at an arc voltage that is no greater than 110V;

ionizing said composition to produce 11B ions;

generating a beam current; and

implanting said 11B ions into a substrate.

2. The method of claim 1, wherein the beam current is greater than a beam current generated with BF3 isotopically enriched in boron mass isotope 11 (11BF3) when 11BF3 is solely used as the dopant gas.

3. The method of claim 1, further comprising operating the ion source so that a glitch rate is no greater than 2 glitches per min while operating the ion source for a source life of 100 hours or more.

4. The method of claim 1, wherein the arc voltage to the ion source is about 5-10% less than an arc voltage created with 11BF3 when 11BF3 is solely used as the dopant gas.

5. The method of claim 1, further comprising the step of generating a beam current that is about 8-13 mA for a source life of 100 hrs or more having an average glitch rate of less than 1 glitch per min during said source life with the arc voltage set between 80-110V.

6. The method of claim 1, wherein said flow rate is between about 3-4 sccm.

7. The method of claim 3 wherein said glitch rate is no greater than 1 glitch per min during said source life.

8. The method of claim 1, wherein said isotopically enriched boron trifluoride is 11BF3 and said 11B ions are substantially derived from 11BF3.

9. The method of claim 1, wherein said 11B ions are substantially derived from 11BF3.

10. A method of operating an ion source, comprising:

introducing a composition into the ion source comprising B2H6 at a level ranging from 0.1%-10%; H2 ranging from about 5%-15% and the balance isotopically enriched boron trifluoride in boron mass isotope 11 ($11BF_3$);

operating at a power that is less than a corresponding power utilized for 11BF3 when solely used as the dopant gas;

ionizing said composition to produce 11B ions;

generating a beam current that is substantially the same as or higher than a beam current produced when using the 11BF3 solely as the dopant gas; and

implanting said 11B ions into a workpiece to achieve a required dosage.

11. The method of claim 10, wherein the ion source life is at least 50% longer than a source life of the 11BF3 when solely used as the dopant gas and the beam current is higher than the beam current produced using solely the 11BF3 as the dopant gas.

12. The method of claim 10, wherein the power is operated at a level that is lower than a power when using only the 11BF3 as the dopant gas to generate the beam current, said beam current being higher than the beam current produced using solely 11BF3 as the dopant gas.

13. The method of claim 10, wherein the power is set by operating at an arc current that is lower in comparison to an arc current used when using solely 11BF3 to generate the beam current, wherein the beam current is substantially the same as the beam current produced using solely the 11BF3 as the dopant gas.

14. The method of claim 10, wherein the workpiece comprises a predetermined dosage of substantially 11B ions implanted therein, and further wherein said workpiece has at least a 40% lower amount of W-based contaminants in comparison to W-based contaminants generated when the 11BF3 is solely used as the dopant gas.

15. The method of claim 10, further comprising operating the ion source for at least a 50% longer source life compared to a source life when using the 11BF3 solely as the dopant gas.

16. The method of claim 12, wherein the power is operated at a level that is 5-10% lower than a power when using the 11BF3 solely as the dopant gas.

17. An ion source apparatus configured to perform boron implantation at an arc voltage that is less than 110V, said ion source adapted to receive about 0.5-5 sccm of a composition comprising B2H6 at a level ranging from 0.1%-10%; H2 ranging from about 5%-15% and the balance isotopically enriched boron trifluoride in boron mass isotope 11 ($11BF_3$), the ion source apparatus characterized by an average glitch rate of no greater than about 2 glitches per min during an ion source life, and the ion source apparatus further characterized by the ion source life of at least 100 hours.

18. The ion source apparatus of claim 17, further comprising a sub-atmospheric delivery package comprising the composition, said sub-atmospheric delivery package in fluid communication with the ion source apparatus.

19. The ion source apparatus of claim 17, wherein said ion source apparatus is capable of generating a higher beam current of 11B ions as the arc voltage is lowered without a reduction of the ion source life.

20. The ion source apparatus of claim 19, further comprising:
an implant end station;
a workpiece in the implant end station;
the workpiece receiving an implantation of 11B ions to achieve a predetermined 11B dosage, and said 11B dosage having at least a 50% lower amount of W-based contaminants compared to W-based contaminants generated from 11BF3 when solely as the dopant gas.

21. A method of operating an ion source for implanting B ions, comprising:
introducing a composition at a flow rate ranging between 0.5-5 sccm directly to an ion source characterized by the absence of vaporizing the composition comprising B2H6 at a level ranging from 2%-5%; H2 ranging from about 5%-10% and the balance boron trifluoride isotopically enriched in boron mass isotope 11 ($11BF_3$);
operating the ion source at an arc voltage between 80-100V;
ionizing the composition to produce 11B ions;
generating a beam current between about 8-13 mA; and operating the ion source for a source life of 200 hours or more having an average glitch rate of less than 1 glitch per min during said source life.

22. The method of claim 21, wherein said B2H6 is isotopically enriched above natural abundance level in any of its isotopes.

23. The method of claim 21, further comprising operating the ion source without an inert gas selected from the group consisting of xenon and argon, thereby avoiding a decrease in the beam current.

24. A boron-containing dopant composition for use in an ion implantation process, comprising:

a boron-containing dopant gas mixture in a source supply comprising B2H6 from 0.1%-10%; H2 ranging from about 5%-15% and the balance isotopically enriched boron trifluoride in boron mass isotope 11 ($^{11}BF_3$), and further wherein said mixture in the source supply is characterized by no greater than 10,000 ppm of higher order boranes.

25. The boron-containing dopant composition of claim 24, characterized by the substantial or entire absence of xenon or argon.