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(54) Title: ENCAPSULATION OF ELECTRODES IN SOLID MEDIA FOR USE IN CONJUNCTION WITH FLUID HIGH VOLTAGE ISOLATION

(57) Abstract: An inductively-coupled plasma source for a focused charged particle beam system includes a conductive shield that provides improved electrical isolation and reduced capacitive RF coupling and a dielectric fluid that insulates and cools the plasma chamber. The conductive shield may be enclosed in a solid dielectric media. The dielectric fluid may be circulated by a pump or not circulated by a pump. A heat tube can be used to cool the dielectric fluid.

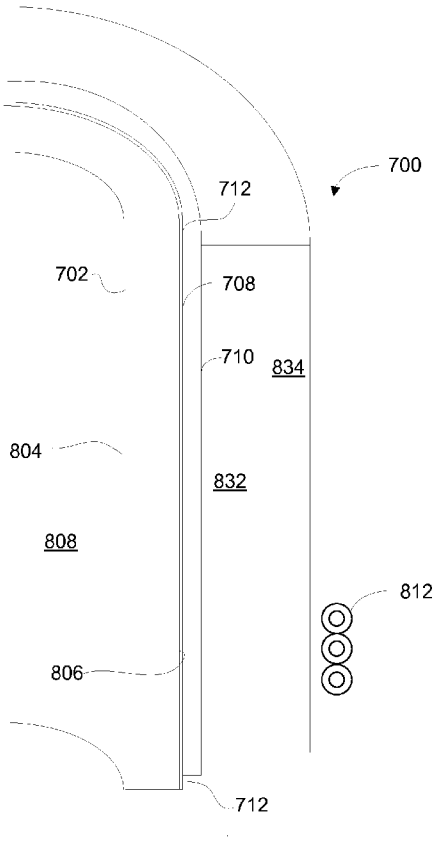

FIG. 8

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AMENDED CLAIMS
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1. A charged particle beam system, comprising:

a plasma source having:

a plasma chamber having a wall composed of a dielectric material, the wall having an interior surface and an exterior surface;

a conductor coiled at least one time around the plasma chamber;

a shield composed of an electrically conductive material and substantially encapsulated in a dielectric media, the conductive shield positioned between the plasma chamber and the conductor coiled around the plasma chamber; and

a source electrode for electrically biasing the plasma to a high voltage; and

one or more focusing lenses for focusing charged particles from the plasma source onto a sample.

2. The charged particle beam system of claim 1 in which the shield is positioned on the exterior surface of the plasma chamber.

3. The charged particle beam system of claim 2 in which there are substantially no voids between the conductive material of the shield and the exterior surface of the plasma chamber.

4. The charged particle beam system of claim 2 in which the shield includes gaps for passing an inductive field to the plasma chamber and in which the dielectric encapsulant contacts the exterior surface of the plasma chamber wall between the gaps in the conductive material.

5. The charged particle beam system of claim 1 in which the dielectric encapsulant comprises an epoxy, enamel, a glass frit, a resin, or a polymer.

6. The charged particle beam system of claim 1 further comprising a fluid contacting at least a portion of the dielectric media.

7. The charged particle beam system of claim 6 in which the fluid is positioned between the dielectric encapsulant and the conductor coiled around the plasma chamber.

8. The charged particle beam system of claim 6 in which the fluid is positioned between the exterior surface of the plasma chamber and the dielectric encapsulant.

9. The charged particle beam system as in claim 6 in which the fluid is not actively pumped.

10. The charged particle beam system of claim 1 in which a non-encapsulated portion of the shield is exposed for making electrical contact.

11. The charged particle beam system of claim 1 in which a material is provided to displace any voids between the exterior surface of the plasma chamber wall and the dielectric media.

12. The charged particle beam system of claim 11 in which the material provided to displace any gaps between the exterior surface of the wall and the dielectric media comprises a liquid or a liquid that subsequently hardens after being applied.

13. A plasma source for a charged particle beam system comprising:

a plasma chamber having a wall with an interior surface and an exterior surface;

a conductor for providing radio frequency energy to the plasma chamber;

a conductive shield substantially encapsulated in a dielectric media, the conductive shield positioned between the conductor and the exterior surface of the plasma chamber; and

a fluid positioned between the conductive shield and the conductor.

14. The plasma source of claim 13 in which the fluid is cooled by a cooling system.

15. The plasma source of claim 14 in which the fluid comprises water or a fluorine compound.

16. The plasma source of claim 14 in which the fluid is positioned between the exterior surface of the plasma chamber and the dielectric media encapsulating the conductive shield.

17. The plasma source of claim 14 in which the fluid is positioned between the exterior surface of the plasma chamber and the dielectric media encapsulating the conductive shield.

18. A method of providing high voltage isolation to a plasma source of a charged particle beam system, comprising:

providing a plasma chamber;

providing a conductor coiled at least one time around the plasma chamber;

providing a conductive shield positioned between the plasma chamber and the conductor;

substantially encapsulating the conductive shield in a solid dielectric media; and

providing a source electrode for electrically biasing the plasma to a high voltage.

19. The method of claim 18 further comprising providing a cooling fluid contacting at least a portion of the solid dielectric media.

20. The method of claim 18 in which the cooling fluid is positioned between the plasma chamber and the dielectric media encapsulating the conductive shield.

21. The method of claim 18 in which the cooling fluid is positioned between the dielectric media encapsulating the conductive shield and the conductor coiled around the plasma chamber.

22. The method of claim 18 further comprising pumping the cooling fluid to cool the plasma chamber.