Claims

1. An ion source, comprising:

a plasma chamber to house a plasma;

an extraction assembly, disposed along a side of the plasma chamber, and comprising at least one extraction aperture;

an antenna assembly extending through the plasma chamber and comprising:

a dielectric enclosure; and

a plurality of conductive antennas extending through the dielectric enclosure, the conductive antennas having respective gas ports formed therein for delivering a gas into the dielectric enclosure; and

a temperature regulation system coupled to the conductive antennas and to the dielectric enclosure for monitoring a temperature of the dielectric enclosure and regulating the gas delivered to the conductive antennas for regulating the temperature of the dielectric enclosure, wherein the temperature regulation system comprises a heater for heating the gas delivered to the conductive antennas; and a heater control for controlling operation of the heater.

2. The ion source of claim 1, wherein the conductive antennas are hollow, tubular bodies.

3. The ion source of claim 1, further comprising a beam blocker disposed within the plasma chamber, adjacent the extraction aperture, for extracting angled ion beams through the extraction aperture.

4. The ion source of claim 1, further comprising a power generator coupled to the plasma chamber for generating the plasma.

5. A processing system, comprising:

an ion source, comprising:

a plasma chamber to house a plasma;

an extraction assembly, disposed along a side of the plasma chamber, and comprising at least one extraction aperture; and

an antenna assembly extending through the plasma chamber and comprising:

a dielectric enclosure; and

a plurality of conductive antennas extending through the dielectric enclosure, the conductive antennas having respective gas ports formed therein for delivering a gas into the dielectric enclosure; and

a temperature regulation system coupled to the conductive antennas and to the dielectric enclosure for monitoring a temperature of the dielectric enclosure and regulating the gas delivered to the conductive antennas for regulating the temperature of the dielectric enclosure, wherein the temperature regulation system comprises a heater for heating the gas delivered to the conductive antennas; and a heater control for controlling operation of the heater.

6. The processing system of claim 5, wherein the temperature regulation system comprises a flow controller for regulating a flow of the gas delivered to the conductive antennas.

7. The processing system of claim 5, wherein the temperature regulation system comprises a temperature sensor for monitoring the temperature of the dielectric enclosure.

8. The processing system of claim 5, wherein the temperature regulation system comprises:

a heater for heating the gas delivered to the conductive antennas;

a heater control for controlling operation of the heater;

a flow controller for regulating a flow of the gas delivered to the conductive antennas;

a temperature sensor for monitoring the temperature of the dielectric enclosure; and

a main controller connected to the heater control, the flow controller, and temperature sensor, the main controller adapted to dictate operation of the heater control and the flow controller based on the temperature monitored by the temperature sensor.

9. The processing system of claim 8, wherein the main controller is adapted to direct the flow controller to increase the flow of gas to the conductive antennas if the temperature of the dielectric enclosure is above a target temperature.

10. The processing system of claim 8, wherein the main controller is adapted to direct the flow controller to decrease the flow of gas to the conductive antennas if the temperature of the dielectric enclosure is below a target temperature.

11. The processing system of claim 8, wherein the main controller is adapted to direct the direct the heater control to decrease or entirely suspend heating of the gas via the heater if the temperature of the dielectric enclosure is above a target temperature.

12. The processing system of claim 8, wherein the main controller is adapted to direct the direct the heater control to increase heating of the gas via the heater if the temperature of the dielectric enclosure is below a target temperature.

13. A method of regulating a temperature within a plasma chamber of an ion source, the method comprising:

monitoring a temperature of a dielectric enclosure within the plasma chamber;

flowing a gas into the dielectric enclosure via a plurality of conductive antennas extending through the dielectric enclosure;

comparing the monitored temperature of the dielectric enclosure to a target temperature, decreasing heating of the gas delivered to the dielectric enclosure if the temperature of the dielectric enclosure is above the target temperature; and increasing heating of the gas delivered to the dielectric enclosure if the temperature of the dielectric enclosure is below the target temperature.

14. The method of claim 13, further comprising regulating at least one of a temperature and a flow of the gas based on the monitored temperature of the dielectric enclosure.

15. The method of claim 13, further comprising comparing the monitored temperature of the dielectric enclosure to a predetermined target temperature.

16. The method of claim 13, further comprising comparing the monitored temperature of the dielectric enclosure to a target temperature and increasing the flow of gas to dielectric enclosure if the temperature of the dielectric enclosure is above the target temperature.

17. The method of claim 13, further comprising comparing the monitored temperature of the dielectric enclosure to a target temperature and decreasing the flow of gas to dielectric enclosure if the temperature of the dielectric enclosure is below the target temperature.