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PATENT
Attorney Docket No.: ZON-009

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	Roman Chistyakov		
SERIAL NO.:	10/249,202	GROUP NO.:	2821
FILING DATE:	March 21, 2003	EXAMINER:	Vo, Tuyet Thi
TITLE:	PLASMA GENERATION USING MULTI-STEP IONIZATION		

Commissioner for Patents
Alexandria, Virginia 22313-1450

AMENDMENT AND RESPONSE

Sir:

The following amendments and remarks are responsive to the Office Action mailed on February 11, 2004 in the above-identified patent application. Entry and consideration of the following amendments and remarks, and allowance of the claims, as presented, are respectfully requested. The Commissioner is hereby authorized to charge the additional claims fee and any other proper fees to Attorney's Deposit Account No. 501211.

Please enter the following amendments and consider the remarks that follow.

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Amendments to the Claims:

Please amend claims 1, 6, 18, 22, 30, 33, and 40-42 and add new claims 43-46 as follows.

1. (currently amended) A plasma generator that generates a plasma with a multi-step ionization process, the plasma generator comprising:

a feed gas source comprising ground state atoms;

an excited atom source that ~~is coupled to~~ receives ground state atoms from the feed gas source, the excited atom source comprising a magnet that generates a magnetic field for substantially trapping electrons proximate to the ground state atoms, the excited atom source generating excited atoms from the ground state atoms;

a plasma chamber that is coupled to the excited atom source, the plasma chamber confining a volume of excited atoms generated by the excited atom source; and

an energy source that is coupled to the volume of excited atoms confined by the plasma chamber, the energy source raising an energy of excited atoms in the volume of excited atoms so that at least a portion of the excited atoms in the volume of excited atoms is ionized, thereby generating a plasma with a multi-step ionization process.

2. (original) The plasma generator of claim 1 wherein the feed gas source comprises ground state atoms that are chosen from the group comprising noble gas atoms, a mixture of different noble gas atoms, reactive gas atoms, a mixture of different reactive gas atoms, and a mixture of noble and reactive gas atoms.

3. (original) The plasma generator of claim 1 wherein the feed gas source comprises a volume of ground state argon atoms.

4. (original) The plasma generator of claim 1 wherein the excited atom source comprises a metastable atom source that generates metastable atoms from the ground state atoms.

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5. (original) The plasma generator of claim 1 wherein the excited atom source comprises a first electrode and a second electrode, the first electrode and the second electrode generating a discharge that excites the ground state atoms.

6. (currently amended) The plasma generator of claim 1 wherein the ~~excited atom source further comprises a magnet that generates a~~ magnetic field that substantially traps electrons proximate to the ground state atoms~~, thereby increasing~~ increases at least one of a rate at which the excited atoms are generated from the ground state atoms and a density of excited atoms.

7. (original) The plasma generator of claim 1 wherein the excited atom source comprises an electron gun that directs an electron beam into the ground state atoms, the electron beam exciting the ground state atoms.

8. (original) The plasma generator of claim 1 wherein a pressure differential exists between a pressure in the excited atom source and a pressure in the plasma chamber, the pressure differential increasing at least one of a rate at which the excited atoms are generated from the ground state atoms and a density of the excited atoms.

9. (original) The plasma generator of claim 1 wherein the excited atom source comprises an inductively coupled discharge source that generates a discharge that excites ground state atoms.

10. (original) The plasma generator of claim 1 wherein the excited atom source is positioned inside the plasma chamber.

11. (original) The plasma generator of claim 1 wherein the excited atom source is positioned outside the plasma chamber.

12. (original) The plasma generator of claim 1 wherein the excited atoms generated by the excited atom source have a lower ionization energy compared with an ionization energy of the ground state atoms.

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13. (original) The plasma generator of claim 1 wherein the energy source is chosen from the group comprising a DC discharge source, a radio frequency (RF) source, an X-ray source, an electron beam source, an ion beam source, an inductively coupled plasma (ICP) source, a capacitively coupled plasma (CCP) source, a microwave plasma source, an electron cyclotron resonance (ECR) plasma source, a helicon plasma source, a magnetron source, and an AC discharge source.

14. (original) The plasma generator of claim 1 wherein the energy source comprises a power supply.

15. (original) The plasma generator of claim 14 wherein the power supply is chosen from the group comprising a pulsed (DC) power supply, a RF power supply, an AC power supply, and a DC power supply.

16. (original) The plasma generator of claim 1 further comprising an electron/ion absorber that receives the excited atoms from the excited atom source, the electron/ion absorber trapping elections and ions.

17. (original) The plasma generator of claim 1 wherein the plasma that is generated with the multi-step ionization process has a higher plasma density than a plasma that is generated by direct ionization of the ground state atoms.

18. (currently amended) A plasma generator that generates a plasma with a multi-step ionization process, the plasma generator comprising:

a feed gas source comprising ground state atoms;

a metastable atom source that ~~is coupled to~~ receives ground state atoms from the feed gas source, the metastable atom source comprising a magnet that generates a magnetic field for substantially trapping electrons proximate to the ground state atoms, the metastable atom source generating metastable atoms from the ground state atoms;

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a plasma chamber that is coupled to the metastable atom source, the plasma chamber confining a volume of metastable atoms generated by the metastable atom source; and

a power supply that is electrically coupled to the volume of metastable atoms confined by the plasma chamber, the power supply generating a power that raises an energy of metastable atoms in the volume of metastable atoms so that at least a portion of the metastable atoms in the volume of metastable atoms is ionized, thereby generating a plasma with a multi-step ionization process.

19. (original) The plasma generator of claim 18 wherein the metastable atom source comprises a first electrode and a second electrode, the first electrode and the second electrode generating a discharge that excites the ground state atoms to a metastable state.

20. (original) The plasma generator of claim 18 wherein the metastable atom source comprises an electron gun that directs an electron beam into the ground state atoms, the electron beam exciting the ground state atoms to a metastable state.

21. (original) The plasma generator of claim 18 wherein the metastable atom source comprises an inductively coupled discharge source that generates a discharge that excites the ground state atoms.

22. (currently amended) The plasma generator of claim 18 wherein the ~~metastable atom source comprises a magnet that generates a~~ magnetic field that substantially traps electrons proximate to the ground state atoms~~, thereby increasing~~ increases at least one of a rate at which the metastable atoms are generated from the ground state atoms and a density of the metastable atoms.

23. (original) The plasma generator of claim 18 wherein a pressure differential exists between a pressure in the metastable atom source and a pressure in the plasma chamber, the pressure differential increasing at least one of a rate at which the metastable atoms are generated from the ground state atoms and a density of the metastable atoms.

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