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APPLICANTS:	Chistyakov		
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FILING DATE:	September 30, 2002	EXAMINER:	Rodney G. McDonald
TITLE:	High-Power Pulsed Magnetron Sputtering		

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AMENDMENT AND RESPONSE FOR RCE

Sir:

The Applicant requests non-entry of the Amendment and Response After Final that was filed March 8, 2006, which was not entered. Instead, the Applicant request entry of this Amendment and Response for RCE. The following remarks are responsive to the final Office Action mailed on January 11, 2006 in the above-identified patent application. Consideration of the following remarks, and allowance of the claims, as presented, is respectfully requested. A Request for Continued Examination (RCE) and a Petition for a one-month extension of time, up to and including May 11, 2006 are submitted herewith. Authorization to charge Attorney's charge card for the RCE fee, the extension fee and any other proper fees is given in the EFS-Web filing submission papers.

Amendments to the Claims begin on page 2 of this paper.

Remarks are on page 9 of this paper.

Amendments to the Claims:

Please amend claims 1, 20, and 40 as follows:

1. (currently amendment) A magnetically enhanced sputtering source comprising:

   a) an anode;

   b) a cathode assembly that is positioned adjacent to the anode, the cathode assembly including a sputtering target;

   c) an ionization source that generates a weakly-ionized plasma proximate to the anode and the cathode assembly;

   d) a magnet that is positioned to generate a magnetic field proximate to the weakly-ionized plasma, the magnetic field substantially trapping electrons in the weakly-ionized plasma proximate to the sputtering target; and

   e) a power supply generating a voltage pulse that produces an electric field between the cathode assembly and the anode, the power supply being configured to generate the voltage pulse with an amplitude and a rise time ~~of the voltage pulse being chosen to~~ that increases an excitation rate of ground state atoms that are present in the weakly-ionized plasma to create a multi-step ionization process that generates a strongly-ionized plasma, which comprises ions that sputter target material, from the weakly-ionized plasma, the multi-step ionization process comprising exciting the ground state atoms to generate excited atoms, and then ionizing the excited atoms within the weakly-ionized plasma without forming an arc discharge ~~to create ions that sputter target material from the sputtering target~~.

2. (original) The sputtering source of claim 1 wherein the power supply generates a constant power.

3. (original) The sputtering source of claim 1 wherein the power supply generates a constant voltage.

4. (original) The sputtering source of claim 1 wherein the electric field comprises a quasi-static electric field.

5. (original) The sputtering source of claim 1 wherein the electric field comprises a pulsed electric field.

6. (previously presented) The sputtering source of claim 1 wherein the rise time of the voltage pulse is chosen to increase the ionization rate of the excited atoms in the weakly-ionized plasma.

7. (previously presented) The sputtering source of claim 1 wherein the weakly-ionized plasma reduces the probability of developing an electrical breakdown condition between the anode and the cathode assembly.

8. (original) The sputtering source of claim 1 wherein the ions in the strongly-ionized plasma impact the surface of the sputtering target in a manner that causes substantially uniform erosion of the sputtering target.

9. (original) The sputtering source of claim 1 wherein the strongly-ionized plasma is substantially uniform proximate to the sputtering target.

10. (original) The sputtering source of claim 1 further comprising a substrate support that is positioned in a path of the sputtering flux.

11. (original) The sputtering source of claim 10 further comprising a temperature controller that controls the temperature of the substrate support.

12. (original) The sputtering source of claim 10 further comprising a bias voltage power supply that applies a bias voltage to a substrate that is positioned on the substrate support.

13. (original) The sputtering source of claim 1 wherein a volume between the anode and the cathode assembly is chosen to increase the ionization rate of the excited atoms in the weakly-ionized plasma.

14. (original) The sputtering source of claim 1 wherein the ionization source comprises an electrode.

15. (original) The sputtering source of claim 1 wherein the ionization source comprises a DC power supply that generates an electric field proximate to the anode and the cathode assembly.

16. (original) The sputtering source of claim 1 wherein the ionization source comprises an AC power supply that generates an electric field proximate to the anode and the cathode assembly.

17. (original) The sputtering source of claim 1 wherein the ionization source is chosen from the group comprising a UV source, an X-ray source, an electron beam source, and an ion beam source.

18. (original) The sputtering source of claim 1 wherein the magnet comprises an electro-magnet.

19. (original) The sputtering source of claim 1 wherein the sputtering target is formed of a material chosen from the group comprising a metallic material, a polymer material, a superconductive material, a magnetic material, a non-magnetic material, a conductive material, a non-conductive material, a composite material, a reactive material, and a refractory material.

20. (currently amended) A method of generating sputtering flux, the method comprising:

    a) ionizing a feed gas to generate a weakly-ionized plasma proximate to a sputtering target;

    b) generating a magnetic field proximate to the weakly-ionized plasma, the magnetic field substantially trapping electrons in the weakly-ionized plasma proximate to the sputtering target; and

c) applying a voltage pulse to the weakly-ionized plasma, an amplitude and a rise time of the voltage pulse being chosen to increase an excitation rate of ground state atoms that are present in the weakly-ionized plasma to create a multi-step ionization process that generates a strongly-ionized plasma, which comprises ions that sputter target material, from the weakly-ionized plasma, the multi-step ionization process comprising exciting the ground state atoms to generate excited atoms, and then ionizing the excited atoms within the weakly-ionized plasma without forming an arc discharge ~~to sputter target material from the sputtering target~~.

21. (original) The method of claim 20 wherein the applying the electric field comprises a applying a quasi-static electric field.

22. (original) The method of claim 20 wherein the applying the electric field comprises applying a substantially uniform electric field.

23. (original) The method of claim 20 wherein the applying the electric field comprises applying an electrical pulse across the weakly-ionized plasma.

24. (original) The method of claim 23 further comprising selecting at least one of a pulse amplitude and a pulse width of the electrical pulse that increases an ionization rate of the strongly-ionized plasma.

25. (original) The method of claim 23 further comprising selecting at least one of a pulse amplitude and a pulse width of the electrical pulse that reduces a probability of developing an electrical breakdown condition proximate to the sputtering target.

26. (original) The method of claim 23 further comprising selecting at least one of a pulse amplitude and a pulse width of the electrical pulse that causes the strongly-ionized plasma to be substantially uniform in an area adjacent to a surface of the sputtering target.

27. (original) The method of claim 23 wherein the electrical pulse comprises a pulse having a current density that is greater than $1A/cm^2$.

28. (original) The method of claim 23 wherein the electrical pulse comprises a pulse having a pulse width that is greater than 1.0 microseconds.

29. (original) The method of claim 23 wherein the electrical pulse comprises a pulse train having a repetition rate that is substantially between 0.1Hz and 1kHz.

30. (original) The method of claim 20 wherein the ions in the strongly-ionized plasma impact the surface of the sputtering target in a substantially uniform manner.

31. (original) The method of claim 20 wherein the strongly-ionized plasma is substantially uniform proximate to the sputtering target.

32. (original) The method of claim 20 wherein the peak plasma density of the weakly-ionized plasma is less than about 10^{12} cm^{-3}.

33. (original) The method of claim 20 wherein the peak plasma density of the strongly-ionized plasma is greater than about 10^{12} cm^{-3}.

34. (previously presented) The method of claim 20 further comprising forming a film on a surface of a substrate from the material sputtered from the sputtering target.

35. (original) The method of claim 34 further comprising controlling a temperature of the film.

36. (original) The method of claim 34 further comprising applying a bias voltage to the film.

37. (original) The method of claim 20 wherein the ionizing the feed gas comprises exposing the feed gas to an electric field.

38. (original) The method of claim 20 wherein the ionizing the feed gas comprises exposing the feed gas to an electrode that is adapted to emit electrons.

39. (original) The method of claim 20 wherein the ionizing the feed gas comprises exposing the feed gas to at least one of a UV source, an X-ray source, an electron beam source, and an ion beam source.

40. (currently amended) A magnetically enhanced sputtering source comprising:

   a) means for ionizing a feed gas to generate a weakly-ionized plasma proximate to a sputtering target;

   b) means for generating a magnetic field proximate to the weakly-ionized plasma, the magnetic field substantially trapping electrons in the weakly-ionized plasma proximate to the sputtering target; and

   c) means for applying a voltage pulse to the weakly-ionized plasma, an amplitude and a rise time of the voltage pulse being chosen to increase an excitation rate of ground state atoms that are present in the weakly-ionized plasma to create a multi-step ionization process that generates a strongly-ionized plasma from the weakly-ionized plasma, the multi-step ionization process comprising exciting the ground state atoms to generate excited atoms, and then ionizing the excited atoms within the weakly-ionized plasma, without forming an arc discharge, to ions that sputter target material from the sputtering target.

41. (previously presented) The sputtering source of claim 1 wherein the cathode assembly and the anode are positioned so as to form a gap therebetween.

42. (previously presented) The sputtering source of claim 1 wherein the weakly-ionized plasma is generated from a feed gas that comprises the ground state atoms.

43. (previously presented) The sputtering source of claim 1 wherein the excited atoms within the weakly-ionized plasma are ionized by electrons to create the ions that sputter material from the sputtering target.

44. (previously presented) The sputtering source of claim 1 wherein the rise time of the voltage pulse is approximately between 0.01 and 100V/μsec.

45. (previously presented) The sputtering source of claim 1 wherein the amplitude of the voltage pulse is approximately between 100V and 30kV.

46. (previously presented) The method of claim 20 wherein the weakly-ionized plasma is generated from a feed gas that comprises the ground state atoms.

47. (previously presented) The method of claim 20 wherein a duration of the weakly-ionized plasma is approximately between one microsecond and one hundred seconds.

48. (previously presented) The method of claim 20 wherein the ionizing the excited atoms within the weakly-ionized plasma to create ions that sputter material from the sputtering target comprises ionizing the excited atoms with electrons.

49. (previously presented) The method of claim 20 wherein the rise time of the voltage pulse is approximately between 0.01 and 100V/μsec.

50. (previously presented) The method of claim 20 wherein the amplitude of the voltage pulse is approximately between 100V and 30kV.

REMARKS

Request for an Examiner's Interview

The Applicant and the Applicant's Attorney hereby request an interview with the Examiner in order to expedite the prosecution of this case.

Pending Claims

Claims 1-50 are currently pending. Independent claims 1, 20, and 40 have been amended.

Rejections under 35 U.S.C. §102(b) As Being Anticipated by Kouznetsov

Claims 1, 5-10, 13-14, 16, 19-20, 22-31, 34, 37-38, and 40-50 are rejected under 35 U.S.C. §102(b) as being anticipated by Kouznetsov (WO98/40532) (hereinafter "Kouznetsov").

To anticipate a claim under 35 U.S.C. §102, a single reference must teach every aspect of the claimed invention either explicitly or impliedly. Any feature not directly taught by the reference must be inherently present in the reference. Thus, a claim is anticipated by a reference only if each and every element of the claim is described, either expressly or inherently, in a single prior art reference.

Independent Claim 1 and Dependent Claims 5-10, 13, 14, 16, and 19

The Applicant respectfully submits that Kouznetsov does not describe each and every element of independent claim 1 as currently amended. Independent claim 1 has been amended to recites that the power supply is configured to generate a voltage pulse with an amplitude and a rise time that increases the excitation rate of ground state atoms that are present in the weakly-ionized plasma to create a multi-step ionization process that generates a strongly-ionized plasma comprising ions that sputter target material from the sputtering target. In addition, independent claim 1 has been amended to recite that the multi-step ionization process comprises exciting the ground state atoms to generate excited atoms, and then ionizing the excited atoms within the weakly-ionized plasma without forming an arc discharge.

The Applicant submits that there is no description in Kouznetsov of the power supply claimed in independent claim 1. In particular, the Applicant submits that there is no description in Kouznetsov of a multi-step ionization process that first excites ground state atoms to generate excited atoms, and then ionizes the excited atoms without forming an arc discharge. In contrast, Kouznetsov specifically describes a power supply that causes the gas to very rapidly transition to a fully ionized state by using an arc discharge. According to Kouznetsov, the gas first adapts the state of a glow discharge and then continues to the state of an arc discharge in order to finally adopt a fully ionized state. See Kouznetsov, page 5, lines 6-8. Thus, the Applicant respectfully submits that Kouznetsov does not describe each and every element of independent claim 1 as currently amended for at least the reason that amended independent claim 1 requires a multi-step ionization process that prevents the formation of an arc discharge.

In addition, Kouznetsov does not teach the multi-step ionization process claimed in amended independent claim 1. Independent claim 1 as currently amended recites that the amplitude and the rise time of the voltage pulse are specifically chosen to increase an excitation rate of ground state atoms that are present in the weakly-ionized plasma to create a multi-step ionization process at the atomic level that generates a strongly-ionized plasma from the weakly-ionized plasma. This argument was presented in the Response filed on February 24, 2005 and in the Response for RCE filed on October 27, 2005. In the Office Action dated January 11, 2006, the Examiner stated that this argument was not persuasive because Kouznetsov teaches utilizing a pulse which has an amplitude and a rise time and that such a pulse will allow the plasma to go from a partially ionized state to a fully ionized state.

The Applicant agrees with the Examiner's statement that Kouznetsov teaches utilizing a pulse that allows the plasma to go from a partially ionized state to a fully ionized state. However, the method described in Kouznetsov of transitioning from a partially ionized state to a fully ionized state using an arc discharge is not equivalent to the claimed multi-step process. The description in Kouznetsov of the terms "partial ionization" and "more ionized" refer to the state of the plasma macroscopically that is used to generate the ions in the plasmas. The term "partially ionized" plasma refers to plasmas that have some ionized ground state atoms and many neutral ground state atoms. The term "more ionized" plasma refers to plasmas that have more ionized ground state atoms and less neutral ground state atoms compared with the "partially ionized" plasma. The macroscopic state of ionization (i.e. the "partially ionized" or "more ionized" plasma state) does not imply anything about the particular ionization process at the atomic level (i.e. direct ionization or the multi-step ionized described in the present application) that is used to ionize the ground state atoms to form the "partially ionized" or "more ionized" plasma.

The term "multi-step" ionization as used in the present application does not mean an ionization process where the plasma goes from a partially ionized state to a fully ionized state as suggested by the Examiner in the Office Action dated January 11, 2006. Instead, the term "multi-step" ionization as used in the present application refers to an ionization process that requires ground state atoms and molecules to transition from the ground state to at least one intermediate excited state before being fully ionized. The present specification provides an example of Ar multi-step ionization in paragraph 63. This paragraph states that an argon atom requires an energy of about 11.55eV at the atomic level to become excited. The excited atoms then require about 4eV of energy at the atomic level to ionize. In contrast, neutral argon atoms ionized by the direct ionization process described in Kouznetsov require about 15.76eV of energy at the atomic level.

In view of the above remarks, the Applicant respectfully submits that Kouznetsov does not describe each and every element of independent claim 1 as currently amended, either expressly or inherently. Therefore, the Applicant submits that Kouznetsov does not anticipate independent claim 1 under 35 U.S.C. §102(b). Thus, the Applicant submits that independent claim 1 is allowable. The Applicant also submits that dependent claims 5-10, 13, 14, 16, and 19 are allowable as depending from an allowable base claim.

Independent Claim 20 and Dependent Claims 22-31, 34, and 37-38

The Applicant respectfully submits that Kouznetsov does not describe each and every element of independent claim 20 as currently amended. Amended independent claim 20 recites the step of applying a voltage pulse to the weakly-ionized plasma where an amplitude and a rise time of the voltage pulse are chosen to increase an excitation rate of ground state atoms that are present in the weakly-ionized plasma to create a multi-step ionization process that generates a strongly-ionized plasma, which comprises ions that sputter target material, from the weakly-ionized plasma. The claimed multi-step ionization process comprises exciting the ground state atoms to generate excited atoms, and then ionizing the excited atoms within the weakly-ionized plasma without forming an arc discharge.

The Applicant respectfully submits that Kouznetsov does not describe each and every element of independent claim 20 as currently amended for at least the reason that amended independent claim 20 requires a multi-step ionization process that prevents the formation of an arc discharge. In addition, the Applicant submits that Kouznetsov does not teach the multi-step ionization process claimed in amended independent claim 20 in view of the arguments made in connection with the rejection of amended independent claim 1. Therefore, the Applicant submits that Kouznetsov does not anticipate independent claim 20. Thus, the Applicant submits that independent claim 20 and dependent claims 22-31, 34, 37, and 38 are allowable under 35 U.S.C. §102(b).

<u>Independent Claim 40 and Dependent Claims 41-50</u>

The Applicant respectfully submits that Kouznetsov does not describe each and every element of independent claim 40 as currently amended. Amended independent claim 40 recites a means for applying a voltage pulse to the weakly-ionized plasma where an amplitude and a rise time of the voltage pulse is chosen to increase an excitation rate of ground state atoms that are present in the weakly-ionized plasma to create a multi-step ionization process that generates a strongly-ionized plasma from the weakly-ionized plasma. The claimed multi-step ionization process comprises exciting the ground state atoms to generate excited atoms, and then ionizing the excited atoms within the weakly-ionized plasma without forming an arc discharge.

The Applicant respectfully submits that Kouznetsov does not describe each and every element of independent claim 40 as currently amended for at least the reason that amended independent claim 40 requires a multi-step ionization process that prevents the formation of an arc discharge. In addition, the Applicant submits that Kouznetsov does not teach the multi-step ionization process claimed in amended independent claim 40 in view of the arguments made in connection with the rejection of amended independent claim 1. Therefore, the Applicant submits that Kouznetsov does not anticipate independent claim 40. Thus, the Applicant submits that independent claim 40 and dependent claims 41-50 are allowable under 35 U.S.C. §102(b).

Rejections under 35 U.S.C. §102(b) as Being Anticipated by Mozgrin

Claims 1, 4-5, 7, 13-14, 16, 19-25, 27-29, 32-33, 37, and 40 are rejected under 35 U.S.C. §102(b) as being anticipated by Mozgrin et al. entitled "High Current Low-Pressure Quasi-Stationary Discharge in a Magnetic Field: Experimental Research", Plasma Physics Reports, Vol. 21, No. 5, 1995, pp. 400-409 (hereinafter "Mozgrin").

To anticipate a claim under 35 U.S.C. §102, a single reference must teach every aspect of the claimed invention either explicitly or impliedly. Any feature not directly taught by the reference must be inherently present in the reference. Thus, a claim is anticipated by a reference only if each and every element of the claim is described, either expressly or inherently, in a single prior art reference.

Independent Claim 1 and Dependent Claims 4-5, 7, 13-14, 16, and 19

The Applicant respectfully submits that Mozgrin does not describe each and every element of independent claim 1 as currently amended. Independent claim 1 has been amended to recites that the power supply is configured to generate a voltage pulse with an amplitude and a rise time that increases the excitation rate of ground state atoms that are present in the weakly-ionized plasma to create a multi-step ionization process that generates a strongly-ionized plasma comprising ions that sputter target material. In addition, independent claim 1 has been amended to recite that the multi-step ionization process comprises exciting the ground state atoms to generate excited atoms, and then ionizing the excited atoms within the weakly-ionized plasma without forming an arc discharge.

The Applicant submits that there is no description in Mozgrin of the power supply claimed in independent claim 1. In particular, the Applicant submits that there is no description in Mozgrin of a multi-step ionization process that first excites ground state atoms to generate excited atoms, and then ionizes the excited atoms without forming an arc discharge. In contrast, Mozgrin describes a power supply that generates a current-voltage characteristic that includes a high-current, low-voltage arc discharge regime. See Mozgrin discussion of quasi-stationary discharge regimes beginning on page 402. Part 4 of the voltage oscillogram of the quasi-stationary discharge corresponds to the high-current low-voltage arc discharge. Thus, the Applicant respectfully submits that Mozgrin does not describe each and every element of independent claim 1 as currently amended for at least the reason that amended independent claim 1 requires a multi-step ionization process that prevents the formation of an arc discharge.

In addition, Mozgrin does not teach the multi-step ionization process claimed in amended independent claim 1. The method of generating the stationary discharge that pre-ionizes the process gas and the method of generating the quasi-stationary discharge described in Mozgrin are not equivalent to the claimed multi-step process. Mozgrin describes generating a stationary discharge that is used to pre-ionize the process gas (See Mozgrin page 401, col. 2, lines 12-13) and then generating a quasi-stationary discharge by applying a square voltage pulse to a gap that contains either neutral or pre-ionized gas (See Mozgrin page 401, col. 1, lines 35-38). The Applicant believes that both of the stationary discharge and the quasi-stationary discharge are generated using a single-step ionization process known as direct ionization by electron impact.

The term "multi-step" ionization as used in the present application refers to an ionization process that requires ground state atoms and molecules to transition from the ground state to at least one intermediate excited state before being fully ionized. The present specification provides an example of Ar multi-step ionization in paragraph 63. In this paragraph it is stated that an argon atom requires an energy of about 11.55eV at the atomic level to become excited. The excited atoms then require about 4eV of energy at the atomic level to ionize. In contrast, neutral argon atoms ionized by the direct ionization process described in Kouznetsov require about 15.76eV of energy at the atomic level.

Furthermore, there is no description in Mozgrin of choosing an amplitude and a rise time as claimed in independent claim 1. In contrast, Mozgrin describes varying the plasma discharge conditions by changing the pressure and magnetic field strength. See Mozgrin page 403 lines 8-13.

In view of the above remarks, the Applicant respectfully submits that Mozgrin does not describe each and every element of independent claim 1, either expressly or inherently. Therefore, the Applicant submits that Mozgrin does not anticipate independent claim 1. Thus, the Applicant submits that independent claim 1 and dependent claims 4-5, 7, 13-14, 16, and 19 are allowable under 35 U.S.C. §102(b).

Independent Claim 20 and Dependent Claims 21-25, 27-29, 32, 33, and 37

The Applicant respectfully submits that Mozgrin does not describe each and every element of independent claim 20 as currently amended. Amended independent claim 20 recites the step of applying a voltage pulse to the weakly-ionized plasma where an amplitude and a rise time of the voltage pulse are chosen to increase an excitation rate of ground state atoms that are present in the weakly-ionized plasma to create a multi-step ionization process that generates a strongly-ionized plasma comprising ions that sputter target material from the weakly-ionized plasma. The claimed multi-step ionization process comprises exciting the ground state atoms to generate excited atoms, and then ionizing the excited atoms within the weakly-ionized plasma without forming an arc discharge.

The Applicant respectfully submits that Mozgrin does not describe each and every element of independent claim 20 as currently amended for at least the reason that amended independent claim 20 requires a multi-step ionization process that prevents the formation of an arc discharge. In addition, the Applicant submits that Mozgrin does not teach the multi-step ionization process claimed in amended independent claim 20 in view of the arguments made in connection with the rejection of amended independent claim 1. Therefore, the Applicant submits that Mozgrin does not anticipate independent claim 20. Thus, the Applicant submits that independent claim 20 and dependent claims 22-31, 34, 37, and 38 are allowable under 35 U.S.C. §102(b).

Independent Claim 40

The Applicant respectfully submits that Mozgrin does not describe each and every element of independent claim 40 as currently. Amended independent claim 40 recites a means for applying a voltage pulse to the weakly-ionized plasma where an amplitude and a rise time of the voltage pulse is chosen to increase an excitation rate of ground state atoms that are present in the weakly-ionized plasma to create a multi-step ionization process that generates a strongly-ionized plasma from the weakly-ionized plasma. The claimed multi-step ionization process comprises exciting the ground state atoms to generate excited atoms, and then ionizing the excited atoms within the weakly-ionized plasma, without forming an arc discharge, to ions that sputter target material from the sputtering target.

The Applicant respectfully submits that Mozgrin does not describe each and every element of independent claim 40 as currently amended for at least the reason that amended independent claim 40 requires a multi-step ionization process that prevents the formation of an arc discharge. In addition, the Applicant submits that Mozgrin does not teach the multi-step ionization process claimed in amended independent claim 40 in view of the arguments made in connection with the rejection of amended independent claim 1. Therefore, the Applicant submits that Mozgrin does not anticipate independent claim 40. Thus, the Applicant submits that independent claim 40 and dependent claims 41-50 are allowable under 35 U.S.C. §102(b).

Rejections under 35 U.S.C. §103(a)

Claims 1-3 are rejected under 35 U.S.C. §103(a) as being unpatentable over Kouznetsov. Claims 1-3, 17, 20, and 39 are rejected under 35 U.S.C. §103(a) as being unpatentable over Mozgrin. Claims 1, 10-12, 15, 20, 34-36 are rejected under 35 U.S.C. §103(a) as being unpatentable over Kouznetsov in view of Chaing. Claims 1 and 18 are rejected under 35 U.S.C. §103(a) as being unpatentable over Kouznetsov in view of Kadlec.

In view of the above claim amendments and remarks, the Applicant submits that independent claim 1 is not obvious under 35 U.S.C. §103(a) in view of the above reference alone or in combination because none of these references teach or suggest choosing an amplitude and a rise time of the voltage pulse generated by a power supply to increase the excitation rate of ground state atoms that are present in the weakly-ionized plasma to generate a multi-step ionization process as claimed in independent claim 1. Furthermore, the Applicant submits that independent claim 20 is not obvious under 35 U.S.C. §103(a) in view of the above reference alone or in combination because none of these references teach or suggest a method of generating a strongly-ionized plasma using a multi-step ionization process as claimed in independent claim 20. Therefore, the Applicant submits that independent claims 1 and 20 and dependent claims 2-3, 10-12, 15, 17-18, 34-36, and 39 are allowable over the prior art of record.

CONCLUSION

The Applicant and the Applicant's Attorney have requested an interview with the Examiner in order to expedite the prosecution of this case.

Claims 1-50 are currently pending. Independent claims 1, 20, and 40 have been amended. The Applicant respectfully requests reconsideration of the pending claims in light of the claim amendments and arguments presented in this Amendment and Response.

Attached are a request for continued examination (RCE) and a Petition for a one-month extension of time. The Commissioner is hereby authorized to charge the RCE fee, the extension fee, and any other proper fees to Attorney's charge card.

If, in the Examiner's opinion, a telephonic interview would expedite prosecution of the present application, the undersigned attorney would welcome the opportunity to discuss any outstanding issues, and to work with the Examiner toward placing the application in condition for allowance.

Respectfully submitted,

Date: May 2, 2006
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