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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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Commissioner of Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

RESPONSE FOR RCE

Sir:

The following remarks are responsive to the final Office Action mailed on May 27, 2005 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 two–month extension of time, up to and including October 27, 2005 are submitted herewith. The Commissioner is hereby authorized to charge the RCE fee, the extension fee and any other proper fees to Attorney's Deposit Account No. 501211.

Please consider the remarks that follow.

Pending Claims:

1. (previously presented) 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, 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 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. (previously presented) 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 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 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. (previously presented) 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 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

Provisional Non-Statutory Double Patenting Rejections

The Applicant acknowledges with appreciation the statement on page 10 of the Office Action dated May 27, 2005 that the obviousness-type double patenting rejection is overcome.

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"). The Applicant respectfully traverses this rejected under 35 U.S.C. §102(b).

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 amended in the Response to Office Action dated June 14, 2004. Independent claim 1 recites a magnetically enhanced sputtering source having a power supply that generates a voltage pulse that produces an electric field between the cathode assembly and the anode. The voltage pulse generated by the power supply comprises an amplitude and a rise time that 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 from the weakly-ionized plasma.

The Applicant submits that there is no description in Kouznetsov of the power supply claimed in independent claim 1. Specifically, the Applicant submits that there is no description in Kouznetsov of choosing the amplitude and the rise time of the voltage pulse generated by the 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.

The multi-step ionization process claimed in independent claim 1, and described in paragraphs 63-67 of the present application, requires energies at the atomic level that are different from the energies at the atomic level that are required to achieve the direct ionization process that is used to generated plasmas in the apparatus described in Kouznetsov. As described in paragraph 63 of the specification of the present application, 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 direct ionization require about 15.76eV of energy at the atomic level.

Independent claim 1 recites that an amplitude and a 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. For the example given in the specification, the amplitude and rise time are chosen to result in an 11.55eV increase in energy compared with a 15.76eV increase in energy at the atomic level that would be required to ionize neutral argon atoms by direct ionization.

The Examiner states on page 10 of the Office Action dated May 27, 2005 that Kouznetsov suggests that as the voltage in the pulse described in Kouznetsov increases, the gas will undergo various ionizations and excited states until being fully ionized. The Applicant respectfully requests that the Examiner provide a reference to the text in Kouznetsov that describes these various ionizations and excited states. The Applicant believes that the Examiner may be referring to Kouznetsov, page 9, lines 21-25, that describes the generation of partially ionized and more fully ionized plasmas. The terms "partial ionization" and "more ionized" as used in Kouznetsov refer to the state of the plasma macroscopically and not to any particular ionization process at the atomic level, which is used to generate the ions in the plasmas. That is, a "partially ionized" plasma has some ionized ground state atoms and many neutral ground state atoms. A "more ionized" plasma has more ionized ground state atoms and less neutral ground state atoms compared with the "partially ionized" plasma. The Applicant submits that the macroscopic state of ionization (i.e. "partially ionized" or "more ionized") does not imply anything about the particular ionization process at the atomic level that is used to ionize the ground state atoms to form the "partially ionized" or "more ionized" plasma.

The Applicant strongly believes that the "partially ionized" or "more ionized" plasma described in Kouznetsov is created by direct ionization or atomic ionization by electron impact (hereinafter "direct ionization") that is used in most known plasma generators. See, for example, paragraphs 27-29 of the present specification for a description of direct ionization. According to Kouznetsov, the pulsed power source used in the Kouznetsov apparatus provides "pulses in such a way, i.e. that so much power is developed in each pulse, that in the application of such a pulse, for a very short time during the start of the pulse, the state of the gas located at the region in which the electrons are trapped by the magnetic field will very rapidly reach a fully ionized state..." See, for example, Kouznetsov page 5, lines 1-4.

Thus, Kouznetsov describes a power supply that generates a pulse having a large voltage (2,000 Volts) in a very short time duration so that the gas very rapidly reaches a fully ionized state. The Applicant submits that one skilled in the art will appreciate that the application of a very large voltage pulse in a very short time duration will ionize the gas by direct ionization with electrons located in the region having crossed electric and magnetic fields. See, for example, Kouznetsov page 12, lines 22-26.

Furthermore, the Applicant submits that one skilled in the art will appreciate that if any multi-step ionization is occurring in plasmas generated using the power supply described in Kouznetsov, that such ionization will be statistically insignificant. Therefore, the Applicant submits that Kouznetsov does not describe the power supply claimed in independent claim 1.

In view of the above remarks, the Applicant respectfully submits that Kouznetsov does not describe each and every element of independent claim 1, 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 amended in the Response to Office Action dated June 14, 2004. Independent claim 20 recites the step of applying a voltage pulse to the weakly-ionized plasma. An amplitude and a rise time of the voltage pulse are chosen to increase an excitation rate of ground state atoms in the weakly-ionized plasma to create a multi-step ionization process. The multi-step ionization process generates excited atoms from ground state atoms in the weakly-ionized plasma, and then ionizes the excited atoms in the weakly-ionized plasma.

The Applicant submits that there is no description in Kouznetsov of the method of generating a strongly-ionized plasma using a multi-step ionization process as claimed in independent claim 20. As described in connection with the rejection of independent claim 1 under 35 U.S.C. §102(b), Kouznetsov describes a power supply that generates a pulse having a large voltage (2,000 Volts) in a very short time duration so that the gas very rapidly reaches a fully ionized state. The Applicant submits that one skilled in the art will appreciate that the application of a very large voltage pulse in a very short time duration will ionize the gas by direct ionization. Furthermore, the Applicant believes that if any multi-step ionization is occurring in plasma generated using the method described in Kouznetsov, that such ionization will be statistically insignificant.

In view of the above remarks, the Applicant respectfully submits that Kouznetsov does not describe each and every element of independent claim 20. 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).

Independent Claim 40 and Dependent Claims 41-50

The Applicant respectfully submits that Kouznetsov does not describe each and every element of independent claim 40 as amended in the Response to Office Action dated June 14, 2004. Independent claim 40 recites a means for applying a voltage pulse to a weakly-ionized plasma. 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. Also, 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 to ions that sputter target material from the sputtering target.

The Applicant submits that there is no description in Kouznetsov of the means for applying a voltage pulse to the weakly-ionized plasma as claimed in independent claim 40. As described in connection with the rejection of independent claim 1 under 35 U.S.C. §102(b), Kouznetsov describes a power supply that generates a pulse having a large voltage (2,000 Volts) in a very short time duration so that the gas very rapidly reaches a fully ionized state. The Applicant submits that one skilled in the art will appreciate that the application of a very large voltage pulse in a very short time duration will ionize the gas by direct ionization. Furthermore, the Applicant believes that if any multi-step ionization is occurring in plasma generated using the method described in Kouznetsov, that such ionization will be statistically insignificant.

In view of the above remarks, the Applicant respectfully submits that Kouznetsov does not describe each and every element of independent claim 40. 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"). The Applicant respectfully traverses this rejected under 35 U.S.C. §102(b).

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 amended in the Response to Office Action dated June 14, 2004. Independent claim 1 recites a magnetically enhanced sputtering source having a power supply that generates a voltage pulse that produces an electric field between the cathode assembly and the anode. The voltage pulse generated by the power supply comprises an amplitude and a rise time that 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 Applicant submits that there is no description in Mozgrin of the power supply claimed in independent claim 1. Specifically, there is no description in Mozgrin of a power supply that generates a voltage pulse having an amplitude and a rise time that are chosen to increase the excitation rate of ground state atoms present in the weakly-ionized plasma to create a multi-step ionization process.

The Examiner states in the Office Action dated May 27, 2005 that the discharge system described in Mozgrin includes a cathode, an anode, a magnetic system, and a system for pre-ionization that creates a pre-ionized plasma. The Applicant submits that merely describing a power supply that can generated a pre-ionized plasma does not teach generating pulses with amplitudes and rise times that are chosen to achieve particular ionization characteristics, such as generating a multi-step ionization process, as claimed in independent claim 1, and as described in the specification. See, for example, paragraphs 63-67 of the present application for a description of multi-step ionization.

The Applicant submits that the term "pre-ionization" does not imply anything about the particular ionization process at the atomic level, which is used to ionize the ground state atoms to form the "pre-ionized" plasma at the macroscopic level. Furthermore, the term "pre-ionization" certainly does not imply that a multi-step ionization process is occurring at the atomic level, as described in the present application, is used to generate the discharge. The Applicant strongly believes that the "pre-ionized" plasma described in Mozgrin is created by direct ionization or atomic ionization by electron impact (hereinafter "direct ionization") that is used in most known plasma generators. See, for example, paragraphs 27-29 of the present specification for a description of direct ionization.

The Applicant has previously submitted, in the Response filed on February 24, 2005, a detailed analysis of the current and voltage characteristics (CVC) shown in FIG. 4 of Mozgrin. The analysis concluded that ions are generated by direct ionization in all four parts of the CVC and that any ions generated in these four parts of the CVC by a multi-step ionization process at the atomic level will be statistically insignificant. Furthermore, there is no description related to any part of the CVC 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.

Thus, the Applicant submits that direct ionization is used to generate the quasi-stationary discharge described in Mozgrin. As described in connection with the 35 U.S.C. §102(b) Kouznetsov rejection, the energies required to achieve the multi-step ionization process claimed in independent claim 1 are different from the energies required to achieve direct ionization. Therefore, Mozgrin does not describe choosing an amplitude and a rise time 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 as described in independent claim 1.

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).

<u>Independent Claim 20 and Dependent Claims 21-25, 27-29, 32, 33, and 37</u>

The Applicant believes that Mozgrin does not describe each and every element of independent claim 20 as amended in the Response to Office Action dated June 14, 2004. Independent claim 20 recites the step of applying a voltage pulse to the weakly-ionized plasma. An amplitude and a rise time of the voltage pulse are chosen to increase an excitation rate of ground state atoms in the weakly-ionized plasma to create a multi-step ionization process. The multi-step ionization process generates excited atoms from ground state atoms in the weakly-ionized plasma, and then ionizes the excited atoms in the weakly-ionized plasma.

The Applicant submits that there is no description in Mozgrin of the method of generating a strongly-ionized plasma using a multi-step ionization process as claimed in independent claim 20. As described in connection with the rejection of independent claim 1 under 35 U.S.C. §102(b), the Applicant respectfully submits that the ionization described in Mozgrin is direct ionization and there is no description of choosing an amplitude and a rise time as claimed in independent claim 20.

In view of the above remarks, the Applicant respectfully submits that Mozgrin does not describe each and every element of independent claim 20, either expressly or inherently. Therefore, the Applicant submits that Mozgrin does not anticipate independent claim 20 and dependent claims 21-25, 27-29, 32, 33, and 37 under 35 U.S.C. §102(b). Thus, the Applicant submits that independent claim 20 and dependent claims 21-25, 27-29, 32, 33, and 37 are allowable.

<u>Independent Claim 40</u>

The Applicant respectfully submits that Mozgrin does not describe each and every element of independent claim 40 as amended in the Response to Office Action dated June 14, 2004. Independent claim 40 recites a means for applying a voltage pulse to a weakly-ionized plasma. 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. Also, 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 to ions that sputter target material from the sputtering target.

The Applicant submits that there is no description in Mozgrin of the means for 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 as claimed in independent claim 40. As described in connection with the rejection of independent claim 1 under 35 U.S.C. §102(b), the Applicant respectfully submits that the ionization described in Mozgrin is direct ionization and that there is no description of choosing an amplitude and a rise time as claimed in independent claim 40.

In view of the above remarks, the Applicant respectfully submits that Mozgrin does not describe each and every element of independent claim 40, either expressly or inherently. Therefore, the Applicant submits that Mozgrin does not anticipate independent claim 40. Thus, the Applicant submits that independent claim 40 is allowable.

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 remarks, the Applicant respectfully traverses the rejections under 35 U.S.C. §103(a). 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

Claims 1-50 are pending. The Applicant respectfully requests reconsideration of the pending claims in light of the arguments presented in this Response.

Attached are a request for continued examination (RCE) and a Petition for a two-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 Deposit Account No. 501211.

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: October 27, 2005
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