PATENT
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANTS:	Chistyakov		
SERIAL NO.:	10/065,277	GROUP NO.:	1753
FILING DATE:	September 30, 2002	EXAMINER:	Rodney G. McDonald
TITLE:	High-Power Pulsed Magnetron Sputtering		

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

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.

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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.

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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.

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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

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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 $1 A/cm^2$.

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