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APPLICANT:	Roman Chistyakov		
SERIAL NO.:	10/065,277	GROUP NO.:	1753
FILING DATE:	September 30, 2002	EXAMINER:	McDonald, Rodney G.
TITLE:	HIGH-POWER PULSED MAGNETRON SPUTTERING		

Commissioner for Patents
Alexandria, Virginia 22313-1450

AMENDMENT AND RESPONSE

Sir:

The following amendments and remarks are responsive to the Office Action mailed on January 15, 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. A Petition for a two–month extension of time, up to and including Tuesday, June 15, 2004 is submitted herewith. The Commissioner is hereby authorized to charge the extension fee, 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.

Amendments to the Claims:

Please amend claims 1, 4, 5, 6, 8, 12, 16, 19, 21, 25, and 27-30, cancel claims 3 and 18 without prejudice, and add claims 31-39 as follows.

1. (currently amended) A sputtering source comprising:

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

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

a power supply that generates a voltage pulse ~~that produces an electric field~~ between the anode and the cathode assembly~~, the electric field~~ that creates~~ing~~ a strongly-ionized plasma from the weakly-ionized plasma, an amplitude and a rise time of the voltage pulse being chosen to increase ~~the strongly-ionized plasma comprising~~ a ~~volume~~ density of ions in the strongly-ionized plasma ~~that impact the sputtering target which~~ enough to generate sufficient thermal energy in the sputtering target to cause a sputtering yield of the sputtering target to be non-linearly related to a temperature of the sputtering target.

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

3. (cancelled).

4. (currently amended) The sputtering source of claim ~~3~~ 1 further comprising a gas flow controller ~~exchange means for exchanging~~ that controls a flow of feed gas to the strongly-ionized plasma, the additional feed gas allowing additional power to be absorbed by the ~~with a new volume of feed gas while applying the electrical pulse across the new volume of feed gas to generate additional~~ strongly-ionized plasma, ~~comprising a second plurality of ions, the second plurality of~~ the additional power creating additional ~~ions that impacting the surface of the sputtering target,~~ thereby generating additional thermal energy in the sputtering target.

Amendments to the Claims:

Please amend claims 1, 6, 7, 20, 34, and 40 and add claims 41-48 as follows.

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

a) an anode;

b) a cathode assembly that is positioned adjacent to the anode ~~and forming a gap therebetween~~, 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, ~~across the gap, the electric field~~ 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 ~~generating~~ excited atoms, and then ~~in the weakly ionized plasma and generating secondary electrons from the sputtering target, the secondary electrons~~ ionizing the excited atoms within the weakly-ionized plasma ~~to thereby creating a strongly ionized plasma having~~ create ions that ~~impact a surface of the~~ sputter target material from the sputtering target, ~~to generate sputtering flux.~~

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. (currently amended) The sputtering source of claim 1 wherein a the rise time of the voltage pulse ~~electric field~~ is chosen to increase the ionization rate of the excited atoms in the weakly-ionized plasma.

7. (currently amended) The sputtering source of claim 1 wherein the weakly-ionized plasma ~~gas~~ 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;

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