

JUN 14 2004

006/026

PATENT
Attorney Docket No.: ZON-001

OFFICIAL

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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.

Amendment and Response
Applicant: Chistyakov
Serial No.: 10/065,739
Page 2 of 20

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.~~

Amendment and Response
Applicant: Chistyakov
Serial No.: 10/065,277
Page 2 of 20

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.

Amendment and Response
Applicant: Chistyakov
Serial No.: 10/065,277
Page 3 of 20

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.

Amendment and Response
Applicant: Chistyakov
Serial No.: 10/065,277
Page 4 of 20

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;

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.