

EXHIBIT D.03
U.S. Patent No. 6,853,142

References cited herein:

- U.S. Pat. No. 6,853,142 (“’142 Patent”)
- D.V. Mozgrin, *et al*, High-Current Low-Pressure Quasi-Stationary Discharge in a Magnetic Field: Experimental Research, Plasma Physics Reports, Vol. 21, No. 5, 1995 (“Mozgrin”)
- U.S. Pat. No. 6,190,512 (“Lantsman”)
- Dennis M. Manos & Daniel L. Flamm, Plasma Etching: An Introduction, Academic Press 1989 (“Manos”)
- Milton Ohring, The Material Science of Thin Films, Academic Press, 1992 (“Ohring”)
- Donald L. Smith, Thin-Film Deposition: Principles & Practice, McGraw Hill, 1995 (“Smith”)

‘142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42	Mozgrin in view of Lantsman
<p>[1pre.] An apparatus for generating a strongly-ionized plasma in a chamber, the apparatus comprising:</p>	<p>The combination of Mozgrin and Lantsman discloses an apparatus for generating a strongly-ionized plasma in a chamber.</p> <p>‘142 Patent at claim 18 (“wherein the peak plasma density of the strongly-ionized plasma is greater than about 10^{12} cm^{-3}”)</p> <p>Mozgrin at Fig 1</p> <p>Mozgrin at 400, right col, ¶ 4 (“To study the high-current forms of the discharge, we used two types of devices: a planar magnetron and a system with specifically shaped hollow electrodes.”)</p> <p>Mozgrin at 401, right col, ¶ 2 (“For pre-ionization ... the initial plasma density in the $10^9 - 10^{11} \text{ cm}^{-3}$ range.”)</p> <p>Mozgrin at 409, left col, ¶ 4 (“The implementation of the high-current magnetron discharge (regime 2) in sputtering ... plasma density (exceeding $2 \times 10^{13} \text{ cm}^{-3}$).”))</p> <p>Mozgrin at 409, left col, ¶ 5 (“The high-current diffuse discharge (regime 3) is useful for producing large-volume uniform dense plasmas $n_i \cong 1.5 \times 10^{15} \text{ cm}^{-3} \dots$”).</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

‘142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42	Mozgrin in view of Lantsman
<p>[1a.] an ionization source that generates a weakly-ionized plasma from a feed gas, the weakly-ionized plasma reducing the probability of developing an electrical breakdown condition in the chamber;</p>	<p>The combination of Mozgrin and Lantsman discloses an ionization source that generates a weakly-ionized plasma from a feed gas, the weakly-ionized plasma reducing the probability of developing an electrical breakdown condition in the chamber.</p> <p>‘142 Patent at 5:18-19 (“The weakly-ionized plasma is also referred to as a pre-ionized plasma.”)</p> <p>‘142 Patent at claim 17 (“wherein the peak plasma density of the <i>weakly-ionized plasma is less than about 10^{12} cm^{-3}</i>”)</p> <p>Mozgrin at Figs. 1, 2, 3, 6, 7</p> <p>Mozgrin at 402, right col, ¶2 (“Figure 3 shows typical voltage and current oscillograms.... Part I in the voltage oscillogram represents the voltage of the stationary discharge (pre-ionization stage).”)</p> <p>Mozgrin at 401, right col, ¶2 (“[f]or pre-ionization, we used a stationary magnetron discharge; ... provided the initial plasma density in the $10^9 - 10^{11} \text{ cm}^{-3}$ range.”)</p> <p>Mozgrin at 400, right col, ¶ 3 (“We investigated the discharge regimes in <i>various gas mixtures</i> at $10^{-3} - 10$ torr...”)</p> <p>402, ¶ spanning left and right cols (“We studied the high-current discharge in wide ranges of discharge current...and operating pressure...<i>using various gases (Ar, N₂, SF₆, and H₂)</i> or their mixtures of various composition...”)</p> <p>Mozgrin at 401, left col, ¶ 1 (“The [plasma] discharge had an annular shape and was <i>adjacent to the cathode</i>.”)</p> <p>Mozgrin at 406, right col, ¶3 (“pre-ionization was not necessary; however, in this case, the probability of discharge transferring to arc mode increased.”)</p> <p>Mozgrin at 400, left col, ¶ 3 (“Some experiments on magnetron systems of various geometry showed that discharge regimes <i>which do not transit to arcs</i> can be</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

‘142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42	Mozgrin in view of Lantsman
	<p>obtained even at high currents.”)</p> <p><u>Background:</u></p> <p>Manos at 231 (“We shall ... [include] information on unipolar <i>arcs</i>. <i>These are a problem...</i>”)</p> <p>Manos at 237 (“<i>When such an arc occurs</i>, the metal object is melted at the arc spot. The metal is explosively released.... <i>How does one prevent such an arc?</i> There are several methods...”)</p>
<p>[1b.] a power supply that supplies power to the weakly-ionized plasma though an electrical pulse applied across the weakly-ionized plasma, the electrical pulse having a magnitude and a rise-time that is sufficient to increase the density of the weakly-ionized plasma to generate a strongly-ionized plasma; and</p>	<p>The combination of Mozgrin and Lantsman discloses a power supply that supplies power to the weakly-ionized plasma though an electrical pulse applied across the weakly-ionized plasma, the electrical pulse having a magnitude and a rise-time that is sufficient to increase the density of the weakly-ionized plasma to generate a strongly-ionized plasma.</p> <p>‘142 Patent at 1:41-43 (“Magnetron sputtering systems use magnetic fields that are shaped to trap and to concentrate secondary electrons, which are produced by ion bombardment of the target surface.”)</p> <p>‘142 Patent at 1:37-40 (“The plasma is replenished by electron-ion pairs formed by the collision of neutral molecules with secondary electrons generated at the target surface.”)</p> <p>Mozgrin at Figs. 1, 2, 3</p> <p>Mozgrin at 402, right col, ¶ 2 (“Part 1 in the voltage oscillogram represents the voltage of the stationary discharge (pre-ionization stage).”)</p> <p>Mozgrin at 401, right col, ¶ 1 (“Thus, the supply unit was made providing square voltage and current pulses with [rise] times (leading edge) of 5 – 60 μs...”)</p>
<p>[1c.] a gas line that supplies feed gas to the strongly-ionized plasma, the feed gas diffusing the strongly-ionized plasma, thereby allowing</p>	<p>The combination of Mozgrin and Lantsman discloses a gas line that supplies feed gas to the strongly-ionized plasma, the feed gas diffusing the strongly-ionized plasma, thereby allowing additional power from the</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

<p>‘142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42</p>	<p style="text-align: center;">Mozgrin in view of Lantsman</p>
<p>additional power from the pulsed power supply to be absorbed by the strongly-ionized plasma.</p>	<p>pulsed power supply to be absorbed by the strongly-ionized plasma.</p> <p>It would have been obvious to one of ordinary skill to continue to add the feed gas in Mozgrin during production of the strongly-ionized plasma (i.e., during either of regions 2 or 3). Such addition of the feed gas would have both diffused the strongly-ionized plasma and allowed additional power from Mozgrin’s repeating voltage pulses to be absorbed by the strongly-ionized plasma.</p> <p>‘142 Patent at 2:21-34 (“FIG. 1 illustrates a cross-sectional view of a known plasma generating apparatus 100.... A feed gas from feed gas source 109, such as an argon gas source, is introduced into the vacuum chamber 104 through a gas inlet 110. The gas flow is controlled by a valve 112.”)</p> <p>Mozgrin at Figs. 1 and 3</p> <p>Mozgrin at ¶ spanning pp. 403-404 (“The ... repetition frequency was 10 Hz....”).</p> <p>Mozgrin at 401, left col, ¶ 4 (“[A]pplying a square voltage pulse to the discharge gap which was filled up with either neutral or pre-ionized gas.”)</p> <p>Lantsman at Fig. 6</p> <div data-bbox="695 1396 1291 1774"> </div> <p style="text-align: right;">FIG. 6</p> <p>Lantsman at 3:9-13 (“[A]t the beginning of processing,</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

‘142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42	Mozgrin in view of Lantsman
	<p>this switch is closed and gas is introduced into the chamber. When the plasma process is completed, the gas flow is stopped....”)</p> <p>Lantsman at 4:36-38 (“To end processing, primary supply 10 is disabled, reducing the plasma current and deposition on the wafer. Then, gas flow is terminated....”)</p> <p>Lantsman at 5:39-42 (“Sometime thereafter, gas flow is initiated and the gas flow and pressure (trace 48) begin to ramp upwards toward normal processing levels.”)</p> <p>Lantsman at 5:42-45</p> <p>Lantsman at 2:48-51 (“This secondary power supply ‘pre-ignites’ the plasma so that when the primary power supply is applied, the system smoothly transitions to final plasma development and deposition.”)</p> <p>It would have been obvious to one of ordinary skill to continue to apply the feed gas during Mozgrin’s regions 1 and 2 as taught by Lantsman. Such a continuous introduction of feed gas balances gas withdrawn by the vacuum system (e.g., as shown in the drawings from Ohring and Smith, copied below) so as to maintain a desired pressure.</p> <p>One of ordinary skill would have been motivated to combine Mozgrin and Lantsman. Both Mozgrin and Lantsman are directed to sputtering using plasma. <i>See</i> Mozgrin at 409, left col, ¶ 4 (“The implementation of the high-current magnetron discharge (regime 2) in sputtering or layer-deposition technologies provides an enhancement in the flux of deposited materials and plasma density....”); <i>see also</i> Lantsman at 1:6-8 (“This invention relates to reduction of device damage in plasma processes, including DC (magnetron or non-magnetron) sputtering, and RF sputtering.”). Both references also relate to sputtering systems that use two power supplies, one for pre-ionization and one for deposition. <i>See</i> Lantsman at 4:45-47 (“[T]he secondary [power] supply 32 is used to pre-ignite the plasma,</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

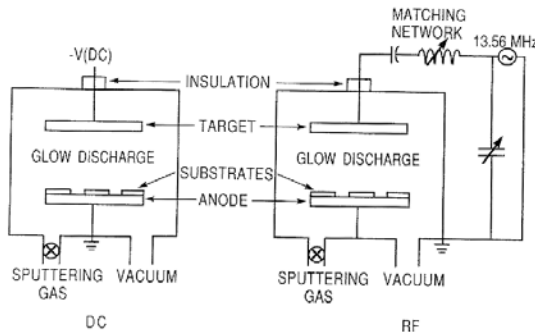
<p>‘142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42</p>	<p style="text-align: center;">Mozgrin in view of Lantsman</p>
	<p>whereas the primary [power] supply 10 is used to generate deposition.”); <i>see</i> Mozgrin at Fig. 2. (<i>showing the “high-voltage supply unit” and the “stationary discharge supply unit”</i>)</p> <p>Moreover, both Mozgrin and Lantsman are concerned with generating plasma while avoiding arcing. <i>See</i> Mozgrin at 400, right col, ¶ 3 (“The main purpose of this work was to study experimentally a high-power noncontracted quasi-stationary discharge in crossed fields of various geometry and to determine their parameter ranges.”); <i>see also</i> Lantsman at 1:51-59 (“Furthermore, arcing which can be produced by overvoltages can cause local overheating of the target, leading to evaporation or flaking of target material into the processing chamber and causing substrate particle contamination and device damage.... Thus, it is advantageous to avoid voltage spikes during processing whenever possible.”).</p> <p>Summarizing, Mozgrin and Lantsman relate to the same application. Further, one of ordinary skill would have been motivated to use Lantsman’s continuous gas flow in Mozgrin so as to maintain a desired pressure in the chamber. Finally, use of Lantsman’s continuous gas flow in Mozgrin would have been a combination of old elements in which each element behaved as expected.</p> <p><u>Background:</u> Ohring at Fig. 3-13</p>  <p>Figure 3-13. Schematics of simplified sputtering systems: (a) dc, (b) RF.</p> <p>Smith at Fig. 3-1</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

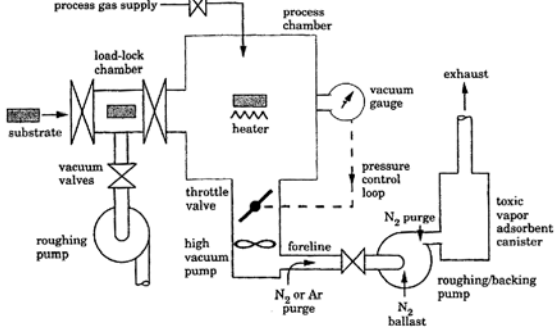
<p>‘142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42</p>	<p style="text-align: center;">Mozgrin in view of Lantsman</p>
	 <p style="text-align: center;">Figure 3.1 Typical vacuum-system components for thin-film deposition.</p>
<p>3. The apparatus of claim 1 wherein the gas line supplies additional feed gas that exchanges the weakly-ionized plasma while applying the electrical pulse across.</p>	<p>The combination of Mozgrin and Lantsman discloses the gas line supplies additional feed gas that exchanges the weakly-ionized plasma while applying the electrical pulse across.</p> <p><i>See evidence cited in claim 1.</i></p>
<p>4. The apparatus of claim 1 wherein the power supply generates a constant power.</p>	<p>The combination of Mozgrin and Lantsman discloses the power supply generates a constant power.</p> <p><i>See evidence cited in claim 1.</i></p> <p>‘142 Patent at Fig. 4</p> <p>‘142 Patent at 12:47-51</p> <p>‘142 Patent, 12:66-67 (“Between time t_1 and time t_2, the voltage 326, the current 328, and the power 330 remain constant....”)</p> <p>Mozgrin at Fig. 3</p> <p>Mozgrin, at 402, right col ¶2 (“Figure 3 shows typical voltage and current oscillograms of the quasi-stationary discharge.”)</p> <p>Lantsman at 1:22-24 (“<i>A typical DC power supply</i> 10 includes a relatively sophisticated control system, designed to <i>permit operation in constant power</i>, constant voltage, or constant current modes.”) (emphasis added)</p>
<p>5. The apparatus of claim 1</p>	<p>The combination of Mozgrin and Lantsman discloses the</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

‘142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42	Mozgrin in view of Lantsman
wherein the power supply generates a constant voltage.	<p>power supply generates a constant voltage.</p> <p><i>See evidence cited in claim 1</i></p> <p>Mozgrin at Fig. 3</p> <p>Lantsman at 1:22-24 (“<i>A typical DC power supply</i> 10 includes a relatively sophisticated control system, designed to <i>permit operation in</i> constant power, <i>constant voltage</i>, or constant current modes.”) (emphasis added)</p>
6. The apparatus of claim 1 wherein the ionization source is chosen from the group comprising an electrode coupled to a DC power supply, an electrode coupled to an AC power supply, a UV source, an X-ray source, an electron beam source, an ion beam source, an inductively coupled plasma source, a capacitively coupled plasma source, and a microwave plasma source.	<p>The combination of Mozgrin and Lantsman discloses the ionization source is chosen from the group comprising an electrode coupled to a DC power supply, an electrode coupled to an AC power supply, a UV source, an X-ray source, an electron beam source, an ion beam source, an inductively coupled plasma source, a capacitively coupled plasma source, and a microwave plasma source.</p> <p><i>See evidence cited in claim 1</i></p> <p>Mozgrin at 401, left col, ¶ 5 (“...The pre-ionization system provided <u>direct current</u> up to 0.3A and voltage up to 3 kV.”) (emphasis added)</p> <p>Mozgrin at Figs. 1 and 2</p>
7. The apparatus of claim 1 further comprising a magnet that is positioned to generate a magnetic field proximate to the weakly-ionized plasma, the magnetic field trapping electrons in the weakly-ionized plasma.	<p>The combination of Mozgrin and Lantsman discloses a magnet that is positioned to generate a magnetic field proximate to the weakly-ionized plasma, the magnetic field trapping electrons in the weakly-ionized plasma.</p> <p><i>See evidence cited in claim 1</i></p> <p>‘142 Patent at 1:41-43 [in the Background of the Invention] (“Magnetron sputtering systems use magnetic fields that are shaped to trap and concentrate secondary electrons...”)</p> <p>Mozgrin at Fig. 1</p> <p>Mozgrin at 401, left col, ¶ 1 (“The electrodes were immersed in a magnetic field of annular permanent</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

'142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42	Mozgrin in view of Lantsman
	<p>magnets.”)</p> <p>Mozgrin at 401, left col, ¶ 1 (“The [plasma] discharge had an annular shape and was adjacent to the cathode.”)</p> <p>Mozgrin at 401, right col, ¶2 (“We found out that only the regimes with magnetic field strength not lower than 400 G provided the initial plasma density in the 10^9-10^{11} cm⁻³ range.”)</p> <p>Mozgrin at 407, left col, ¶ 3 (“The action of the magnetic field serves only to limit the electron thermal conductivity and to provide collisions sufficient for efficient energy transfer from electrons to heavy particles.”)</p>
<p>8. The apparatus of claim 7 wherein the magnet comprises an electro-magnet.</p>	<p>The combination of Mozgrin and Lantsman discloses the magnet comprises an electro-magnet.</p> <p><i>See evidence cited in claim 7</i></p> <p>Mozgrin at Fig. 1</p> <p>Mozgrin at 401, right col, Fig. 1 caption, (“Fig. 1. Discharge device configurations: (a) planar magnetron; (b) shaped-electrode configuration...”)</p> <p>Mozgrin at 401, left col, ¶ 2 (“The system with shaped electrodes involved two axisymmetrical electrodes 120 mm in diameter separated by about 10 mm, and immersed in a cusp-shaped magnetic field produced by oppositely directed multilayer coils. The values of B_{max} were controlled by coil current variation to range from 0 to 1000 G.”) (emphasis added)</p>
<p>9. The apparatus of claim 7 wherein the magnet is movable.</p>	<p>The combination of Mozgrin and Lantsman discloses the magnet is movable.</p> <p><i>See evidence cited in claim 7</i></p> <p>Mozgrin at 401, left col, ¶ 1 (“[t]o control the magnetic field strength at the cathode surface, we displaced the magnetic system along the axis z (Fig. 1)...”)</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

'142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42	Mozgrin in view of Lantsman
[10pre.] A method for generating a strongly-ionized plasma in a chamber, the method comprising:	The combination of Mozgrin and Lantsman discloses a method for generating a strongly-ionized plasma in a chamber. <i>See evidence cited in claim 1 preamble.</i>
[10a.] ionizing a feed gas to form a weakly-ionized plasma that reduces the probability of developing an electrical breakdown condition in the chamber;	The combination of Mozgrin and Lantsman discloses ionizing a feed gas to form a weakly-ionized plasma that reduces the probability of developing an electrical breakdown condition in the chamber. <i>See evidence cited in claim 1(a)</i>
[10b.] supplying power to the weakly-ionized plasma by applying an electrical pulse across the weakly-ionized plasma, the electrical pulse having a magnitude and a rise-time that is sufficient to increase the density of the weakly-ionized plasma to generate a strongly-ionized plasma; and	The combination of Mozgrin and Lantsman discloses supplying power to the weakly-ionized plasma by applying an electrical pulse across the weakly-ionized plasma, the electrical pulse having a magnitude and a rise-time that is sufficient to increase the density of the weakly-ionized plasma to generate a strongly-ionized plasma. <i>See evidence cited in claim 1(b)</i>
[10c.] diffusing the strongly-ionized plasma with additional feed gas thereby allowing the strongly-ionized plasma to absorb additional energy from the power supply.	The combination of Mozgrin and Lantsman discloses diffusing the strongly-ionized plasma with additional feed gas thereby allowing the strongly-ionized plasma to absorb additional energy from the power supply. <i>See evidence cited in claim 1(c)</i>
12. The method of claim 10 further comprising exchanging the weakly-ionized plasma with additional feed gas.	The combination of Mozgrin and Lantsman discloses exchanging the weakly-ionized plasma with additional feed gas. <i>See evidence cited in claim 10</i>
14. The method of claim 10 further comprising selecting at least one of a pulse amplitude and a pulse width of the electrical pulse in order to increase an ionization rate of the strongly-ionized plasma.	The combination of Mozgrin and Lantsman discloses selecting at least one of a pulse amplitude and a pulse width of the electrical pulse in order to increase an ionization rate of the strongly-ionized plasma. <i>See evidence cited in claim 10</i>

EXHIBIT D.03
U.S. Patent No. 6,853,142

‘142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42	Mozgrin in view of Lantsman
<p>15. The method of claim 10 further comprising selecting at least one of a pulse amplitude and a pulse width of the electrical pulse in order to cause the strongly-ionized plasma to be substantially uniform.</p>	<p>The combination of Mozgrin and Lantsman discloses selecting at least one of a pulse amplitude and a pulse width of the electrical pulse in order to cause the strongly-ionized plasma to be substantially uniform.</p> <p><i>See evidence cited in claim 10</i></p> <p>Mozgrin, at 403, left col, last ¶ (“...being transferred to the high-current regime, the discharge expands over a considerably larger area of the cathode surface than it occupied in the stationary pre-ionization regime.”)</p>
<p>17. The method of claim 10 wherein the peak plasma density of the weakly-ionized plasma is less than about 10^{12} cm^{-3}.</p>	<p>The combination of Mozgrin and Lantsman discloses the peak plasma density of the weakly-ionized plasma is less than about 10^{12} cm^{-3}.</p> <p><i>See evidence cited in claim 10</i></p> <p>Mozgrin at 401, right col. ¶ 2 (“For pre-ionization, ... the initial plasma density [is] in the $10^9 - 10^{11} \text{ cm}^{-3}$ range....”)</p>
<p>18. The method of claim 10 wherein the peak plasma density of the strongly-ionized plasma is greater than about 10^{12} cm^{-3}.</p>	<p>The combination of Mozgrin and Lantsman discloses the peak plasma density of the strongly-ionized plasma is greater than about 10^{12} cm^{-3}.</p> <p><i>See evidence cited in claim 10</i></p> <p>Mozgrin at 409, left col, ¶ 4 (“The implementation of the high-current magnetron discharge (regime 2) in sputtering or layer deposition technologies provides an enhancement in the flux of deposited materials and plasma density (exceeding $2 \times 10^{13} \text{ cm}^{-3}$)”)</p> <p>Mozgrin at 409, left col, last ¶ (“The high-current diffuse discharge (regime 3) is useful for producing large-volume uniform dense plasmas $n_i \cong 1.5 \times 10^{15} \text{ cm}^{-3}$”)</p>
<p>19. The method of claim 10 wherein the ionizing the feed gas comprises exposing the feed gas to one of a static electric field, an pulsed electric field, UV radiation, X-ray radiation, electron beam</p>	<p>The combination of Mozgrin and Lantsman discloses the ionizing the feed gas comprises exposing the feed gas to one of a static electric field, an pulsed electric field, UV radiation, X-ray radiation, electron beam radiation, and an ion beam.</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

‘142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42	Mozgrin in view of Lantsman
radiation, and an ion beam.	<p><i>See</i> evidence cited in claim 10</p> <p>Mozgrin at Figs. 1, 3</p> <p>Mozgrin, at 401, Fig. 1 caption, (“Fig. 1. Discharge device configurations: (a) planar magnetron;”)</p> <p>Mozgrin, at 403-404, right col, last paragraph of 403, left col, first paragraph of 404 (“The current pulse ... repetition frequency was 10 Hz...”)</p>
20. The method of claim 10 further comprising generating a magnetic field proximate to the weakly-ionized plasma, the magnetic field trapping electrons in the weakly-ionized plasma.	<p>The combination of Mozgrin and Lantsman discloses generating a magnetic field proximate to the weakly-ionized plasma, the magnetic field trapping electrons in the weakly-ionized plasma.</p> <p><i>See</i> evidence cited in claim 7</p> <p><i>See</i> evidence cited in claim 10</p>
[40pre.] An apparatus for generating a strongly-ionized plasma in a chamber, the apparatus comprising:	<p>The combination of Mozgrin and Lantsman discloses an apparatus for generating a strongly-ionized plasma in a chamber.</p> <p>‘142 Patent at claim 18 (“wherein the peak plasma density of the strongly-ionized plasma is greater than about 10^{12} cm^{-3}”)</p> <p>Mozgrin at Fig 1</p> <p>Mozgrin at 400, right col, ¶ 4 (“To study the high-current forms of the discharge, we used two types of devices: a planar magnetron and a ystem with specifically shaped hollow electrodes.”)</p> <p>Mozgrin at 401, right col, ¶2 (“For pre-ionization ... the initial plasma density in the $10^9 - 10^{11} \text{ cm}^{-3}$ range.”)</p> <p>Mozgrin at 409, left col, ¶ 4 (“The implementation of the high-current magnetron discharge (regime 2) in sputtering ... plasma density (exceeding $2 \times 10^{13} \text{ cm}^{-3}$).”)</p> <p>Mozgrin at 409, left col, ¶5 (“The high-current diffuse</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

'142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42	Mozgrin in view of Lantsman
	discharge (regime 3) is useful for producing large-volume uniform dense plasmas $n_i \cong 1.5 \times 10^{15} \text{ cm}^{-3} \dots$).
[40a.] means for ionizing a feed gas to form a weakly-ionized plasma that reduces the probability of developing an electrical breakdown condition in the chamber;	<p>The combination of Mozgrin and Lantsman discloses means for ionizing a feed gas to form a weakly-ionized plasma that reduces the probability of developing an electrical breakdown condition in the chamber.</p> <p><u>Claimed function</u></p> <p>Claim 40 recites “means for ionizing a feed gas to form a weakly-ionized plasma that reduces the probability of developing an electrical breakdown condition in the chamber.”</p> <p>The combination of Mozgrin and Lantsman teach the function corresponding to the “means for ionizing...” limitation.</p> <p>‘142 Patent at 5:18-19 (“The weakly-ionized plasma is also referred to as a pre-ionized plasma.”)</p> <p>‘142 Patent at claim 17 (“wherein the peak plasma density of the <i>weakly-ionized plasma is less than about 10^{12} cm^{-3}</i>”)</p> <p>Mozgrin at Figs. 1, 2, 6, 7</p> <p>Mozgrin at 402, right col, ¶2 (“Figure 3 shows typical voltage and current oscillograms.... Part I in the voltage oscillogram represents the voltage of the stationary discharge (pre-ionization stage).”)</p> <p>Mozgrin at 401, right col, ¶2 (“[f]or <i>pre-ionization</i>, we used a stationary magnetron discharge; ... provided the initial <i>plasma density in the $10^9 - 10^{11} \text{ cm}^{-3}$ range</i>.”)</p> <p>Mozgrin at 400, right col, ¶ 3 (“We investigated the discharge regimes in <i>various gas mixtures</i> at $10^{-3} - 10$ torr...”)</p> <p>402, ¶ spanning left and right cols (“We studied the high-current discharge in wide ranges of discharge current...and operating pressure...<i>using various gases</i></p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

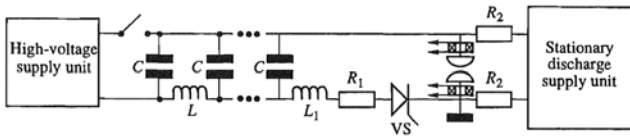
‘142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42	Mozgrin in view of Lantsman
	<p><i>(Ar, N₂, SF₆, and H₂)</i> or their mixtures of various composition...”)</p> <p>Mozgrin at 401, left col, ¶ 1 (“The [plasma] discharge had an annular shape and was <i>adjacent to the cathode</i>.”)</p> <p>Mozgrin at 406, right col, ¶ 3 (“pre-ionization was not necessary; however, in this case, the probability of discharge transferring to arc mode increased.”)</p> <p>Mozgrin at 400, left col, ¶ 3 (“Some experiments on magnetron systems of various geometry showed that discharge regimes <i>which do not transit to arcs</i> can be obtained even at high currents.”)</p> <p><u>Corresponding structure</u></p> <p>The ‘142 Patent discloses the following structure that corresponds to the” means for ionizing...” limitation:</p> <p>a power supply, generating the voltage, current and power values shown in Fig. 4 (e.g., between t₁ – t₂ and t₆ – t₇), electrically coupled to cathode (e.g., 204), anode (e.g., 216) and/or an electrode (e.g., 452, 452’), wherein the cathode, anode and/or electrode are arranged relative to a sputtering target as shown in Figs. 2A-2D and 6A-6D, and as described in the text of the ‘142 Patent at 5:5-36, 16:24-40, 17:40-18:12, 18:13-34, and 18:35-46</p> <p>The combination of Mozgrin and Lantsman discloses the structure corresponding to the “means for ionizing...” limitation. For example:</p> <p>Mozgrin at Figs. 1, 2, 3.</p>  <p>Mozgrin at 401, right col, ¶ 2 (For pre-ionization, we used a stationary magnetron discharge ... provided the initial plasma density in the 10⁹ – 10¹¹ cm⁻³ range.)</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

‘142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42	Mozgrin in view of Lantsman
	<p>Mozgrin at 406, right col, ¶3 (“pre-ionization was not necessary; however, in this case, the probability of discharge transferring to arc mode increased.”)</p> <p>Mozgrin at 401, left col, ¶ 1 (“The [plasma] discharge had an annular shape and was <i>adjacent to the cathode</i>.”) (emphasis added)</p> <p>Any differences between Mozgrin’s and the ‘142 patent’s mechanical arrangement of the anode and cathode is nothing more than the mechanical rearrangement of well-known components. Rearranging Mozgrin’s components to match that of the ‘142 patent would be obvious to one of ordinary skill.</p> <p><u>Background:</u></p> <p>Manos at 231 (“<i>arcs...are a problem...</i>”)</p>
<p>[40b.] means for supplying power to the weakly-ionized plasma by applying an electrical pulse across the weakly-ionized plasma, the electrical pulse having a magnitude and a rise-time that is sufficient to increase the density of the weakly-ionized plasma to generate a strongly-ionized plasma; and</p>	<p>The combination of Mozgrin and Lantsman discloses means for supplying power to the weakly-ionized plasma by applying an electrical pulse across the weakly-ionized plasma, the electrical pulse having a magnitude and a rise-time that is sufficient to increase the density of the weakly-ionized plasma to generate a strongly-ionized plasma.</p> <p><u>Claimed function</u></p> <p>Claim 40 recites “means for supplying power to the weakly-ionized plasma by applying an electrical pulse across the weakly-ionized plasma, the electrical pulse having a magnitude and a rise-time that is sufficient to increase the density of the weakly-ionized plasma to generate a strongly-ionized plasma.”</p> <p>The combination of Mozgrin and Lantsman teach the function corresponding to the “means for supplying power...”</p> <p>‘142 Patent at 1:41-43 (“Magnetron sputtering systems use magnetic fields that are shaped to trap and to concentrate secondary electrons, which are produced by</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

<p>‘142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42</p>	<p>Mozgrin in view of Lantsman</p>
	<p>ion bombardment of the target surface.”)</p> <p>‘142 Patent at 1:37-40 (“The plasma is replenished by electron-ion pairs formed by the collision of neutral molecules with secondary electrons generated at the target surface.”)</p> <p>Mozgrin at Figs. 1, 2, 3</p> <p>Mozgrin at 402, right col, ¶ 2 (“Part 1 in the voltage oscillogram represents the voltage of the stationary discharge (pre-ionization stage).”)</p> <p>Mozgrin at 401, right col, ¶ 1 (“Thus, the supply unit was made providing square voltage and current pulses with [rise] times (leading edge) of 5 – 60 μs...”)</p> <p>See evidence cited in [40pre] of claim 40.</p> <p><u>Corresponding structure</u></p> <p>The ‘142 Patent discloses the following structure that corresponds to the “means for supplying power...”:</p> <p>pulsed power supply (e.g., 202), generating the voltage, current and power values shown in Fig. 4 (e.g., between $t_2 - t_4$), electrically coupled to a cathode (e.g., 204) and anode (e.g., 216), wherein the cathode and anode are arranged relative to a sputtering target as shown in Figs. 2A-2D and 6A-6D, and as described in the text of the ‘142 Patent at 6:57-7:31, 8:16-25, 12:1-16, 13:25-55, 13:63-14:5, 17:12-33, 19:3-14, and 19:22-32</p> <p>The combination of Mozgrin and Lantsman teach the structure corresponding to the “means for supplying power...” limitation. For example:</p> <p>Mozgrin at Figs. 1, 2, 3</p> <p>Any difference between Mozgrin’s and the ‘142 Patent’s mechanical arrangement of the anode and cathode is nothing more than the mechanical rearrangement of well-known components. Rearranging Mozgrin’s components</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

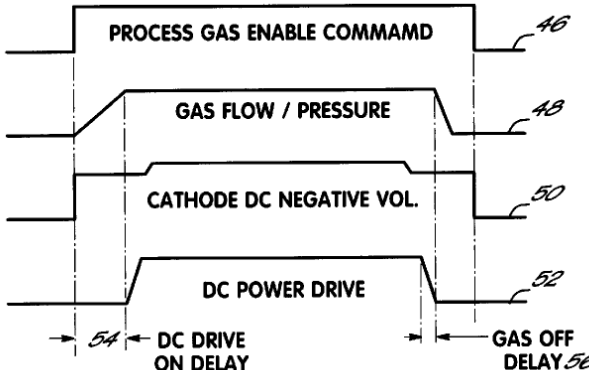
<p>‘142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42</p>	<p style="text-align: center;">Mozgrin in view of Lantsman</p>
	<p>to match that of the ‘142 Patent would be obvious to one of ordinary skill.</p>
<p>[40c.] means for diffusing the strongly-ionized plasma with additional feed gas to allow additional power to be absorbed by the strongly-ionized plasma.</p>	<p>The combination of Mozgrin and Lantsman discloses means for diffusing the strongly-ionized plasma with additional feed gas to allow additional power to be absorbed by the strongly-ionized plasma.</p> <p><u>Claimed function</u></p> <p>Claim 40 recites “means for diffusing the strongly-ionized plasma with additional feed gas to allow additional power to be absorbed by the strongly-ionized plasma.”</p> <p>The combination of Mozgrin and Lantsman teach the function corresponding to “means for diffusing...”</p> <p>It would have been obvious to one of ordinary skill to continue to add the feed gas in Mozgrin during production of the strongly-ionized plasma (i.e., during either of regions 2 or 3). Such addition of the feed gas would have both diffused the strongly-ionized plasma and allowed additional power from Mozgrin’s repeating voltage pulses to be absorbed by the strongly-ionized plasma.</p> <p>Mozgrin at ¶ spanning pp. 403-404 (“The ... repetition frequency was 10 Hz....”).</p> <p>Lantsman at Fig. 6</p>  <p style="text-align: right;">FIG. 6</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

<p>‘142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42</p>	<p>Mozgrin in view of Lantsman</p>
	<p>Lantsman at 3:9-13 (“[A]t the beginning of processing, this switch is closed and gas is introduced into the chamber. When the plasma process is completed, the gas flow is stopped....”)</p> <p>Lantsman at 4:36-38 (“To end processing, primary supply 10 is disabled, reducing the plasma current and deposition on the wafer. Then, gas flow is terminated....”)</p> <p>Lantsman at 5:39-42 (“Sometime thereafter, gas flow is initiated and the gas flow and pressure (trace 48) begin to ramp upwards toward normal processing levels.”)</p> <p>Lantsman at 5:42-45</p> <p>Lantsman at 2:48-51 (“This secondary power supply ‘pre-ignites’ the plasma so that when the primary power supply is applied, the system smoothly transitions to final plasma development and deposition.”)</p> <p>It would have been obvious to one of ordinary skill to continue to apply the feed gas during Mozgrin’s regions 1 and 2 as taught by Lantsman. Such a continuous introduction of feed gas balances gas withdrawn by the vacuum system (e.g., as shown in the drawings from Ohring and Smith, copied below) so as to maintain a desired pressure.</p> <p>One of ordinary skill would have been motivated to combine Mozgrin and Lantsman. Both Mozgrin and Lantsman are directed to sputtering using plasma. <i>See</i> Mozgrin at 409, left col, ¶ 4 (“The implementation of the high-current magnetron discharge (regime 2) in sputtering or layer-deposition technologies provides an enhancement in the flux of deposited materials and plasma density....”); <i>see also</i> Lantsman at 1:6-8 (“This invention relates to reduction of device damage in plasma processes, including DC (magnetron or non-magnetron) sputtering, and RF sputtering.”). Both references also relate to sputtering systems that use two power supplies, one for pre-ionization and one for deposition. <i>See</i> Lantsman at 4:45-47 (“[T]he secondary</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

'142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42	Mozgrin in view of Lantsman
	<p>[power] supply 32 is used to pre-ignite the plasma, whereas the primary [power] supply 10 is used to generate deposition.”); <i>see</i> Mozgrin at Fig. 2. (<i>showing the “high-voltage supply unit” and the “stationary discharge supply unit”</i>)</p> <p>Moreover, both Mozgrin and Lantsman are concerned with generating plasma while avoiding arcing. <i>See</i> Mozgrin at 400, right col, ¶ 3 (“The main purpose of this work was to study experimentally a high-power noncontracted quasi-stationary discharge in crossed fields of various geometry and to determine their parameter ranges.”); <i>see also</i> Lantsman at 1:51-59 (“Furthermore, arcing which can be produced by overvoltages can cause local overheating of the target, leading to evaporation or flaking of target material into the processing chamber and causing substrate particle contamination and device damage.... Thus, it is advantageous to avoid voltage spikes during processing whenever possible.”).</p> <p>Summarizing, Mozgrin and Lantsman relate to the same application. Further, one of ordinary skill would have been motivated to use Lantsman’s continuous gas flow in Mozgrin so as to maintain a desired pressure in the chamber. Finally, use of Lantsman’s continuous gas flow in Mozgrin would have been a combination of old elements in which each element behaved as expected. The combination of Mozgrin and Lantsman therefore teaches the function required by the “means for diffusing...”</p> <p><u>Corresponding structure</u></p> <p>The ‘142 Patent discloses the following structure that corresponds to the “means for diffusing...” limitation:</p> <p>feed gas lines 224 as shown in Figs. 2A-2D and 6A-D and as described in the text of the ‘142 Patent at 4:48-5:4</p> <p>The combination of Mozgrin and Lantsman teach the structure corresponding to the “means for diffusing...” limitation. For example:</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

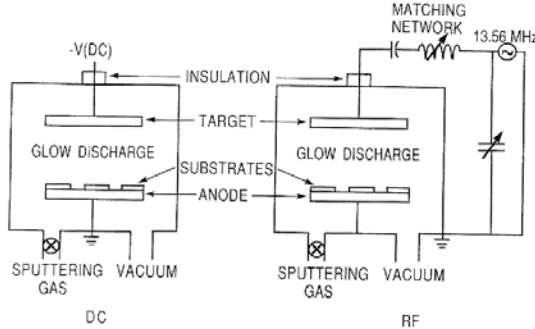
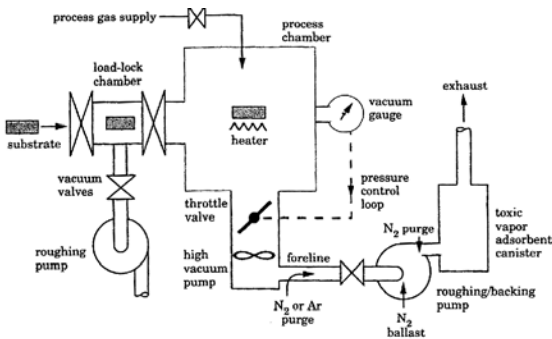
<p>'142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42</p>	<p style="text-align: center;">Mozgrin in view of Lantsman</p>
	<p>'142 Patent at 2:21-34 ("FIG. 1 illustrates a cross-sectional view of a known plasma generating apparatus 100.... A feed gas from feed gas source 109, such as an argon gas source, is introduced into the vacuum chamber 104 through a gas inlet 110. The gas flow is controlled by a valve 112.")</p> <p>Mozgrin at Figs. 1 and 3</p> <p>Mozgrin at 401, left col, ¶ 4 ("[A]pplying a square voltage pulse to the discharge gap which was filled up with either neutral or pre-ionized gas.")</p> <p><u>Background:</u></p> <p>Ohring at Fig. 3-13</p>  <p style="text-align: center;">DC RF</p> <p>Figure 3-13. Schematics of simplified sputtering systems: (a) dc, (b) RF.</p> <p>Smith at Fig. 3-1</p>  <p>Figure 3.1 Typical vacuum-system components for thin-film deposition.</p>
<p>42. The apparatus of claim 1 wherein the power supply</p>	<p>The combination of Mozgrin and Lantsman discloses the power supply comprises the ionization source. See evidence cited in claim 1</p>

EXHIBIT D.03
U.S. Patent No. 6,853,142

'142 Claims 1, 3-9, 10, 12, 14, 15, 17-20, 40 and 42	Mozgrin in view of Lantsman
comprises the ionization source.	<p>Mozgrin at Fig. 2</p> <p>Mozgrin at 401, left col, ¶5 (“Figure 2 presents a simplified scheme of the discharge supply system. The supply unit involved a pulsed discharge supply unit and a system for pre-ionization.”)</p>