EXHIBIT A.12
U.S. Patent No. 7,147,759

References cited herein:

- U.S. Patent No. 7,147,759 ("'759 Patent")
- U.S. Pat. No. 6,413,382 ("Wang")
- A. A. Kudryavtsev, *et al*, Ionization relaxation in a plasma produced by a pulsed inert-gas discharge, Sov. Phys. Tech. Phys. 28(1), January 1983 ("Kudryavtsev")
- EP 1 113 088 ("Yamaguchi")

Claim 38	Wang in view of Kudryavtsev and Yamaguchi
[20pre.] A method of generating sputtering flux, the method comprising:	The combination of Wang and Kudryavtsev discloses a method of generating sputtering flux. Wang at Title ("Pulsed sputtering with a small rotating magnetron.").
[20a.] ionizing a feed gas to generate a weakly-ionized plasma proximate to a sputtering target;	The combination of Wang and Kudryavtsev discloses ionizing a feed gas to generate a weakly-ionized plasma proximate to a sputtering target. Wang at Fig. 1 Wang at 4:5-6 ("A sputter working gas such as argon is supplied from a gas source 32…."). Wang at 4:20-21 ("… a reactive gas, for example nitrogen is supplied to the processing space 22…."). Wang at 7:17-31 ("The background power level P_B is chosen to exceed the minimum power necessary to support a plasma... [T]he application of the high peak power P_P quickly causes the already existing plasma to spread and increases the density of the plasma.") Wang at 7:19-25 ("Preferably, the peak power P_P is at least 10 times the background power P_B … and most preferably 1000 times to achieve the greatest effect of the invention. A background power P_B of 1 kW [causes] little if any actual sputter deposition.") Wang at 4:23-31 ("A small rotatable magnetron 40 is thus creating a region 42 of a high-density plasma (HDP)…")
[20b.] generating a magnetic field proximate to the	The combination of Wang and Kudryavtsev discloses generating a magnetic field proximate to the weakly-ionized plasma, the magnetic field substantially trapping electrons in the weakly-ionized plasma

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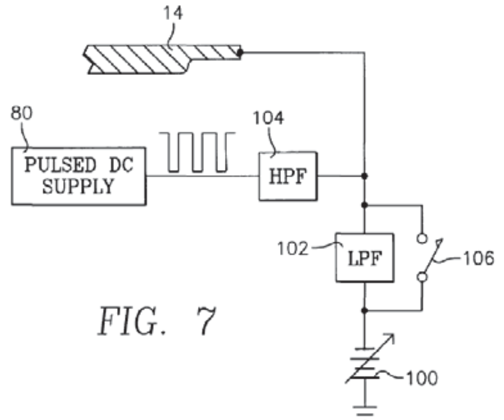
weakly-ionized plasma, the magnetic field substantially trapping electrons in the weakly-ionized plasma proximate to the sputtering target; and	proximate to the sputtering target. '759 Patent at 3:10-12 ("FIG. 1 shows a cross-sectional view of a known magnetron sputtering apparatus 100…" that has a magnet 126.") '759 Patent at 4:4-10 [*describing the prior art Fig. 1*] ("The electrons, which cause ionization, are generally confined by the magnetic fields produced by the magnet 126. The magnetic confinement is strongest in a confinement region 142….") Wang at Fig. 1. Wang at 4:23-27 ("A small rotatable magnetron 40 is disposed in the back of the target 14 to create a magnetic field near the face of the target 14 which traps electrons from the plasma to increase the electron density.")
[20c.] 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	The combination of Wang and Kudryavtsev discloses 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. '759 Patent at Fig. 5 Wang at Figs. 6, 7.  FIG. 7 Wang at 7:61-62 ("The pulsed DC power supply 80 produces a train of negative voltage pulses.").

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atoms, and then ionizing the excited atoms within the weakly-ionized plasma without forming an arc discharge.	Wang at 5:23-27 ("[The pulse's] exact shape depends on the design of the pulsed DC power supply 80, and significant rise times and fall times are expected."). Wang at 4:29-31 ("increases the sputtering rate..."). Wang at 7:19-25 ("Preferably, the peak power level P_P is at least 10 times the background power level P_B, … most preferably 1000 times to achieve the greatest effects of the invention. A background power P_B of 1 kW will typically be sufficient…") Wang at 7:31-39 ("The SIP reactor is advantageous for a low-power, low-pressure background period since the small rotating SIP magnetron can maintain a plasma at a lower power and lower pressure than can a larger stationary magnetron. However, it is possible to combine highly ionized sputtering during the pulses With significant neutral sputtering during the back ground period."). Wang at 7:3-6 ("Plasma ignition, particularly in plasma sputter reactors, has a tendency to generate particles during the initial arcing, which may dislodge large particles from the target or chamber.") Wang at 7:47-49 ("The initial plasma ignition needs be performed only once and at much lower power levels so that particulates produced by arcing are much reduced."). Wang at 7:13-28 ("Accordingly, it is advantageous to use a target power waveform illustrated in FIG. 6… As a result, once the plasma has been ignited at the beginning of sputtering prior to the illustrated waveform…"). Kudryavtsev at 34, right col, ¶ 4 ("Since the effects studied in this work are characteristic of ionization whenever a field is suddenly applied to a weakly ionized gas, they must be allowed for when studying emission mechanisms in pulsed gas lasers, gas breakdown, laser sparks, etc.") Kudryavtsev at Fig. 1

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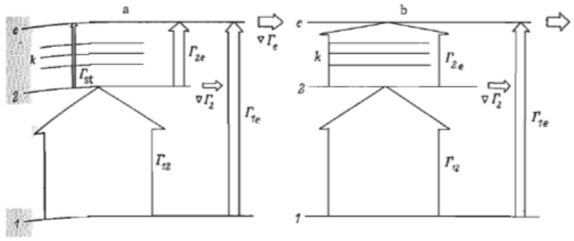
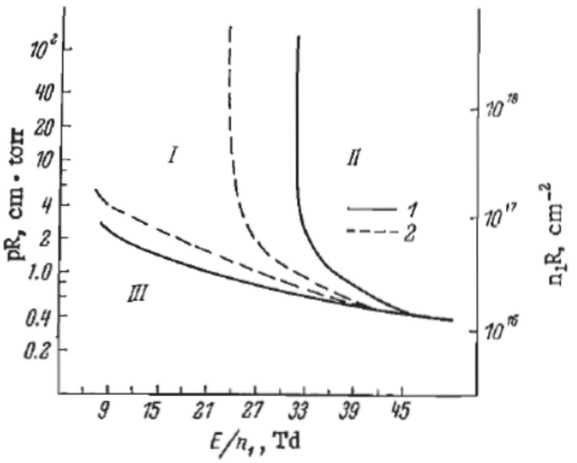
	 FIG. 1. Diagram showing the relative sizes of the electro fluxes in terms of the atomic energy levels for the slow (and fast (b) stages. The width of the arrows indicates the magnitude of the electron flux. The horizontal arrows gi the diffusion fluxes of electrons and excited atoms reachi the walls of the discharge tube. Kudryavtsev at Fig. 6  FIG. 6. The behavior of n_e in the bulk of an argon discharge. 1) $n_{e0}/n_1 = 10^{-8}$; 2) 10^{-7}. Stepwise ionization predominates in region I, direct ionization processes predominate in region II, and n_e does not increase in region III. Kudryavtsev at 31, right col, ¶ 7 ("The behavior of the increase in n_e with time thus enables us to arbitrarily divide the ionization process into two stages, which we will call the slow and fast growth stages. Fig. 1 illustrates the relationships between the main electron currents in terms of the atomic energy levels during the slow and fast stages."). Kudryavtsev at 31, right col, ¶ 6 ("For nearly stationary n_2 [excited atom density] values … there is an explosive increase in n_e [plasma density]. The subsequent increase in n_e then reaches its maximum value, equal to the rate of excitation [equation omitted], which is several orders of magnitude greater than the ionization rate during the initial stage.") Kudryavtsev at Abstract ("[I]n a pulsed inert-gas discharge plasma at moderate pressures… [i]t is shown that the electron density increases explosively in time due to accumulation of atoms in the lowest excited

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	states.") If one of ordinary skill, applying Wang's power levels did not experience Kudryavtsev's "explosive increase" in plasma density, it would have been obvious to adjust the operating parameters, e.g., increase the pulse length and/or pressure, so as to trigger Kudryavtsev's fast stage of ionization. One of ordinary skill would have been motivated to use Kudryavtsev's fast stage of ionization in Wang so as to increase plasma density and thereby increase the sputtering rate. Further, use of Kudryavtsev's fast stage in Wang would have been a combination of old elements that yielded predictable results of increasing plasma density and multi-step ionization. Kudryavtsev states, "[s]ince the effects studied in this work are characteristic of ionization whenever a field is suddenly applied to a weakly ionized gas, they must be allowed for when studying emission mechanisms in pulsed gas lasers, gas breakdown, laser sparks, etc." Kudryavtsev at 34, right col, ¶ 4 (Ex. 1004). Because Wang applies voltage pulses that "suddenly generate an electric field," one of ordinary skill reading Wang would have been motivated to consider Kudryavtsev and to use Kudryavtsev's fast stage in Wang.
38. 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.	The combination of Wang with Kudryavtsev and Yamaguchi discloses ionizing the feed gas comprises exposing the feed gas to an electrode that is adapted to emit electrons. *See* evidence cited in claim 20. Wang at 1:6-8 ("…the invention relates to sputtering apparatus and a method capable of producing a high fraction of ionized sputter particles."). Wang at 1:25-29 ("…the positively charged sputtered ions can be accelerated towards a negatively charged wafer and reach deep into high aspect-ratio holes."). Yamaguchi at ¶ [0027] ("introducing … a sputtering discharge gas, such as a rare gas…at the center of an ionizing space.") Yamaguchi at ¶ [0027] (emphasis added) ("The ionizing mechanism 6, which is of a hot cathode type using Penning ionization, ionizes sputtering ions by hitting thermoelectrons, emitted from a hot electrode against ... sputtering discharge gas particles…")

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