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The influence of pulse shape, length and peak current density on ion flux to the substrate, deposition rate and plasma composition for high power pulsed sputtering discharges.

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The peak pulse current density as well as the pulse shape and length for high power pulsed sputtering discharges can have a strong effect on both the plasma composition and ion flux to the substrate. These type of discharges can be generated by various methods. One method, commonly known as High Power Impulse Magnetron Sputtering (HIPIMS), involves the discharging of a capacitor bank in order to generate a high density plasma. The pulse length in the case is usually between 50-200µs . For the HIPIMS discharge, the discharge current builds in time after a sustained voltage is applied to the cathode. Another method, known as Modulated Pulsed Power (MPP™) utilizes a controlled series of micropulses in order to build up the discharge current in time. Both types of discharges have been compared using the peak current density as the control variable. It can be seen that as the peak current density is building to a steady state value, that there is little difference in the plasma characteristics. However, a certain period of time is needed to reach a steady state plasma (>200us). For longer pulses (>200µs), it has been found that the ion flux to the substrate can reach a level greater than three times that for a shorter pulse for the same peak current density for chromium. OES measurements have also been made in order to examine the plasma composition during the pulse. Deposition rate measurements taking film density into account have been made in order to look at absolute deposition rate as a function of peak current density and pulse length.

Keywords
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