Abstract Submitted
for the GEC11 Meeting of
The American Physical Society

Current-voltage-time characteristics of the reactive Ar/N_2 high power impulse magnetron sputtering discharge JON TOMAS GUDMUNDSSON, Shanghai Jiao Tong University, FRIDRIK MAGNUS, OLAFUR B. SVEINSSON, SVEINN OLAFSSON, University of Iceland — By pulsing a magnetron target to a high power density with unipolar voltage pulses, at a low frequency (a low duty cycle), very high electron densities are achieved. The high electron density results in a high ionization fraction of the sputtered vapor. This is referred to as high power impulse magnetron sputtering (HiPIMS). The discharge current and voltage waveforms have been measured in a reactive HiPIMS Ar/N_2 discharge with a Ti target for 400 μs long pulses. We observe that the current waveform in the reactive Ar/N_2 HiPIMS discharge is highly dependent on the pulse repetition frequency, unlike the non-reactive Ar discharge. The current is found to increase significantly as the frequency is lowered. This is attributed to an increase in the secondary electron emission yield for self-sputtering when the nitride forms on the target at low frequencies. In addition, self-sputtering runaway occurs at lower discharge voltages when nitrogen is added to the discharge. This illustrates the crucial role of self-sputtering in the behavior of the reactive HiPIMS discharge. The secondary electron emission yield is higher for a nitride target than a titanium target when self-sputtering is the dominant sputtering mechanism. This differentiates HiPIMS from dcMS where self-sputtering is not as important.

Jon Gudmundsson
Shanghai Jiao Tong University

Date submitted: 11 Jul 2011 Electronic form version 1.4