Abstract Submitted
for the GEC15 Meeting of
The American Physical Society

Current-Voltage Characteristics and Deposition of AlTiN Thin Films by High Power Impulse Magnetron Sputtering Process WAN-YU WU, Da-Yeh University, Taiwan, AMEI SU, YAWEI LIU, Fujian University of Technology, China, CHI-MING YEH, WEI-CHIH CHEN, CHI-LUNG CHANG, Ming-Dao University, Taiwan — In this study, AlTiN thin films were deposited using a high power impulse magnetron sputtering (HiPIMS) process under a unipolar mode. The AlTi target had a composition of 70 at% Al and 30 at% Ti. Nitrogen was used as the reactive gas to deposite AlTiN thin films along with Ar gas at a working pressure of 1x10-3 torr. The target voltage and current were measured at different conditions including various duty cycles from 1 to 5%, pulse durations from 50 to 400 μs, target powers from 0.6 to 1.8 kW, and N2/Ar ratios from 0 to 1. Depending on the deposition condition, peak powers in the range of 104 to 105 W were observed. The effect of deposition conditions were discussed. For film deposition, the pulse duration and the duty cycle were fixed at 100 μs and 3%, respectively. A fixed bias of -150 V was applied to the substrates, including Si wafer, 304 stainless steel, and tungsten carbide.It was found that the nitrogen content increases with the N2/Ar ratio and then saturates. With increasing target power, a higher N2/Ar ratio was required for the AlTiN thin films to have a better mechanical properties. Meanwhile, the hardness of the AlTiN thin films also increases with the target power. The highest hardness of 41 GPa was observed as the N2/Ar ratio was 0.9 and the power was 1.8 kW. It was found that the amount Al-N bonding and the distribution of AlN phase within the AlTiN thin films play an important role in determining the mechanical properties.

Wan-Yu Wu
Da-Yeh University, Taiwan

Date submitted: 28 Jul 2015 Electronic form version 1.4