For oral presentation

HiPIMS: An improvement of magnetron sputtering

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High power impulse magnetron sputtering (HiPIMS) is a technique where a very high power (hundreds of kW/cm^2) is applied to the cathode in short pulses - typically 10s of μs, at a relatively low frequency (~50-1000 Hz). By keeping the duty cycle at a few percent the average power to the cathode is kept low enough for conventional cooling to suffice. The high power in the pulse causes the plasma in front of the target to reach very high densities (10^{19} m^{-3}), thus allowing efficient ionization of the sputtered species (up to 90%). This high degree of ionization opens for several improvements in the magnetron sputter deposition process in view of guiding and aligning the deposition flux enabling coating of complex shaped objects. The high degree of ionization also allows for self-ion bombardment during substrate cleaning, film nucleation, and film growth. A disadvantage with HiPIMS is that the deposition rate is generally lower compared to DCMS at the same average power. HiPIMS deposited metal and compound coatings are generally denser than DCMS coatings deposited under comparable conditions. The densification of the films results in a higher hardness and better scratch resistance. The use of HiPIMS for alumina and ceria growth shows a drastic reduction of the hysteresis effect normally observed during reactive DC sputtering. Stoichiometric films can therefore be deposited under stable process conditions at high rates.