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Time resolved ion energy distribution functions of non-reactive and reactive high power impulse magnetron sputtering of titanium KATHARINA GROSSE, WOLFGANG BREILMANN, CHRISTIAN MASZL, JAN BENEDIKT, ACHIM VON KEUDELL, Ruhr-University Bochum — High power impulse magnetron sputtering (HiPIMS) is a technique for thin film deposition and can be operated in reactive and non-reactive mode. The growth rate of HiPIMS in non-reactive mode reduces to 30% compared to direct current magnetron sputtering (dcMS) at same average power. However, the quality of the coatings produced with HiPIMS is excellent which makes these plasmas highly appealing. In reactive mode target poisoning is occurring which changes the plasma dynamics. An advantage of reactive HiPIMS is that it can be operated hysteresis-free which can result in a higher growth rate compared to dcMS. In this work thin films are deposited by a HiPIMS plasma which is generated by short pulses of 100 μs with high power densities in the range of 1 kW/cm^2. Ar and Ar/N_2 admixtures are used as a working gas to sputter a 2" titanium target. The particle transport is analysed with time resolved ion energy distribution functions which are measured by a mass spectrometer with a temporal resolution of 2 μs. Phase resolved optical emission spectroscopy is executed to investigate the particle dynamics of different species. The time and energy resolved particle fluxes in non-reactive and reactive mode are compared and implications on the sputter process are discussed.

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