

Current Progress and New Results in Characterising the HIPIMS Plasma

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Abstract

Plasma composition near the substrate was investigated in HIPIMS discharge using Langmuir probe, mass spectroscopy and atomic absorption spectroscopy (AAS). HIPIMS discharge was operated in non-reactive Ar atmosphere and the magnetron was furnished with Ti target. The parameters such as plasma density, metal ion - to - neutral ratio and gas ion - to - metal ion ratio were studied as a function of a discharge current. At discharge current densities of $\sim 1 \text{ Acm}^{-2}$ the results show that the dense plasma ($n_e \sim 10^{18} \text{ m}^{-3}$) expanded from the target towards the substrate and lasted more than 330 μs after the supplied power was turned off. The shape of the time-averaged ion energy distribution function of sputtered material exhibited a transition from Thompson to Maxwellian distribution, indicating efficient energy transfer in the discharge. The metal content monotonically increased in plasma with the discharge current and metal ion - to - neutral ratio reached approximately 1:1 in the post-discharge plasma at current density of 5 Acm^{-2} .