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Energy flux to substrate in high-power impulse magnetron sputtering measured by using optical low-coherence interferometry KATSUHIRO HATTORI, TAKAYUKI OHTA, Meijo university, AKINORI ODA, Chiba Institute of Technology, HIROYUKI KOUSAKA, Nagoya University, MASAFUMI ITO, Meijo university — The substrate during the plasma irradiation is heated by charged species, neutral species, and the heat radiation and the substrate temperature is determined by energy flux to the substrate. High-power impulse magnetron sputtering (HiPIMS) using short-pulse high-voltage promotes the ionization of sputtered atoms and realizes high density plasma. In this study, we measured the silicon substrate temperature with non-contact type substrate temperature measurement method using optical low-coherence interferometry(LCI) and elucidated the heating mechanisms of the substrate temperature in HiPIMS. The target material was Ti and the distance between the substrate and the target was 60mm. Ar is used as the sputtering gas. The pulse width was from 50 to 300sec, the pulse frequency was from 100 to 500Hz. Applied voltages were changed to be from -400V to -900V. Measurement accuracy of contact-type thermocouples and that of noncontact-type LCI were within 2 degree C and 0.7 degree C, respectively. The heat influx to the substrate was calculated from the temporal variation of substrate temperature base on the energy balance equation and increased with increasing applied voltage. The emission intensity of Ti ion increased with increasing applied voltage even though that of Ti atom was constant. These results suggested that main contribution of substrate heating is Ti ion bombardment.

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