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**Determination of the energy influx onto a high voltage pulsed substrate during HiPIMS with a fiber optic calorimetric probe**Sven Gauter<sup>1</sup>, Maik Fröhlich<sup>2</sup>, Wagdi Garkas<sup>2</sup>, Klaus-Dieter Weltmann<sup>2</sup>, Martin Polak<sup>2</sup>, Holger Kersten<sup>1</sup><sup>1</sup>IEAP CAU Kiel, Kiel, Germany <sup>2</sup>Leibniz Institute for Plasma Science and Technology (INP), Greifswald, Germany

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The combination of HiPIMS and plasma based ion implantation (PBII) offers new possibilities for surface modification taking advantage of the high density of target ions combined with a synchronized high voltage pulse onto the substrate. A very important parameter in this combined experiment is the delay between HiPIMS pulse and PBII pulse, according to the evolution of the HiPIMS pulse.

We present results of calorimetric measurements investigating the effect of combining HiPIMS and pulsed high substrate voltages. Due to limitations in probe design it is specifically challenging to determine the energy flux onto high voltage pulsed substrates. In preceding measurements qualitative information about the energy flux in a combined experiment of HiPIMS and PBII were obtained using a combination of a high voltage pulsed grid and a passive thermal probe. As described in [1] this probe uses a thermocouple for the measurement of substrate temperature, which has the disadvantage that it does not allow the direct application of high voltages in the range of several kV onto the substrate. To realize a direct measurement on such a substrate the classic thermal probe was modified by replacing the thermocouple by a fiber optic thermometer and thus electrically decoupling the probe from the measurement electronics. In the present study quantitative results for the influence of delay time, gas pressure and distance between substrate and magnetron onto the energy flux for a high voltage pulsed substrate are presented. The results support the observations made by the preceding measurements about the transport of ions from target to substrate and the remarkable influence of delay time between HiPIMS and PBII pulse. Furthermore, absolute values for the deposited energy and current onto the substrate are obtained, allowing an approximation of the average ion energy and the thermal load of the substrate.

[1] Bornholdt et al., Complex Plasmas, Bonitz et al. (Eds.), 197-234, 2014.

**Keywords**

HiPIMS

Thermal probe

PBII