

PO4010

## **Investigations of Dynamic Effects in Plasma Immersion Ion Implantation using Calorimetric Probe and High Speed Camera Measurements**

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Plasma based coating processes are a widespread field in industrial surface modification. Plasma immersion ion implantation (PIII) is a relatively common technique where the substrate itself is biased with high voltage pulses to implant ions into the surface [1]. However, many secondary processes during PIII have not yet been fully investigated but are crucial to the process due to potential feedback mechanisms which may change the outcome of the coating procedure in terms of quality and properties of the deposited films. Furthermore, development of new diagnostics will be useful for related processes utilizing rapidly varying plasmas – spatially and temporary.

Secondary electrons are a major undesired component of energetic particles during PIII. These secondary electrons emitted from the substrate may lead to interactions with the plasma and increase the local plasma density as a function of the applied HV power (pulse length, pulse voltage and pulse frequency) and the substrate (varying materials, eg. Al, Cu, or stainless steel). Using a calorimetric probe [2] allows the measurement of the directed flux perpendicular away from the substrate and its variation with the distance from the probe to the substrate surface. Thus, the interaction of these electrons with the plasma can be calculated.

As an additional point, direct information of the sheath dynamics has been only available using either simulation, local probing which disturbs the plasma, or indirect LiF measurements. A more direct approach, especially suited for complex geometries is the direct observation using probe particles inside the plasma sheath. The probe particles as well as the behaviour of the sheath are studied using a high speed camera system enabling visual observation of the fast process during pulses.

[1] J.R. Conrad et al., J. Appl. Phys. 62: 4591 (1987)

[2] S. Bornholdt and H. Kersten, Eur. Phys. J. D. 67(8):167 (2013)

### **Keywords**

PIII

Diagnostics

Calorimetric Probe

High Speed Camera