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Changing Secondary Electron Emission During PIII Processing

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Secondary electrons are an ubiquitous nuisance during plasma immersion ion implantation (PIII) necessitating excessive current supplies and shielding for X-rays generated by them. Nevertheless, probing them with a passive calorimetric probe mounted near the chamber wall away from the pulsed substrate holder without interfering with the PIII process leads to useful process information. However, the time averaged energy flux due to the pulsed secondary electron emission from the high voltage electrode – in the centre of the vacuum chamber – is only measured as an additional contribution to the continuous local energy flux from the plasma at the position of the probe. While nitriding or oxidising metal samples, e.g. Cu, Al or steel, the surface composition is changing continuously and, thus, variations in the secondary electron emission are possible. Additionally, the sputter removal of such modified surface layers by HV pulses in Ar plasma, leading to sputtering without film formation can be monitored and used as endpoint detection. Using the passive calorimetric probe, it is possible to record these variations in secondary electron emission as a function of incident ion fluence, substrate material and substrate temperature. Hence, by this method the relative as well as the absolute secondary electron emission coefficient for different chemistries and surface temperatures can be determined.

Keywords
PIII
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