KN2200

Ion beam diagnostics with non-conventional methods

Holger Kersten[1], Viktor Schneider[2], Alexander Spethmann[2], Thomas Trottenberg[2]

[1]Universiity of Kiel, IEAP, Kiel, Germany [2]University of Kiel, IEAP, Kiel, Germany

kersten@physik.uni-kiel.de

For optimization and adjustment of broad ion beam sources in surface application, knowledge of composition and physical parameters of the energetic beam has to be provided by suitable diagnostics.
Commonly used ion beam diagnostics as Faraday cups, retarding field analyzers, plasma monitors etc. are based on electrostatic measurements. These methods are limited to the determination of charged particles (ions) and their energy distribution. However, sometimes energetic neutrals are also generated by charge exchange collisions with the background gas [1] - and the detection and quantification of these particles is highly desirable.
In addition to measurements of the energy influx (thermal probes) by the particles of the beam [2] a novel force probe has been introduced to determine the momentum flux of charged and neutral particles. The force probe also allows for the estimation of sputtering effects by the energetic particles impinging on the surface.
For comparison of the measured forces another innovative experiment has been taken into account: In a broad ion beam of several hundreds of eV, which is vertically upward directed, small hollow glass spheres are injected as test particles (dust) [3]. The particles are illuminated by a diode laser and their trajectories are recorded with a camera system. From the trajectories the acceleration and the net force on the particles are determined. Again, such an experimental setup allows for the measurement of the momentum transfer due to the two possible mechanisms, i.e. ion-dust and fast-neutral-dust collisions. If the ion beam current density and the ion velocity distribution are known, the net force can be attributed quantitatively to the two mechanisms.
[1] Trottenberg,T., Schneider,V., Kersten,H., IEEE Trans. Plasma Sci., accepted.
[2] Kersten,H., Wiese,R., Hannemann,M., Kapitov,A. Scholze,F., Neumann,H., Hippler,R.,
Surf.Coat.Technol. 200(2005), 809.
[3] Schneider,V., Trottenberg,T., Teliban,J., Kersten,H., Rev. Sci. Instrum. 81(2010), 013503.

Keywords
plasma diagnostics
ion beam
ion-soild interaction