In situ measurements of spectral reflectivity of metallic mirrors in low density plasmas

O. Marchuk\textsuperscript{a}, S. Dickheuer\textsuperscript{a}, C. Brandt\textsuperscript{b}, A. Pospieszczycyk\textsuperscript{a} and A. Goriaev\textsuperscript{c}

\textsuperscript{a} Institut für Energie und Klimaforschung, Forschungszentrum Jülich GmbH, 52425 Jülich, Germany
\textsuperscript{b} Max-Planck-Institut für Plasmaphysik, 17491 Greifswald, Germany
\textsuperscript{c} Laboratory for Plasmaphysics, LPP-ERM/KMS, 1000 Brussels, Belgium

In this contribution a new method for measurements of spectral reflectance of any metallic (conductive) surface placed in low density Ar-H or Ar-D plasmas is demonstrated. We prove that the emission of fast reflected atoms caused by atom-atom collisions detected on the distances of few millimeters in front of the surface could be efficiently used to derive the specular reflectance of the surface at the principal wavelength of Hα, Hβ and Hγ lines.

The experiments were performed at the linear plasma device PSI-2 for the C, Fe, Pd, W and Ag targets. In all cases a very good agreement within of 15-20\% between the measured and the theoretical data was obtained. Results of the measurements are summarized in the Figure 1.

![Figure 1. Comparison of the measurements of the specular reflectance in the plasma at the wavelength of the Hα line.](image)

The in-situ measurements, e.g. without removing mirror out of the plasma or by using any additional diagnostics (laser, etc...), were performed by passively monitoring the emission of the atoms with kinetic energies in the range of 80..200 eV using the spectrometer at the line-of-sight of 35° relative to the surface normal. The error bars are determined by the photon statistics and the resolution of the instruments, which both impact the integral of the emission profile. In addition to the direct and straightforward measurements of specular reflectance of the targets we could also efficiently estimate the material of the surface and trace accurately the surface modification during the plasma operation. Finally, the measured emission profiles are used to derive the characteristics of the energy and angular distribution of the reflected atoms.