Determination of small admixture concentration in the near-surface plasma during tests of the fusion reactor's first wall prototypes

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This work studies low-pressure helium plasma with magnetic confinement at MPEI experimental installation called plasma linear multicusp (PLM) [1]. The installation creates plasma impact conditions on sample surfaces which are close in nature and parameters to the operation modes of diverter plates of a tokamak reactor. PLM is a trap with magnetic field minimum on its axis in which plasma is created by a stream of electrons moving from a hot cathode to an anode. The installation provides sustained jet of helium plasma for several hours at constant parameters: helium pressure 10^{-3}–10^{-1} Torr, discharge current 4–15 A, plasma column radius 15–17 mm, voltage drop on the discharge section 100–200 V. This provides heat load up to 10 MW/m^2 for the tested sample introduced into the axial region. We propose a technique for determining atomic concentrations of small metallic admixtures in plasma from the relative intensities of atomic spectral lines obtained by optical emission spectroscopy.

[1] Budaev V P, Fedorovich S D, Martynenko Y V, Lukashevsky M Vand Gubkin M K, Karpov A V, Lazukin A V, Shestakov E A, Kavyrshin D I and Rogozin K S 2019 *Phys. Atom. Nuclei* **82** 1281–1291