COMPARISON OF corpuscular AND OPTICAL DIAGNOSTICS IN A radioFREQUENCY LOW-PRESSURE DISCHARGE IN INERT GASES [[1]](#footnote-1)\*)

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Investigations of the ion flux composition in low-temperature plasmas of various gas discharges attract much attention keeping in mind the importance of ion-surface bombardment processes in many technological applications. In particular, a pressing problem is to diagnose ion fluxes in mixtures of process gases [1], or in the presence of different sort of ions in plasma in addition to the main ions [2].

Experiments on the diagnostics of the mass-resolved composition of plasma were carried out in Bella facility. Here, plasma is formed using a radiofrequency generator (13.56 MHz), which excites a planar coil. The produced plasma fills a fairly large volume (~ 30 l). For corpuscular diagnostics, a magnetic sector mass analyzer with a custom extraction system was used [3]. The maximum detectable mass for the accelerating voltage of 4 kV was 53 amu. A three-channel Avantes AvaSpec ULS2048L spectrometer was used for optical diagnostics.

![E:\OneDrive - mephi.ru\work\conf+publ\2020\[conf] Звенигород XLVIII\ICP fig2.png]()![E:\OneDrive - mephi.ru\work\conf+publ\2020\[conf] Звенигород XLVIII\ICP fig1.png]()Several series of experiments were carried out. In the first series, a discharge in Ar was characterized at various pressures (3×10–4–1×10–3 mbar) and power levels (700–2000 W). The behavior Ar+ and Ar2+ ion fluxes and the corresponding intensities of their spectral lines were studied. The measurement results for experiments with power variation are shown in Fig. 1.

Figure 1. Ar2+ ion fraction in flux from plasma (left) and intensity ratio of Ar+ и Ar2+ lines (right)

In the second series, a discharge was investigated in He/Ar and He/Ne mixtures with a fixed total pressure of 1×10–2 mbar at a power of 1700 W. A small Ar impurity in the main gas (He) leads to a significant Ar+ ion flux to the surface. If the impurity is Ne instead of Ar, this effect is not observed, and the fraction of Ne+ ions in the flux is close to the percentage of Ne gas in the mixture. This work was supported by the Russian Science Foundation (grant 20-12-00203).

References

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