Experimental study of a plasma VUV emission of negative hydrogen ion source based on CW ECR discharge

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One of the promising high-current sources of continuous negative ion (H^-) beams is a discharge maintained under conditions of electron cyclotron resonance in open magnetic traps by powerful radiation of the millimeter wave gyrotron radiation. The main idea is to use a magnetic structure consisting of a simple mirror trap and a cusp. The mirror trap is used as the main discharge chamber where dense ECR plasma is produced. The cusp is filled in with the plasma from the main discharge and acts as a reaction chamber where H^- ions are generated. It has been shown earlier that in case of pulsed operation it is possible to obtain negative hydrogen ion beams with current density $j = 80\,\mathrm{mA/cm^2}$ [1]. The main ECR discharge could be a powerful source of vacuum ultraviolet (VUV) radiation, which could has a strong influence on processes in the reaction chamber (dissociation and excitation of molecules).

Present paper is devoted to the experimental investigation of VUV emission in the proposed H^- source based on CW ECR discharge sustained by 28 GHz / 10 kW gyrotron radiation. Plasma VUV emission was studied in three bands: the atomic Lyα line (122 ± 10 nm), molecular radiation in the Lyman band (160 ± 10 nm) and the molecular continuum (180 ± 20 nm). Experiments showed a possibility of effective plasma parameters tuning by varying heating power and neutral gas ressure.

The work was supported by the Russian Science Foundation (project No. 21-12-00297).

[1] Lapin R, Izotov I, Skalyga V, Razin S, Shaposhnikov R and Tarvainen O 2018 *Journal of Instrumentation* **13** C12007