Estimation of characteristics of plasma created by electron beam generator with rare gas blown through the discharge gap in gas mixture OF medium pressure [[1]](#footnote-1)\*)

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Electron beam generators (EBGs) that are able to operate directly in gaseous medium are a promising means of solving many technological problems such as gas conversion, the plasma-beam coating etc. Operational aspects of these EB generators were extensively studied and presented in [1, 2], also possible ways to increase the working range of the EBG by supplying the discharge channel with a substituent gas like helium was considered in [3].

The figure shows plasma produced by EBG in gas mixture at a pressure of 1 kPa, a discharge voltage of 5.0 kV and a current of 7.6 mA using helium at a pressure of 2.6 kPa as a substituent gas.

However, direct measurements of mentioned parameters lead to a wide range of technological difficulties. As an alternative to direct measurements of plasma parameters method that combines experimental approach and simulations to estimate the plasma parameters has been proposed.

The power of electron beam and electrons mean free path could be found from current-voltage characteristics and the energetic efficiency of EBG [4]. Ionization yield of gases mixture could be found in assumption that ionization and recombination rates are equal. In this case ionization yield is proportional to the square root of the specific (per unit volume of plasma) power of the beam energy distribution and doesn't depend on the gas pressure. Estimates of the reliability of the initial assumptions are given.

Using measured in [4] current-voltage characteristics, the calculation of plasma characteristics in gases mixture (oxygen 20.9%, nitrogen – 78.1%, water vapor 1%) in the pressure range from 1 to 2.5 kPa has been conducted.

Possible means of validating the proposed estimation technique with experimental diagnostics have been considered.

References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Pt/ru/GG-Shloydo.docx) [↑](#footnote-ref-1)