

P2.3007 Influence of radiation transport on discharge characteristics of an atmospheric pressure plasma jet in argon

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Non-thermal atmospheric pressure plasma jets have been subject to numerous scientific studies during the last decades [1]. An extremely wide application field of such devices demands deep understanding of the plasma processes. One of those, which influences the formation of various spatiotemporal structures in the gas discharge plasma, is the transport of resonance atoms caused by radiation trapping [2]. The correct treatment of the radiation transport, along with diffusion and convection, is important point in plasma modelling. The majority of multi-scale complicated models use local Holstein or Biberman approximation to describe radiation transport, which does not take into consideration the spatial redistribution of excited atoms.

Efficiency of the matrix method [2] of correct account of the radiation trapping effect, demonstrated on the certain examples [3] embodies the basic motivation of the current study. In the work [5], adapted 1D method was successfully applied to a plasma jet model described in [6] and characterized by complex geometry and chemistry.

The main goal of the current work was to develop a new technique for treating 2D axisymmetrical geometries. The developed method allows discretization of the radiation transport integral operator, calculating corresponding matrix and setting up a system of linear equations with particular excitation source. The implementation of the developed method of radiation transport treatment in plasma jet modelling and results of the calculations, taking into account both complex geometry of the device and large set of plasma-chemical reactions, will be discussed.

References:

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