Controlling the structure of low-pressure glow discharge in argon through the organization of acoustic streaming

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The discharge plasma has been widely used in various fields of modern science and technology: the semiconductor industry (production of microchips), modification of the surface of materials, plasma spray coating process, space electric rocket engines, powerful light sources. At the same time smooth control of plasma parameters at constant values of the current and the pressure in the chamber is one of the important problems of modern plasma physics and application of plasma gas discharge. Of special interest is the ability to control the discharge structure, as well as flow and concentration of charged and excited particles [1, 2].

In this study, within hybrid model of the discharge [3] in argon at low pressures, demonstrated the possibility of controlling the parameters and structure of a glow discharge through the organization of acoustic streaming in the discharge tube when excited in her a standing acoustic wave. It is shown that is possible to increase the density of charged and excited particles in the axial region of the discharge, and gently affect the electric field distribution and thus on the electron temperature. The main mechanism leading to this effect is the fact that the organization of acoustic streaming occurs the convective flow of gas along the radius from the wall to the axis of discharge tube. Achieving the necessary sound pressure values at which this rate is comparable or greater than the flow of ions caused by drift in an electric field and diffusion can achieve contraction of the positive column of the electric discharge. However, he remains stable, as evidenced by the growing nature of the current-voltage characteristics.

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References

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