DYNAMICS OF OPTICAL CARACTERISTICS IN MAGNETASED DISCHARGE PLASMA

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The effect of the external magnetic field on the dynamics of shock waves (SW) generated in argon plasma due to both explosive processes on the cathode and expansion of the spark channel (SC) has been studied experimentally. The analysis of the spectral structure of plasma radiation is made.

The studied discharge is created between two electrodes in Rogovsky form. The distance between electrodes is changed ranging from d=0,1÷0,4 cm. Magnetic field was created by the capacitor bank discharge via Helmholtz like solenoid, in which the studied gap was put [1].

The longitudinal magnetic field leads to a decrease in the expansion velocity of the channel and an increase in current density, conductivity, temperature, and charged particle density in plasma channel, as well as in the specific energy deposition in discharge. The decrease in the expansion velocity of the plasma channel in neutral gas is due to the jump in the magnetic pressure at the channel boundary, which leads to decrease in the SW intensity and an increase in the internal energy and emission intensity of plasma.

After the formation of the SC, the spectrum of the cathode plasma is characterized by intense lines of the cathode material (AlII 396.1, 394.4, 280.1, and 281.6 nm) with high excitation energies and an intense continuum in the spectral of 260–360 nm. The lines of aluminum ions appear simultaneously with the beginning of the sharp increase in the discharge current, and their intensities reach maximum values in 20–30 ns. In the presence of a magnetic field, starting from the time t = 700 ns, the intensities of argon lines (ArI 394.89 nm, ArII 280.6 nm, and ArIV 280.9 nm) and aluminum lines (281.6, 280.1, 309.27, and 308.216 nm) increase significantly, whereas the intensities of lines in the visible region decrease with increasing magnetic field.

Note that the peak of the emission intensity shifts toward the short-wave length range with increasing magnetic field:λ_{max} = 420 nmat B = 0, 400 nmat B = 140 kG, and 380 nmat B = 200 kG. The intensity of continuum, and ion lines ArII 280.6 nm, ArIV280.9 nm in the UV region, as well as of the lines of the electrode material Al 280.1 nm and 281.6 nm increases in the presence of magnetic field.

The analysis of the external magnetic field effect and small concentrations of the metal vaporon the electron drift characteristics is also made in the study. It is shown that metal vapor change tangibly the kinetics of the processes in cathode plasma.

Reference

[1] Kurbanismailov V.S., Omarov O.A., Ragimkhanov G.B., Abakarova K.M., AbbasAli A.R. //PlasmaPhysicsReports. 2016. V. 42. № 7. C. 687-698.