Radiation characteristics of high current pulsed discharge in high density hydrogen in visible and soft x-ray spectral ranges

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Results are presented from experimental studies of self-constricted discharge (z-pinch) in dense hydrogen at initial pressure of hydrogen up to 35 MPa and current amplitude up to 1600 kA. Current half-period was varied from 100 to 150 mcs. The discharge burns in metal vapor of initiating wire and eroded electrode material, surrounded with hydrogen.

The brightness temperature of the discharge channel at the wavelengths 695 and 550 nm was measured by two identical monochromatic pyrometers. Brightness temperature of an external hydrogen shell of the discharge channel is ~ 1-9 eV. The SXR intensity was measured with SPD-8UVHS photodiodes. Temperature of the central metal zone, from which x-ray radiation is registered, achieves several hundreds eV. On based of the experimental data the estimations of discharge parameters were produced. The equalization of the magnetic and gaskinetic pressures in the course of the contraction and subsequent expansion of the channel is accompanied by oscillations of the channel diameter. These oscillations, which are clearly seen in optical streak images, correlate with spikes in the voltage waveform and oscillations in the intensity of X-ray emission.

The constricted discharge channel surrounded by hydrogen shell can be used for producing pure photoionized hydrogen plasma, for modelling various astrophysical processes (radiative energy transfer in the outer shells of stars, oscillations of stellar brightness due to the arrival of shock waves at the stellar surface, etc.)