Features of radiation gas discharge with liquid electrolyte cathode by using aqueous solutions of sodium chloride

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Gas discharge with liquid electrolyte cathode allows to create a plasma with a significant geometric volume at atmospheric pressure using a relatively simple technical means. In this regard, it may find application in various plasma chemical technologies.

In this research experimentally investigated the spectral characteristics of the gas discharge at high currents (4-20 A). As the electrolyte used salt solution in distilled water. Electrical conductivity of the electrolyte was varied in the range 4-60 mS/cm.

Discharge was ignited between the electrolyte flowing out from the cylindrical channel in the vertical direction and the metal electrode-anode. The height of the discharge gap ranged from 5-20 cm. The power supply has served three-phase full wave rectifier was connected to the secondary windings of the boosting transformer. Voltage ripple smoothed out by C-L-C-filter. Current is changed by a step variation of ballast resistance. The radiation spectra were recorded on a high-speed fiber-optic spectrometer AvaSpec-3648 in the wavelength range 484-708 nm with a resolution of 0,15 nm.

Against the background of the leading line of the main series sodium (yellow D-line) intensity other radiation components were negligible. In modes with the saturation of the CCD detector in the spectrum of doublets appeared diffuse and sharp series of sodium. In the radiation coming from the cathode region was observed a line of hydrogen H. The appearance of this line is caused by the presence of a strong electric field near the cathode.

Exploration of the spectrum in a narrow range of wavelengths indicated that the yellow D-line of sodium has a fine structure in the form of so-called "yellow doublet". The feature that emerged in the experiments is that the intensities of the fine structures differ only slightly from each other and for them is not satisfied classical 2:1 ratio. The formation of "yellow doublet" in this form indicates the absence of thermodynamic equilibrium plasma discharge.

Another feature of the radiation that was manifested in the experiments was that the yellow sodium *D*-line except for the multiplet splitting subjected to additional splitting. It has been found, the splitting pattern is independent of the direction of observation. In observations far and wide the discharge, splitting occurred with the same laws. Current rise and increase electrical conductivity of the electrolyte led to increased of splitting. Among the components of the splitting was absent linearly polarized. In all the figures have been two additional lows intensity. Characteristic feature was that they both coincide with highs of classic "yellow doublet." In all probability, there was an intensive absorption of radiation at these wavelengths. Thus, changes in the configuration of the "yellow doublet" sodium in the emission spectrum can serve as a channel for information about fast-moving processes within the gas discharge with liquid electrolyte cathode.

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