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Determination of the pressure and temperature of the radiating arc plasma from the measured values of photocurrent, voltage and discharge current

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It is shown that the pressure and temperature of the radiating arc plasma can be determined from the measured values of the voltage on the plasma column, the discharge current and the photocurrent caused by caused by the radiation flux of the entire volume of plasma to the photodetector. For the case of axially symmetric homogeneous arc plasma in a state of local thermodynamic equilibrium, equations are formulated that connect the values of plasma parameters with the measurement results. The equation for photocurrent is obtained from the solution of the radiation transfer equation in arc plasma of arbitrary optical density. Cases of electrode surfaces reflecting and absorbing electromagnetic radiation are considered. It is shown that the problem of determining the parameters of the arc plasma is reduced to solving a system of two non-linear equations with respect to pressure and temperature. The described method is used to determine plasma parameters of a high-current vacuum arc at the stage of anode activity. Using the example of vacuum arc plasma, the stability of the method with respect to the errors of the initial data is shown.

Keywords: low temperature plasma, electromagnetic radiation, electric arc, photodetector, plasma parameters.

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