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TIME-RESOLVED SPECTRAL DIAGNOSTICS OF A HIGH-VOLTAGE PLASMA TORCH

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Electric arc generators of thermal plasma are promising tools for creating plasma technologies that are in demand for solving global issues. Among the current technologies: pyrolysis of hydrocarbons to produce hydrogen [1], reforming to produce synthesis gas [2], gasification of municipal waste to produce energy, production of clean materials [3]. Powerful AC plasma torches [4, 5] are well suited for industrial applications. High requirements for the reliability of plasma torches determine the need for their improvement. Therefore, it is necessary to have knowledge about the processes occurring in the electric discharge chamber and at the outlet of plasma torch. This determines the relevance of complex research. Experimental data are of interest not only for understanding a particular process under study but are also necessary for validation of computational models.

High-temperature gas flow with high gradients of parameters is formed in the limited space of the electric discharge chamber of a high-voltage plasma torch. At the same time, the processes are non-stationary in nature, assuming periodic changes in parameters. This is due to the time-varying release of energy from AC power source.

Previously, time-averaged temperature distribution profiles were obtained at the outlet of the channel of a high-voltage air plasma torch [6]. This report presents new data on the change in the temperature profile with a change in the phase of the arc discharge current of a high-voltage plasma torch (Fig.1).

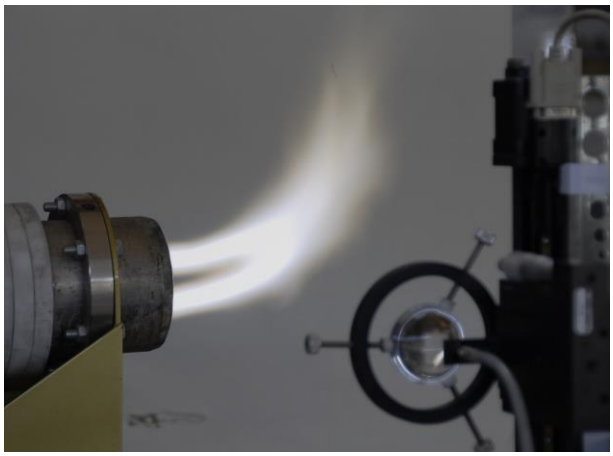

Fig.1. The arc column at the outlet of the channels of the high-voltage plasma torch.

Temperature profiles were obtained by the copper emission spectra. Spatial scanning was provided automatically synchronously with the shooting, the minimum allowable step was 5 microns. The exposure was about 1 ms when synchronized at the set values of the current amplitude. The power of the plasma torch was 6.5 kW at RMS voltage of 1.2 kV with an air flowrate of 1.0 g/s. On the axis of the plasma torch channel, the temperature during the period of current change varies in the range from 5000 to 5500 K.

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