

FORMATION OF POWERFUL PLASMA FLOW FROM SUBSTANCE OF LIQUID ELECTROLYTE CATHODE*

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Plasma is formed predominantly from a liquid phase substance when using a liquid electrolyte as a cathode. Such a plasma is promising for creating a high-temperature vapor-gas medium in plasma-chemical reactors designed for energy-intensive plasma technologies, in particular, for the conversion of hydrocarbons into synthesis gas [1, 2]. To solve the problems of practical application requires research in the power range of tens of kilowatts. The aim of this work was to obtain a plasma flow of such capacities.

To create a plasma flow, plasma generator with a liquid electrolyte cathode and metal anode was developed. The walls of the generator discharge chamber were made of refractory material. As a liquid electrolyte cathode, aqueous solutions of sodium chloride with concentrations of 0.1-0.2 mol/l were used.

The distance between the liquid cathode and the metal anode was 20 cm. The power source was a three-phase, full-wave rectifier connected to the secondary windings of the step-up transformer. The voltage ripples was smoothed with a C-L-C filter. To study the energy characteristics, the technique described in paper [3] was used. The current was changed by the stepwise variation of the ballast resistor. It should be noted that the ballast resistor is not a required element in the electrical supply circuit. The plasma generator has an increasing current-voltage characteristic (fig. 1) and, therefore, its operating modes were stable at zero electrical resistance of the ballast resistor.

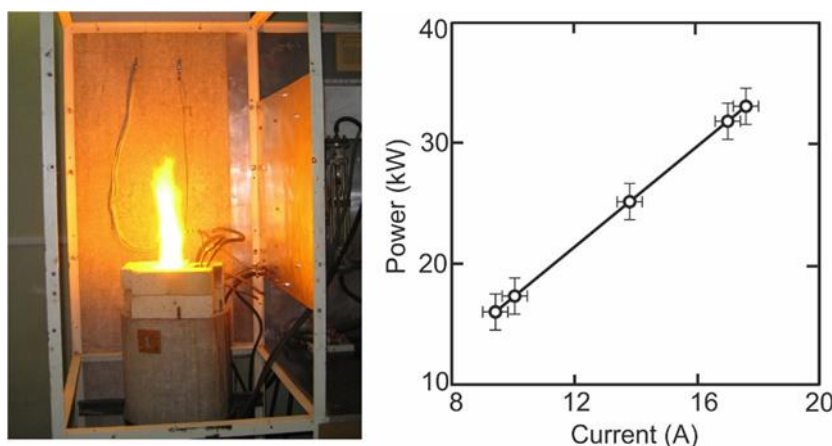


Fig. 1. Photo of the plasma flow at the exit of the plasma generator (energy consumption 30 kW) and graph of dependence of power from discharge current

During the operation of plasma generator, part of electrolyte was spent on the formation of plasma flow. The electrolyte loss was compensated by the addition of distilled water. In this case, the energy characteristics of plasma generator remained almost unchanged.

The paper studies the influence of electrolyte flow regimes through the cathode assembly on plasma flow formation.

REFERENCES

- [1] *Fridland S.V. et al. // Vestnik mashinostroyeniya. - 2006. - № 7. - P. 72-73.*
- [2] *Tazmeev A.K., Fridland S.V., Miftahov M.N. // Vestnik Kazanskogo tekhnologicheskogo universiteta. - 2006. - № 6. - P. 43-47.*
- [3] *Tazmeev K.K., Arslanov I.M., Tazmeev G.K. // Phys.: Conf. Ser. - 2014. - V. 567. - P. 012001.*

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