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FORMATION OF EXTENDED ARC DISCHARGES OF ATMOSPHERIC PRESSURE *)

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At the P-2000 installation of the MSU Mechanics Research Institute [1], the power supply circuit of the electric discharge stand was upgraded, associated with arc shunting by capacity and active resistance. The objectives of the study are to increase the stability of arc initiation and burning, reduce interference in measuring circuits. The main goal is to increase the time of stable burning discharge and its power while maintaining the safety of the electrode assemblies and acceptable heating and power loads on the equipment—the walls of the discharge chamber, coils of magnets. The main experiments were carried out in a discharge chamber with cylindrical side walls made of quartz electro-vacuum glass at atmospheric pressure, and its height and diameter were of 250 mm. Previously. this camera was tested in a series of experiments presented in the reports [2–5]. Vertically oriented discharges are considered mainly in the air environment. Arcs between graphite (3OPG) electrodes of different diameters (6–150 mm) were studied. The initiation of the discharge was carried out by disconnecting the initially closed graphite electrodes. The interelectrode distance is 5–15 cm. The duration of the discharges is several seconds. The work continues the study of the discharge instabilities theoretically considered in [6–8]. High-speed video recording of discharges with a frequency of 1200 fps was carried out synchronously with the diagnosis of current and voltage waveforms of arcs, the pyrometric measurement of cathode temperature. As a result of the conducted experiments, the principal possibility of increasing the burning time of the discharge at currents up to 500 A in a stable mode from the traditional 2–3 to 10 or more seconds, even without the use of special cooling of electrodes and magnets, is shown. This expands the possibilities of using the installation for heat resistance tests and resource assessments of new materials.

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References

[1]. Glinov A.P., Golovin A.P., Kozlov P.V.// J. Phys.: Conf. Ser. 2055(2021) 012006.
[2]. Glinov A.P., Golovin A.P., Kozlov P.V. // Book of abstracts of the XLIX International (Zvenigorod) Conference on Plasma Physics and TCB, Moscow: IBA Publishing House 2022, p. 172.
[3]. Golovin A.P., Glinov A.P. // Lomonosov readings, Mechanics section, abstracts, MSU Publishing House 2022, pp. 58-59.
[4]. Glinov A.P., Golovin A.P., Kozlov P.V. // ibid., pp. 57-58.
[5]. Glinov A.P., Golovin A.P., Kozlov P.V. Investigation of initiation and flow of current and interelectrode medium of different atmospheric pressure gases in extended discharge chambers // XIII All-Russian Congress on Fundamental problems of theoretical and Applied Mechanics, St. Petersburg, August 21-25, 2023.
[6]. Barmin A.A., Glinov A.P., Shumova G.A. // TVT, 1987, volume 25, issue 5, 873-879.
[7]. Barmin A.A., Glinov A.P., Shumova G.A., Zotikov I.B. Investigation of the effect of convective heat exchange and an external electrical circuit on the overheating instability of an electric discharge // Report on the Research Institute of Mechanics of Moscow State University, No. 3322, M. 1986.
[8]. Barmin A.A., Zotikov I.B. // TVT, 1991, volume 29, issue 3, 440-445.

*) abstracts of this report in Russian