THERMO-MECHANICAL DESTRUCTION OF THE SURFACE OF MATERIALS WHEN EXPOSED TO PLASMA FORMATION [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2020.47.1.160

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Tests of thermal protection coatings under thermal shock [1] are relevant in various fields of science and technology. However, during these studies, the sample is heated for a long time (30 seconds or more). At the same time, as a rule, they are cyclic (from 1 000 to 6 000 cycles).

In some cases, a test of the sample for a single surface thermal effect is required. In this paper, we propose the results of experiments to test materials for short-term (no more than 100 ms) heat stroke using plasma formation in a free atmosphere. The experiments were carried out at atmospheric pressure by an electric explosion of a conductive diaphragm located horizontally in a plasma gun with a current pulse of up to 16 kA, a duration of 70 to 100 ms and a supply energy of 50 kJ. The design of the plasma gun is a ring-pin electrode system [2]. Such a system of current leads provides the necessary configuration of the magnetic field in the region of the discharge gap. The pulse of electric energy generated by the inductive accumulator [3] transfers the material of the conducting diaphragm in the form of a circle to the state of low-temperature plasma. The characteristic size of the plasma formation was 35-40 sm.

Tests were both single and multiple (1-10 times). Textolite, Sitall, glass, plexiglass and other non-conductive materials were used as a sample.

Experiments have shown that the short-term surface effect of plasma formation (brightness temperature reached 4500 K) leads to partial detachment of the material. The surface area of ≈ 300 sm2. The thickness of the sample varied from 3 to 10 mm. the Resulting thermal gradients at the heating and cooling stage also, depending on the conditions of the experiment, lead to melting and partial delamination of the sample. Experiments have shown that the greatest effect was achieved when testing Sitall and glass. Detachment of the material reached up to 1 mm. Depending on the conditions of the experiment (energy input, exposure time), in some experiments, the destruction of the sample occurred.

The results of the studies allow us to speak about the prospects of surface short-term thermal impact (impact) on heat-loaded materials, including glass-ceramic and ceramic composite.

References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/Pt/ru/GO-Furov.docx) [↑](#footnote-ref-1)