Plasma torch working gas selection for the production technology of ultrapure white corundum [[1]](#footnote-1)\*)

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The development of optical systems, microcircuits, and medical equipment enhances further production material requirements for their manufacture. First and foremost, it applies to their purity. One of such production materials is white corundum, which is widely used in all of the above-mentioned fields. Moreover, the production of ultrapure white corundum constitutes one of the technological stages of manufacturing pure aluminum from its melt.

Nowadays, there are two main ways to produce corundum: 1) in arc furnaces having a capacity of 5-7 MVA when melting with casting on a solid block, and 2) in furnaces having a capacity of 12.5-16.5 MVA when melting with the release of melting products in two tap holes [1-3]. The major drawback of these methods is that the produced corundum is extensively polluted by furnace electrode materials, which entails crystalline inhomogeneity, and high energy consumption.

Pure corundum can also be produced by a number of chemical processes, for example, pressure reactor synthesis from aluminum [4], alkoxide technique [5], etc. However, all of them are time-and resource-consuming.

We present a technology that involves alumina fusion in a plasma reactor. To ensure the purity of the produced corundum we utilize the lowest-impurity raw material, and minimize the impurity level of the melt.

The right choice of a plasma-forming gas for the plasma torch makes it possible to eliminate flux contamination by the products which plasma jet contacts with:

* melt,
* plasma torch electrodes,
* lining material.

Within the framework of studies, we considered using hydrogen, nitrogen, or argon as the working gas. We defined their efficiency of the heat exchange between a plasma jet and a heated surface, their chemical inertness towards the used structural materials and the melt, and their explosion hazard.

References

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