NUMERICAL SIMULATION OF the CHARACTERISTICS OF THE PLASMA UNIT "THERMOPLASMA 50-01" AND A WAY OF MANAGing ITS PLASMA JET

1,2Saifutdinov A.I., 1Fadeev S.A., 1Fayrushin I.I., 1Kashapov N.F., and 1Ibragimov A.P.

1Kazan (Volga region) Federal University, Kazan, Russia, [as.uav@bk.ru](mailto:as.uav@bk.ru),  
 [fadeev.sergei@mail.ru](mailto:fadeev.sergei@mail.ru), [fairushin\_ilnaz@mail.ru](mailto:fairushin_ilnaz@mail.ru), [kashnail@gmail.com](mailto:kashnail@gmail.com),  
 [ibragimov.a.r@mail.ru](mailto:ibragimov.a.r@mail.ru)   
2Saint Petersburg State University, Saint Petersburg, Russia, [as.uav@bk.ru](mailto:as.uav@bk.ru)

Now in various industries, there are many problems associated with the protection of products against corrosion and high temperatures. Increased wear resistance of structural elements, repair and recovery of products throughout their life is an important task. One way to address these issues can be applying special coatings on the surface of products of gas-thermal spraying methods (GTSM). In this regard several decades carried the creation of modern plasma systems for spraying of protective coatings and developing ways to control gas discharge jets.

In particular, one of the modern commercial plants for plasma spraying of thermal coatings is "Thermoplasma 50-01" [1]. Installation developed by a team of ITAM SB RAS. It is currently under extensive experimental research on the characterization of plasma jets and their application possibilities for thermal coatings. It is extremely important is the ability to predict the main parameters of the installation and its operation modes with different parameters and additional external influences. In this case, come to the aid of numerical simulation methods.

In the present study, based on the Navier-Stokes equations, the heat balance equation and Maxwell's equations performed a series of numerical experiments to determine the basic parameters of the plasma unit "Thermoplasma 50-01." Obtained temperature distribution in the plasma channel. Simulated outflow of a jet from the plasmatron and plasma velocity field in a plasma reactor. The possibility to influence the characteristics of the plasma torch by using superposition of the sound field directly in the plasma channel as well as the expiration of the plasma jet. In particular, the expiration of a laminar plasma jet mode when it is applied to the sound field created by the turbulence of the plasma stream. Numerical calculations are confirmed by experimental studies.

Thus, in this paper we obtain an adequate model of the plasma jet produced by modern plasma unit "Thermoplasma 50-01." The model allows you to vary the plasma torch power, plasma gas flow, its initial velocity and others.

The reported study was funded by RFBR, according to the research project No. 16-38-60187 mol\_а\_dk.

References

1. Kuzmin V.I., Mikhal’chenko A. A., Kovalev O. B. [et al.] J. of Thermal Spray Technology, 2012, V. 21, Р. 159–168.