

Investigation of the effect on the electrodes of a small addition of propane-butane to the plasma-forming gas of the low-temperature argon plasma generator

M. Kh. Gadzhiev, D. I. Yusupov, M. V. Ilyichev and A. S. Tyuftyaev

Joint Institute for High Temperatures RAS
Bd. 2, 13 Izhorskaya st., Moscow, 125412, Russia
E-mail: makhach@mail.ru

Received 10.07.2024; accepted 18.11.2024

The state of the cathode with an insert made of pure and lanthanide tungsten was studied when propane-butane was added to the argon plasma-forming gas for a low-temperature DC plasma generator with vortex arc stabilization and an expanding channel of the gas-discharge path. With a small addition of propane (1 %) in argon medium, carbon is deposited at the interface between tungsten and the copper cathode housing at a rate of ~0.2 mm/min. No deposition was found at the anode at this rate.

Keywords: low temperature plasma generator; plasma torch; electrode; argon; propane-butane.

REFERENCES

1. Rajzer Yu. P., Fizika gazovogo razryada. 3-e izd. (Physics of a gas discharge), Moscow, 2009 [in Russian].
2. Cherednichenko V. S., Anshakov A. S. and Kuzmin M. G., Plazmennye elektrotehnologicheskie ustanovki (Plasma electrotechnological installations), Novosibirsk, NTGU, 2008 [in Russian].
3. Petrov S. V. and Karp I. N., Plazmennoe gazovozdushnoe napylenie (Plasma gas-air spraying), Kiev, Nauk. dumka, 1993 [in Russian].
4. Kudinov V. V., Plazmennye pokrytiya (Plasma coatings), Moscow, Nauka, 1977 [in Russian].
5. Lakomskij V. I., Plazmenno-dugovoj pereplav (Plasma arc remelting), Kiev, Tekhnika, 1974 [in Russian].
6. Krasnov A. N., Sharivker S. Yu. and Zilberberg V. G., Nizkotemperaturnaya plazma v metallurgii (Low-temperature plasma in metallurgy), Moscow, Metallurgiya, 1970 [in Russian].
7. Polezhaev Yu. V. and Yurevich F. B., Teplovaya zashchita (Thermal protection), Moscow, Energiya, 1976 [in Russian].
8. Mihatulín D. S., Polezhaev Yu. V. and Reviznikov D. L., Teploobmen, termohimicheskoe i termoerozionnoe razrushenie teplovoj zashchity (Heat transfer, thermochemical and thermoerosive destruction of thermal protection), Moscow, Yanus-K, 2011 [in Russian].
9. Sanlisoy A. and Carpinlioglu M. O., Int. J. Hydrogen Energy **42** (2), 1361 (2017).
10. Son E. E., Gadzhiev M. Kh. and Kulikov Yu. M., High Temp. **58** (4), 495 (2020).
11. Zhukov M. F., Koroteev A. S. and Uryukov B. A., Prikladnaya dinamika termicheskoi plazmy (Applied Dynamics of Thermal Plasma), Novosibirsk, Nauka, 1975 [in Russian].
12. Glebov I. A. and Rutberg F. G., Moshchnye generatory plazmy (Powerful Plasma Generators), Moscow, Energoatomizdat, 1985 [in Russian].
13. Koroteev A. S., Mironov V. M. and Svirchuk Yu. S., Plazmotrony. Konstruktsii, kharakteristiki, raschet (Plasma Torches: Design, Characteristics, Calculations), Moscow, Mashinostroyeniye, 1993 [in Russian].
14. Zhukov M. F., Zasyupkin I. M., Timoshevskiy A. N. et al., Elektrodugovye generatory termicheskoi plazmy. Nizkotemperaturnaya plazma (Electric Arc Generators of Thermal Plasma. Low-Temperature Plasma), vol. 17 of Nizkotemperaturnaya plazma (Low-Temperature Plasma), Novosibirsk, Nauka, 1999 [in Russian].
15. Asinovskiy E. I., Kirillin A. V. and Nizovskiy V. L., Stabilizirovannyye elektricheskie dugi i ikh primeneniye v teplofizicheskom eksperimente (Stabilized Electric Arcs and Their Application in Thermophysical Experiment), 2-e izd., Moscow, Fizmatlit, 2008 [in Russian].
16. Gadzhiev M. K., Kulikov Y. M., Son E. E. et al., High Temp **58** (6), 12 (2020).
17. Goryachev S. V., Isakaev E. Kh., Myasnikov M. I. and Chinnov V. F., High Temp **46**, 752 (2008).
18. Konjevic N., Lesage A., Fuhr J. R. and Wiese W. L., J. Phys. Chem. Ref. **31** (3), 819 (2002).
19. Cagran C., Brunner C., Seifert A. and Pottlacher G., High Temperatures-High Pressures **34** (6), 669 (2002).
20. Cagran C., Pottlacher G., Rink M. and Bauer W., International Journal of Thermophysics **26** (4), 1001 (2005).